Knowledge Management: Current Issues and Challenges

Elayne Coakes

IRM Press

Knowledge Management: Current Issues and Challenges

edited by

Elayne Coakes
University of Westminster, United Kingdom

IRM Press
Publisher of innovative scholarly and professional information technology titles in the cyberage

Hershey • London • Melbourne • Singapore • Beijing

Acquisitions Editor:	Mehdi Khosrow-Pour
Senior Managing Editor:	Jan Travers
Managing Editor:	Amanda Appicello
Development Editor:	Michele Rossi
Copy Editor:	Bernhard J. Kieklak, Jr.
Typesetter:	Amanda Lutz
Cover Design:	Korey Gongloff
Printed at:	Integrated Book Technology

Published in the United States of America by
IRM Press
701 E. Chocolate Avenue, Suite 200
Hershey PA 17033-1240
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@idea-group.com
Web site: http://www.irm-press.com

and in the United Kingdom by
IRM Press
3 Henrietta Street
Covent Garden
London WC2E 8LU
Tel: 44 20 7240 0856
Fax: 44 20 7379 3313
Web site: http://www.eurospan.co.uk

Library of Congress Cataloging-in-Publication Data

Coakes, Elayne, 1950-
Knowledge management : current issues and challenges / Elayne Coakes.
p. cm.
ISBN 1-931777-51-9 (soft- cover) -- ISBN 1-931777-67-5 (e-book)
1. Knowledge management. I. Title.
HD30.2.C355 2003
658.4'038--dc21
2002156237

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

Other New Releases from IRM Press

- **Multimedia and Interactive Digital TV: Managing the Opportunities Created by Digital Convergence**/Margherita Pagani
  ISBN: 1-931777-38-1; eISBN: 1-931777-54-3 / US$59.95 / © 2003
- **Virtual Education: Cases in Learning & Teaching Technologies**/ Fawzi Albalooshi (Ed.), ISBN: 1-931777-39-X; eISBN: 1-931777-55-1 / US$59.95 / © 2003
- **Managing IT in Government, Business & Communities**/Gerry Gingrich (Ed.)
  ISBN: 1-931777-40-3; eISBN: 1-931777-56-X / US$59.95 / © 2003
- **Information Management: Support Systems & Multimedia Technology**/ George Ditsa (Ed.), ISBN: 1-931777-41-1; eISBN: 1-931777-57-8 / US$59.95 / © 2003
- **Managing Globally with Information Technology**/Sherif Kamel (Ed.)
  ISBN: 42-X; eISBN: 1-931777-58-6 / US$59.95 / © 2003
- **Current Security Management & Ethical Issues of Information Technology**/Rasool Azari (Ed.), ISBN: 1-931777-43-8; eISBN: 1-931777-59-4 / US$59.95 / © 2003
- **UML and the Unified Process**/Liliana Favre (Ed.)
  ISBN: 1-931777-44-6; eISBN: 1-931777-60-8 / US$59.95 / © 2003
- **Business Strategies for Information Technology Management**/Kalle Kangas (Ed.)
  ISBN: 1-931777-45-4; eISBN: 1-931777-61-6 / US$59.95 / © 2003
- **Managing E-Commerce and Mobile Computing Technologies**/Julie Mariga (Ed.)
  ISBN: 1-931777-46-2; eISBN: 1-931777-62-4 / US$59.95 / © 2003
- **Effective Databases for Text & Document Management**/Shirley A. Becker (Ed.)
  ISBN: 1-931777-47-0; eISBN: 1-931777-63-2 / US$59.95 / © 2003
- **Technologies & Methodologies for Evaluating Information Technology in Business**/ Charles K. Davis (Ed.), ISBN: 1-931777-48-9; eISBN: 1-931777-64-0 / US$59.95 / © 2003
- **ERP & Data Warehousing in Organizations: Issues and Challenges**/Gerald Grant (Ed.), ISBN: 1-931777-49-7; eISBN: 1-931777-65-9 / US$59.95 / © 2003
- **Practicing Software Engineering in the 21st Century**/Joan Peckham (Ed.)
  ISBN: 1-931777-50-0; eISBN: 1-931777-66-7 / US$59.95 / © 2003
- **Knowledge Management: Current Issues and Challenges**/Elayne Coakes (Ed.)
  ISBN: 1-931777-51-9; eISBN: 1-931777-67-5 / US$59.95 / © 2003
- **Computing Information Technology: The Human Side**/Steven Gordon (Ed.)
  ISBN: 1-931777-52-7; eISBN: 1-931777-68-3 / US$59.95 / © 2003
- **Current Issues in IT Education**/Tanya McGill (Ed.)
  ISBN: 1-931777-53-5; eISBN: 1-931777-69-1 / US$59.95 / © 2003

Excellent additions to your institution's library!
Recommend these titles to your librarian!

To receive a copy of the IRM Press catalog, please contact (toll free) 1/800-345-4332, fax 1/717-533-8661, or visit the IRM Press Online Bookstore at: [http://www.irm-press.com]!

Note: All IRM Press books are also available as ebooks on netlibrary.com as well as other ebook sources. Contact Ms. Carrie Skovrinskie at [cskovrinskie@idea-group.com] to receive a complete list of sources where you can obtain ebook information or IRM Press titles.

Knowledge Management: Current Issues and Challenges

Table of Contents

Preface

Since the 1990s, we have had an increasing number of books and journal articles discussing knowledge management (KM) and how it can be performed. So far, we have not discovered an all-singing, all-dancing solution to the issues we find when attempting to implement KM in organisations. What happens is that as we investigate, discuss, and practice knowledge management, we find yet more challenges and issues.

In this book we are looking at a number of these challenges and issues, and we hope that the chapters presented will not only stretch our readers' minds but will also prove of practical benefit to their organisations. These chapters were selected to provide a representative sample of the ideas in four main domains - the theory of knowledge management; technical challenges; management and organisational issues and, finally, some illustrations of knowledge management at work in organisations and the lessons that can be learned.

There are 20 chapters in this book drawn from an international base of authors, including East and Western Europe, the Antipodes, Asia, and North America.

A consistent message across all these diverse contributions is the need to consider knowledge management in its context – as an holistic practice. Knowledge management is not solely about the technology and the systems that are put into place, but it is also about the humans who populate the system and utilise the technology – and so we need to take a sociotechnical view on the practice of managing knowledge.

The book is divided into four parts and below is outlined each author's contribution to these sections. We hope that you enjoy reading our work.

Section One: The Theory of Knowledge Management

We start the book with a look at theory, our first chapter coming from Poland by Witold Abramowicz, Marek Kowalkiewicz and Piotr Zawadzki. This looks at a skill map ontology for IT courseware. Our second chapter comes from Michael Boahene and George Ditsa from Australia and relates to the perennial challenge of distinguishing between data, information and knowledge. The third and final chapter in this section, by K.D. Joshi and Saonee Sarker of the USA, looks at knowledge "stickiness."

Abramowicz and his colleagues are concerned with creating a knowledge exchange platform for the corporate environment. They briefly describe topic maps and skill maps – the latter being a new concept developed by the authors. The proposed solution for the knowledge exchange platform is currently being used in a Knowledge e-Marketplace for Courseware Distribution project that has been developed at the Poznan University of Economics, Poland. The project's target is to integrate the traditional e-Marketplace with topic maps technology and to introduce the new technology – skill maps – for representing an individual employee's knowledge.

Our second theoretical contribution comes from Boahene and Ditsa and tackles the conceptual confusion about data, information and knowledge that appears to be finding its way into the Knowledge Management literature. They explore how a would-be investor in a KMS (Knowledge Management System) might realise its anticipated benefits and how to ensure that a would-be implementor of such systems might know if they are on the right path. They, therefore, propose a "conceptual cleansing" in their terms and distinguish between information management, knowledge-based and knowledge management systems according to what they are typically capable of, and the questions that they can answer.

Our final theoretical chapter, authored by Joshi and Sarker, relates to the information systems development (ISD) process. They suggest that one possible cause for the failure of ISD may be the lack of relevant knowledge transferred from the system users to system developers. Their chapter thus provides a framework that allows researchers to study this knowledge transfer process in a systematic fashion, identifying a comprehensive set of factors that influence the process. These factors are presented as a set of propositions that relate to the (potential or otherwise) "stickiness" of this knowledge, which should also guide the future researcher in this field.

Having looked at some theory of knowledge, we now turn our attention to issues and challenges relating to the management of knowledge in the organisation.

Section Two: Management and Organisational Factors

In this second section of the book, we see authors writing on a variety of topics. From Scandinavia, Fredrik Ericsson and Anders Avdic look at the issue of systems acceptance; Abdus Sattar Chaudhry from Singapore looks at how to measure KMS impacts; Helen J. Mitchell, who writes from New Zealand, is interested in the evaluation of the technical element of knowledge management, her discussion relating to whether it adds value to the process or is merely an enabler; Denise Johnson and Charles A. Snyder from the USA interest themselves in management under uncertainty and the need for the disaster planning of KM alongside other organisational assets; Ricky Laupase looks at reward systems to see whether they encourage knowledge sharing; Karen Nelson and Michael Middleton are interested in the information and knowledge management enablers; and Ran Wang and Bonnie Rubenstein-Montano consider the impact of trust on knowledge sharing benefits.

The Ericsson and Avdic chapter concerns itself with how and why people will accept KMS, based on empirical work undertaken in a manufacturing environment. They contend that acceptance of knowledge management systems is dependent on perceived relevance, systems accessibility and management support. In order to achieve acceptance, KMS implementation should be iterative and cooperative between users and developers by continually developing, implementing and testing prototypes. They conceive of workers and management as two different social groups within the organisation. Workers' everyday jobs are known and to some extent governed by different instructions. Relevance to workers will be achieved if they see that use of the KMS will add value to their work results, and if it is integrated into their work practice. Importantly, they emphasise that a KMS does not manage knowledge by itself – it is dependent on those who give meaning and understanding to the knowledge represented in the system.

Second in this section comes the chapter by Chaudhry. He considers performance measurement in knowledge management, as developing such a measurement system is considered key to the competitive success of the organisation. The chapter provides an overview of the main measures currently in use for measuring knowledge assets, including the Balanced Scorecard, the Intangible Assets Monitor, Skandia's Intellectual Capital Taxonomy and also reports the results of a study carried out to review the use of KM performance measures in selected organisations. Chaudhry points out the commonalities of applications of performance measures and the need for the development of more relevant measures, as these measures only provide a partial assessment of the impact of knowledge management in organisations.

Helen J. Mitchell is also interested in the valuation of knowledge management, but here she is looking at whether the IT element, in particular, adds value to the process. Technology, she claims, is providing a means through which information can be gathered with relative ease and developments in technology have provided pathways for accessing vast amounts of information. Information, however, is static unless activity is taken, through the application of knowledge, to translate it into something with meaning that can be acted upon. In this chapter, Mitchell refers to an exploratory study that she undertook. Her conclusions were somewhat disappointing in that she discovered that, as expected, every organisation uses technology in some way or another, although the level of sophistication varies considerably and that the use of technology to share knowledge has not developed to any great extent. However, where it is used to bring people together, technology can be considered to add value.

McManus and Snyder take a somewhat different view of the value of knowledge by considering the situation of a major disaster and how most plans ignore, or downplay, the essential requirement for the organisation to preserve its critical knowledge resources in the event the possessors of that knowledge are killed. They claim that most proponents of knowledge management have neglected this important facet of the field and, at the same time, the risk management and disaster recovery fields have ignored the important contributions of knowledge management to a viable business continuity plan. They provide a knowledge management checklist to assist managers in their efforts to harvest and preserve essential knowledge surrounding the organisation's key processes for the business continuity plan. This is needed, but – in the event of a major disaster – it may be impossible to recover the loss of expertise unless there has previously been a concerted effort to harvest the knowledge and preserve it.

Ricky Laupase is concerned with how to reward staff for sharing knowledge, particularly in management consultancy firms. Some of his conclusions and comments would apply equally well to firms that employ consultants or where staff act as internal consultants. He proposes a framework suggesting that, with effective implementation, reward systems would encourage the sharing of tacit knowledge. His research showed that informal meetings and offering non-material or "soft" rewards are more often cited as an effective approach to encourage tacit knowledge sharing. Given the choice of receiving intrinsic or extrinsic rewards, consultants were in favour of receiving the former. They liked the feeling of satisfaction by being recognised for an award, as well as having an enhanced reputation by peers. The public recognition of an award or an achievement and the opportunity to enhance their reputation encouraged consultants to share their tacit knowledge.

Karen Nelson, in her chapter, explores the factors limiting organisational information and knowledge management (IKM) through the perceptions of practitioners. The work proposes that a number of organisational factors – which for them are enablers – influence IKM project outcomes. It follows that explication of these enablers in an integrated framework could be beneficial for practitioners. The results of exploratory research are presented in this chapter to understand which organisational factors IKM practitioners believe are enablers for these activities. The surveys, performed in a sample of Australian organisations, indicated that gaps exist between the significance of IM and KM enablers and the actual situation. The research revealed a significant difference between what was regarded as theoretically ideal and what was the actual organisational practice.

Finally, in this section of the book, Ran Wang and Bonnie Rubenstein-Montano write about the impact of trust on the benefits obtained from knowledge sharing. They argue that the benefits change as the level of trust changes, so the more trust there is, the more benefits that can be obtained. Trust is a basic feature of human interactions that requires cooperation and inter-reliance, as is the case in knowledge sharing. The authors experimented with their graduate students with respect to assignment completion and the results of this experiment are reported and analysed for significance. They put a caveat on the results, however, as the motivation for knowledge sharing amongst students will be different from that in a commercial organisation and thus the impact of trust may also be different. This leaves plenty of scope for future research for these authors.

Along with the organisational challenges for managing knowledge, we also have a number of technical challenges, some of which are discussed in the third section of our book.

Section Three: Technical Challenges

In the technical section, we have two chapters, Murray E. Jennex writing about Internet support and Yongtae Park, Yeongho Kim, and Intae Kang writing about the design of workflow-based knowledge management systems.

Murray E. Jennex shows how using a common infrastructure, through an integrated network (the Internet), facilitates access to, and the utilization of, knowledge and organisational memory and so increases the usability and success of such knowledge management type systems. Success factors are identified as: System Quality; System and Information Quality; Information Quality; and Use, which are then illustrated with case studies. Jennex concludes that there are issues associated with using the Internet that KMS designers need to be aware of. Chief among these are knowledge representation and search. As knowledge bases grow, designers need to be aware of increasing search times, as well as a variety of knowledge artifacts. Other critical issues include site maintenance, the knowledge life cycle and different patterns of KMS usage by novice or experienced users.

Park, Kim, and Kang, from Seoul, propose a framework for designing a knowledge management system for a generalised R&D organisation. Broadly, they say that a KMS comprises two principal modules: a process management module to administer knowledge activities to generate and utilize knowledge and a contents management module to deal with the knowledge contents, input and output of knowledge activities. The two modules are then made explicit through two operational systems: a workflow management system for the R&D process and an R&D knowledge management system for the R&D contents. As a building block to integrate the two systems, a workflow-based knowledge map is suggested.

Finally, this book moves on to some examples of how KM has been implemented in organisations, looking to the case studies to provide us with lessons we can learn for our own organisations.

Section Four: Case Studies of Knowledge Management in Practice

In this practical section, we have El-Sayed Abou-Zeid writing about a strategic alignment model using Buckman Laboratories as his example; Bendik Bygstad writing about a difficult CRM (Customer Relationship Management) implementation; Gillian Wright and Andrew Taylor writing about public services organisations and the barriers to knowledge sharing; Ricky Laupase, in this his second chapter, again examining management consultants' work; Violina Ratcheva, who is concerned with collective knowledge in an electronic business space for virtual partners; Ahmed Abdel Kader Hussain who looks at issues in an Egyptian government department; Greg Timbrell and Karen J. Nelson, writing with Tony J. Jewels, about knowledge re-use for enterprise systems planning support; and an entire collective or community of practice known as MOISIG, (Anabela Sarmento, João Batista, Leonor Cardoso, Mário Lousã, Rosalina Babo, Teresa Rebelo), discussing their personal experiences in Portugal. While many of our previous chapters have included the results of research and case study material, this particular section is more practically biased and has more in-depth case study work and analysis.

Abou-Zeid, in his chapter, concerns himself with the articulation of the relationship between an organisation's competitive strategy and its knowledge strategy, in particular with the enterprise business strategy. He proposes a model that includes the external domains (opportunities / threats) and internal domains (capabilities / arrangements) of both business and knowledge strategies, and the relationships between them, and provides alternative strategic choices. This model is used to analyse the KM initiatives undertaken at Buckman Laboratories, demonstrating that business strategy is the anchor domain and that the two, key pivot domains that follow are the knowledge strategy and the organisational, infrastructure and processes strategy. The model, he argues, provides executives with a logical framework for analysing and assessing alternative strategic choices.

The chapter by Bendik Bygstad illustrates that technology-driven approaches to knowledge management are not likely to succeed. It also indicates some limitations of top-down managerial interventions, arguing that we need a deeper understanding of learning processes to be able to implement KM systems successfully. Whilst this case study is concerned with the implementation of a CRM system at a Norwegian organisation, the lessons learned are equally applicable to the other organisations undertaking similar implementations of knowledge intensive systems. He argues that traditional organisational development methods may not work well in the development of knowledge management systems and suggests some changes and additions that may improve the process and, thus, the success rate.

Wright and Taylor concern themselves with organisational knowledge sharing and the potential barriers to effective knowledge sharing in public service partnerships and service provision. They introduce a model to guide managers in their development of an effective knowledge-sharing environment. They claim that to date KM is largely a private sector innovation, although public sector bodies are moving towards this concept, and discuss the issues they found when researching health and social care bodies in the UK. The issues related to the need for changes in the areas of inter-organisation socialization processes, reflection and learning from past practices, information systems support and the development of shared performance measures. Most of these changes will require alterations to people's mental maps of what is important. Therefore, it will also require changes in the organisational culture and top management roles in order for organisations to become receptive to new ideas and to support staff motivation and innovation.

Looking at organisational structure, Ricky Laupase, writing his second chapter, is concerned with how culture and information technologies support the conversion of consultants' tacit knowledge to organisational explicit knowledge. Three case studies of management consulting firms in Australia are reported. The organisations investigated realised the importance of their tacit and explicit knowledge, but they lacked guidelines on how to convert individual tacit knowledge to firm explicit knowledge. Formal meetings did not necessarily support knowledge sharing amongst consultants, while informal meetings did encourage such processes as a result of socialisation. Metaphors, narratives and analogies also assisted in the expression of tacit knowledge. However, it was concluded that time constraints were a problem for the documentation or the externalisation process.

Violina Ratcheva is interested in unravelling the mystery of knowledge creation processes in virtual partnerships. The chapter presents the preliminary results of a research study on seven virtual partnerships and proposes an initial conceptual framework of the knowledge creation processes taking place. The author argues that as new media and communication technologies have led to significant changes in the ways we interact and work together, it is important not to constrain this phenomenon to its novel information processing side, but to also consider virtualisation as a social process. Distant ways of working have had a significant impact on social interactions and relationships developed in a business context and have led to new views of the way we understand organisational norms, roles, identity and culture. The creation of new knowledge is socially embedded in interaction and communication practices and so resides in the connections of experts. These patterns, and the rules established amongst team members, determine how knowledge is accumulated.

The chapter by Ahmed Abdel Kader Hussein and Khaled Whaba concerns itself with the Information Decision Support Center for the Cabinet of Ministers for the Egyptian Government (IDSC), which faces a problem of a high employee turnover rate that threatens the loss of its organisational memory. The chapter thus sets out to explore a number of questions relating to the human aspects of knowledge management and the human barriers that might prevent the sharing of this organisational memory. It found that employees were concerned about losing power within the organisation when they shared knowledge and thought this would affect their competitiveness and promotion possibilities. They perceived the major barriers to sharing knowledge as being departmental, with expert knowledge often in the minds of individuals with a lack of adequate communication between the individuals and departments. They were also concerned about a possible invasion of privacy, especially when personal e-mails and documents were expected to be reviewed for possible addition to the knowledge base. This issue of privacy seems to be an important point that is often forgotten in the drive to capture data and information in all possible forms and is a challenge for organisations to consider carefully.

The issue of capturing knowledge is also brought up by Greg Timbrell, Karen J. Nelson, and Tony J. Jewels in their discussion of the issue of lifecycle knowledge management in an ASP (Application Service Provider) as it faces the first major upgrade of its clients' enterprise systems. The extent and cost of these major upgrades can match or exceed the initial implementation, so the ASP management is beginning to appreciate the need to recall their lessons and practices from initial projects and are acknowledging the value of reusing the knowledge from earlier implementations as a means of reducing financial risk. Within the ASP, they studied the help desk and support personnel and discovered a number of issues relating to the lack of knowledge captured, especially relating to contracted staff. The findings also revealed the prevalence of informal networks in the support context and their important role in enterprise (and other) systems' lifecycle knowledge reuse.

Our final chapter in this section, and in the book, is—most unusually and with great insight—written by a complete Community of Practice (CoP) in Portugal. The issues of virtual teams and the necessity for communication to be performed using appropriate tools and technology have already been discussed in previous chapters. In this chapter, we see the practical difficulties that six researchers—coming from different disciplines and being geographically dispersed—faced when sharing and developing their common knowledge. We see here which tools and technologies the CoP found most useful and which were not utilised. We note the need the group felt for face-to-face meetings as they felt that it was in those meetings that the component of interpersonal knowledge happened more intensely, that the group values and norms were created and consolidated, and that the group identity was established.

Concluding Remarks

In this book we discuss and explore a number of issues relating to organisational culture, structure and reward systems, as well as technology. It is accepted by the authors that knowledge should be strategically valued, with the strategies optimising both people and technology. The development of innovative and creative learning and knowledge requires the right culture to support creation and sharing. The chapters in this book emphasise these points and indicate the theoretical basis on which these conclusions can be drawn, pointing to good practice from which other organisations can learn.

This book can only represent some of the many issues and challenges facing the study and practice of knowledge management. We hope that you, the readers of this book, can empathise and extrapolate from these examples and perhaps contribute your own experiences to our next book on this important topic.

Acknowledgments

The editor would like to acknowledge the help of all those involved in the collation and review process of the book, without whose support the project could not have been satisfactorily completed.

Many of the authors of chapters included in this book also served as referees for papers written by other authors at the conference from which these chapters were drawn. Thanks go to all those who provided constructive and comprehensive reviews.

Special thanks also go to the publishing team at Idea Group, Inc., most especially Amanda Appicello, whose enthusiasm motivated me to accept her invitation for taking on this project and who has ably managed the birth of this tome.

In closing, I wish to thank all of the authors for their insights and excellent contributions to this book. In addition, this book would not have been possible without the ongoing professional support from Mehdi Khosrow-Pour and Jan Travers at Idea Group, Inc. A further special note of thanks goes to all the staff at Idea Group, Inc., whose contributions throughout the whole process have been invaluable.

Elayne Coakes
University of Westminster, United Kingdom
February 2003

Section I

The Theory of Knowledge Management

Chapter I

Ontology Frames for IT Courseware Representation

Witold Abramowicz, Marek Kowalkiewicz, and Piotr Zawadzki
The Poznan University of Economics, Poland

ABSTRACT

This chapter introduces topic maps and skill maps technologies as a framework for storing courseware and relevant user profiles. It is a result of research being conducted on creating a knowledge exchange platform for the corporate environment. It briefly describes topic maps and skill maps – a new concept developed by the authors. It then proposes applying ontology frames to latter technologies. The proposition is followed by specification of a proposed solution. This solution is used in the Knowledge e-Marketplace for a Courseware Distribution project that is being developed at The Poznan University of Economics, Poland. The project's target is to integrate traditional e-Marketplace with topic map technology and to introduce a new technology – skill maps – for representing an individual employee's knowledge. There is a need to create common ontology frames for topic maps and skill maps in order to coherently represent knowledge and knowledge profiles.

TOPIC MAPS—INTRODUCTION

Topic maps is an ISO standard, which has been established as an answer to the problem of coherent representation of relations between topics (or ideas) and associating those topics with actual documents (topic occurrences). It is based on concepts and relations, as in conceptual graphs. Primarily, the standard was established in order to provide a means for uniform document index representation, but soon it turned out that topic maps can be used in clustering document repositories.

Among many potential topic map applications, the ISO specification enumerates the following:

- Qualifying the content and/or data contained in information objects as topics to enable navigational tools such as indexes, cross-references, citation systems, or glossaries.
- Linking topics together in such a way as to enable navigation between them. This capability can be used for virtual document assembly and for creating thesaurus-like interfaces to corpora, knowledge bases, etc.
- Filtering an information set to create views adapted to specific users or purposes. For example, such filtering can aid in the management of multilingual documents, management of access modes depending on security criteria, delivery of partial views depending on user profiles and/or knowledge domains, etc.
- Structuring unstructured information objects or facilitating the creation of topic-oriented user interfaces that provide the effect of merging unstructured information bases with structured ones. The overlay mechanism of topic maps can be considered as a kind of external markup mechanism, in the sense that an arbitrary structure is imposed on the information without altering its original form (ISO/IEC 13250, 2000).

Topics, associations and occurrences are main topic map components. Using those elements, you can create maps in document repositories. Below, we briefly describe those main components:

- Topics – the term topic refers to the element in the topic map that represents the subject being referred to. Topics can be categorized. They can have zero or more topic types. Topics can also have names. The standard names for topics are: base name, display name and sort name. Each topic can have facets – elements for storing additional information, for example topic profiles (Abramowicz et al., 2002; Ksiezyk, 2000).
- Associations – a topic association is a link element, showing relationships between topics. Associations can have types (influenced by, required by, written in, etc.) and roles (influencer, influenced; prerequisite, result; document, language) (Abramowicz et al., 2002; Ksiezyk, 2000).

- Occurrences – occurrences link topics to one or more relevant information resources. An occurrence can be anything; most often it is a URL or a document (article, picture, video, etc.). Occurrences can have roles and role types (web-based training, computer-based training, MS Word document, flash animation, knowledge base, etc.) (Abramowicz et al., 2002; Ksiezyk, 2000).

Additionally, the ISO specification of topic maps defines the following:

- Scope - the extent of the validity of a topic characteristic assignment: the context in which a name or an occurrence is assigned to a given topic and the context in which topics are related through associations.
- Facets - facets basically provide a mechanism for assigning property-value pairs to information resources. A facet is simply a property; its values are called facet values. Facets are typically used for supplying the kind of metadata that might otherwise have been provided by SGML or XML attributes or by a document management system. This could include properties such as "language," "security," "applicability," "user level," "online/offline," etc. Once such properties have been assigned, they can be used to create query filters producing restricted subsets of resources, for example, those whose language is "Italian" and user level is "secondary school student" (Pepper, 2000).

It is important not to confuse facets with scope. Facets are not used to qualify the objects in the "topic domain" part of the topic map (i.e., the topics, topic names and associations). Their purpose is simply to add attributes to information resources. Despite this, they provide a useful mechanism that complements and significantly extends the power of topic maps (Pepper, 2000).

SKILL MAPS

Topic maps technology is an advanced solution to the problem of structuring, storing and representing knowledge within a corporation. However, topic maps are limited instruments when we need to represent the knowledge of each employee within a corporation. If we need to provide those employees with mechanisms to enhance searching knowledge repositories that can take into consideration the state of each employee's knowledge and skills while conducting their searches, we need to extend topic maps technology by creating new structures for storing information about employees, their knowledge and their skills. Our proposed name for those new structures is skill maps.

The skill map is created by copying specified topic map objects and adding individual modifications. Adding this third, upper tier enhances the two-tiered topic maps' architecture. In order to specify which topic map objects are to be copied into a skill map, we have divided topic map objects into two groups: abstract objects and non-abstract objects.

Non-abstract objects are those directly related to the representation of the state of an employee's knowledge, such as topics pointing at courseware (topics of courseware type) or associations representing relations among pieces of courseware.

Abstract objects, on the other hand, store additional information, which is helpful when navigating and retrieving data from a topic map. An example of abstract objects could be document author, relations between documents and their categories, etc. Those objects are not required in order to represent employee's knowledge and, as such, are not stored in the skill map.

Modifications stored in a skill map represent the following facts:

- Knowledge resources accessed by an employee
- Level of skills in an individual topic
- Employee's interest in a topic

Moreover, employees can enter modifications on their own. They can modify topic associations. For example, employees can remove unneeded associations and they can create new ones. Due to that, skill maps provide users with means of catalogue personalization. Those modifications can also be used in order to maintain topic map associations (for example, locate invalid associations or introduce new ones).

Data stored in skill maps is virtually unusable without access to the lower-tier topic map. Because of the fact that we store only non-abstract objects, modifications and additional information, in order to generate a skill map we need to retrieve non-abstract objects from the topic map. After retrieving non-abstract objects, applying modifications and introducing additional information, the skill map is prepared.

We propose storing one skill map for each employee. However, it is possible to create and store skill maps for workgroups, if such an option turns out to be more effective in specific situations.

In our model, we propose using terminology which is based on topic maps' terminology. For example, a skill map's objects are named: skills, skill associations, skill facets, and skill scopes. The skill occurrence term is equal to an occurrence in the topic map (while those two objects point at the same document).

We propose using skill maps only for a user's knowledge analyses and determining a document's relevance. If there is a need to use skill maps for catalogue representation or for navigating knowledge resources, we propose using SMTM (skill map + abstract topic map).

SMTM is a product of merging a skill map with selected objects taken from a topic map. The selected objects are abstract ones – the objects omitted when creating the skill map. By generating such structure, we construct a coherent map, which can be used later for navigating and personalizing stored knowledge.

Formalization Needs

Ontologies are a concept taken from Artificial Intelligence and provide definitions for the vocabulary used to represent knowledge in a given domain. Ontology formalizes the semantics of objects and relations in a universe of discourse and provides a set of terms which can be used to talk about these objects and their relationships.

In this piece of writing we want to propose sample ontology for structuring the information technology courseware.

Developing such unified ontology is part of the project dedicated to creating The Knowledge e-Marketplace for Courseware Distribution held at The Department of Management Information Systems of The Poznan University of Economics. The main goal of this project is the integration of existing implementation solutions dedicated to electronic markets with knowledge representation techniques such as topic maps. Additionally equipping the platform with enhanced functionality is also taken into consideration as further part of the work.

Knowledge e-Marketplace as a platform for Courseware Distribution employs e-Marketplace's build-in mechanisms.

This ontology serves as a framework for structuring information technology knowledge based on a topic map solution. Equipped with the taxonomic formalism designed for these structures, we enhanced our system with properties for future merging processes. Topic map for IT courseware will be able to incorporate the suppliers' structures of their learning materials.

Automating the process of merging new learning units into an existing structure of associations will allow us to avoid the misclassification errors.

In case of a situation where our supplier uses his own ontology, we propose the process of mapping any inconsistencies in these structures, which is possible through one of the standard functions of DAML+OIL (OWL).

Such a process is an additional functionality and improvement of distributing the courseware either within an organization (the corporate version of the platform) or through the Internet (the community version) (Gruber, 1993).

Ontology Guidelines

Ontology is an explicit specification of a conceptualization. The term is borrowed from philosophy, where Ontology is a systematic account of Existence. For AI systems, what "exists" is that which can be represented. When the knowledge of a domain is represented in a declarative formalism, the set of objects that can be represented is called the universe of discourse. This set of objects, and the describable relationships among them, are reflected in the representational vocabulary with which a knowledge-based program represents knowledge. Thus, in the context of AI, we can describe the ontology of a program by defining a set of representational terms. In such an ontology, definitions associate the names of entities in the universe of discourse (e.g., classes, relations, functions or other objects) (Gruber, 1993) with human-readable text describing what the names mean and formal axioms that constrain the interpretation and well-formed use of these terms. Formally, ontology is the statement of a logical theory.

Metadata schemas and ontologies are very closely related; it could be said that the former are a special case of the latter (the knowledge-representation languages used to express ontologies are often more expressive than the data models underlying common metadata schemas).

One of the most general taxonomy for the process of describing knowledge is based on the universe of discourse which ontology applies to:

- Top-level ontologies - describe very general concepts like space, time, matter, object, event, action, etc., which are independent from a particular problem or domain; therefore, it seems reasonable, at least in theory, to have unified top-level ontologies for large communities of users (Gangemi et al., 2001; Sowa, 2000).
- Domain-specific ontologies and task ontologies - describe, respectively, the vocabulary related to a generic domain (like medicine or automobiles) or a generic task or activity (like diagnosing or selling) by specializing the terms introduced in the top-level ontology, i.e., ontology for information systems (Guarino, 1998).
- Application-specific ontologies - describe concepts depending both on a particular domain and task which are often specializations of both of the related ontologies. These concepts often correspond to roles played by domain entities while performing a certain activity, like a replaceable unit or spare component (Guarino, 1998).

There are many domain-independent methodological approaches to design criteria in an ontological development process, as well as evaluation steps for verification of well-constructed structures.

Taking into consideration that until now there is no unified format for building ontologies, the situation in this area is going to get worse. One of the approaches worth mentioning here are Gruber's five design criteria (Gruber, 1993).

Design criteria:

- Clarity: The Ontology should effectively communicate the intended meaning of a concept, which might arise from social situations or computational requirements; the definition should be independent from social or computational context. All definitions should be documented with natural language.
- Coherence: It should sanction inferences that are consistent with the definitions. At the least, the defining axioms should be logically consistent. Coherence should also apply to the concepts that are defined informally, such as those described in natural language documentation and examples.

- Extendibility: The Ontology should be designed to anticipate the uses of the shared vocabulary. It should offer a conceptual foundation for a range of anticipated tasks. It should be able to define new terms for special uses based on the existing vocabulary, in a way that does not require the revision of the existing definitions.
- Minimal encoding bias: The conceptualization should be specified at the knowledge level without depending on a particular symbol-level encoding. An encoding bias results when representation choices are made purely for the convenience of notation or implementation.
- Minimal ontological commitment: The Ontology should require the minimal ontological commitment sufficient to support the intended knowledge-sharing activities. The Ontology should make as few claims as possible about the world being modeled. Ontological commitment can be minimized by specifying the weakest theory (allowing the most models) and defining only those terms that are essential to the communication of knowledge consistent with that theory.

The evaluation methods and criteria (consistency, completeness, conciseness, expandability and sensitiveness) used to evaluate ontologies proposed by Gómez-Pérez is the second approach earlier mentioned. He also addresses the possible types of errors made when domain knowledge is structured in taxonomies in ontology (circularity errors, exhaustive and non-exhaustive class partition errors, redundancy errors and incompleteness errors) (Gómez-Pérez, 1999).

Courseware Ontology Proposal

The need to create courseware ontology occurred during research we conducted. The research focused on merging e-Marketplace technology with knowledge management and state-of-the-art distance learning techniques. We intend to create e-Marketplace for learning organizations, where employees will be able to access courseware materials and self-improve without the need to leave work. As opposed to existing corporate, knowledge-management technologies, which enable managing knowledge-based systems using the so-called corporate memory systems (storing expert knowledge, how-to documents), our system will have to not only provide described functionalities but, furthermore, it will have to provide modules for employees' knowledge management and improvement.

The proposed system is based on the e-Marketplace platform in order to be able to employ its mechanisms for knowledge exchange. Additionally, we presume that the organization will acquire knowledge from unstructured sources in document repositories. This mechanism is also supported by the e-Marketplace platform.

The proposed ontology for describing courseware in topic maps includes types and values of topic and association objects, which we consider to be the most important ones in our solution.

Table 1

Topic Type	Sample Base Name	Sample Display Name
Abstract		
Company	company_510	Brainbuzz Inc.
Author	author_115	John F. Smith
Theme	theme_19	Novell
Product_name	product_name_155	NetWare 6
Courseware_type	courseware_type_5	Web Based Training
Language	Language_3	English
Non-abstract		
Courseware	courseware_1241	SCO 241: Administration 1: User Services

As discussed above in Table 1, we divide topic map objects into abstract and non-abstract ones. Non-abstract elements are required for further users' (employees') knowledge representation; abstract ones provide additional information in maps.

The proposed topic types store specific data:

- *company* – courseware vendor's name
- *author* – courseware author's name (if applicable)
- *theme* – theme the courseware applies to (i.e., VPN technologies)
- *product_name* – product the courseware applies to
- *courseware_type* – teaching technology (WBT, CBT, manual, etc.)
- *language* – courseware's language
- *courseware* – courseware name (non-abstract topic)

The lack of standardization mentioned above forced us to choose a tool for building an ontology from the wide range being developed. It seems that one of the most powerful tools is DAML+OIL, therefore we opt for incorporating it into our knowledge representation solution.

- KIF – Knowledge Interchange Format is a computer-oriented language for the interchange of knowledge among disparate programs. It has declarative semantics (i.e., the meaning of expressions in the representation can be understood without appeal to an interpreter for manipulating those expressions); it is logically comprehensive (i.e., it provides for the expression of arbitrary sentences in the first-order predicate calculus); it provides for the representation of knowledge about knowledge.

- XOL – Ontology Exchange Language was designed in response to a study of ontology languages performed by the BioOntology Core Group.
- SHOE – The Simple HTML Ontology Extensions. SHOE was developed at the University of Maryland by members of Professor Hendler's research group.
- OML was originally intended to be subservient to the more inclusive CKML (Conceptual Knowledge Markup Language) and to CKP (Conceptual Knowledge Processing). The earlier versions of OML were basically a translation to XML of the SHOE formalism, with suitable changes and improvements.
- DAML stands for the DARPA Agent Markup Language, which is a project being funded by the US Defense Advanced Research Projects Agency.
- OIL stands for the Ontology Interchange Language and was developed by a number of researchers, primarily a group funded by the European Union's Information Society Technologies Program.
- SHOE, DAML, OIL research groups, working together as a committee, created a new language with the best features of their products and several other markup approaches. At the time of this writing, DAML+OIL is the most advanced web ontology language and it is expected to provide the basis for future web standards for ontologies. DAML+OIL language is being developed as an extension to XML and the Resource Description Framework (RDF). The latest release provides a rich set of constructs with which to create ontologies and to markup information so that it is machine readable and understandable.

Proposed Ontology for Skill Maps

The ontology proposed for representing courseware in topic maps can be easily employed in skill maps, after a few modifications. Skill maps are an extension of topic maps and as such they have more features.

Because of the fact that a skill map is created by copying and modifying topic maps, we do not propose any new topic or association types. At the time of writing, we have worked out that we need to add attributes to topics and associations in order to properly represent the state of a user's knowledge.

The topic map standard does not propose any attributes that can be added to associations. In skill maps, we propose adding one attribute for each non-abstract association (skill association) (see Tables 2 and 3).

The attribute type "state" stores information about changes the user entered in his her skill map. Unchanged is the default value for state attribute when creating the map. The other attributes can occur either when removing associations (removed replaces unchanged) or when adding a new association (added).

We also propose adding three attributes for each skill.

The attribute type "done" stores information about a user's activity. Namely, it can say if the skill map owner has used the courseware or not. It can have one of two values: 0 (meaning that the user did not use the courseware) and 1 (meaning that the user used the courseware).

Table 2

Association Type	Association Role 1	Association Role 2
Abstract		
courseware_author	courseware	Author
courseware_vendor	courseware	Company
courseware_date	courseware	Date
courseware_theme	courseware	Theme
courseware_product_name	courseware	product_name
courseware_type	courseware	courseware_type
courseware_language	courseware	Language
Non-abstract		
courseware_prerequisite	courseware	Courseware
courseware_successor	courseware	Courseware
courseware_related	courseware	Courseware

The proposed associations link courseware *topic with abstract topics, as well as with other* courseware *(non-abstract) topics.*

Table 3

Association Type	Attribute Type	Attribute Values
courseware_prerequisite	State	unchanged (default), removed, added
courseware_successor	State	unchanged (default), removed, added
courseware_related	State	unchanged (default), removed, added

The attribute type "passed" stores information about evaluated user's knowledge. After doing the courseware, the user can take tests, which will then provide Skill Map with the test results. It can have values between 0 and 1, where 0 is the lowest grade and 1 is the highest.

The attribute type "estimated_interest" stores information about the interest in courseware's importance for the user. We estimate this value dynamically, by analyzing user's behavior. 0 means the lowest interest, 1 the highest.

REFERENCES

Abramowicz, W., Kowalkiewicz, M., Schmale, T., & Zawadzki, P. (2002). Corporate knowledge vs. Knowledge within corporation. *Publication for Network Learning Conference*, Berlin.

An XML-Based Ontology Exchange Language. Retrieved from the World Wide Web: http://www.ai.sri.com/~pkarp/xol/xol.html

The DARPA Agent Markup Language. Retrieved from the World Wide Web: http://www.daml.org/

Gangemi, A., Guarino, N., Masolo, C., & Oltramari, A. (2001). Understanding top-level ontological distinctions. *IJCAI 2001 Workshop on Ontologies and Information Sharing*.

Gómez-Pérez, A. (1999). Evaluation of Taxonomic Knowledge in Ontologies and Knowledge Bases. *Knowledge Acquisition Workshop*, KAW99.

Grønmo, G. Ove. (2000). Creating semantically valid topic maps. *XML Europe Conference*, Paris, France.

Gruber, T.R. (1993). A Translation Approach to Portable Ontology Specifications. *Knowledge Acquisition*. Stanford University, Knowledge Systems Laboratory.

Gruber, T.R. (1993). Toward Principles for the Design of Ontologies Used for Knowledge Sharing. *International Workshop on Formal Ontology*, Padova, Italy.

Guarino, N. (1998). Formal Ontology and Information Systems. In *Proceedings of FOIS'98*. Trento, Italy.

Information technology – SGML Applications – Topic Maps. (2000) International Organization for Standardization, *ISO/IEC 13250.*, Geneva.

Knowledge Interchange Format. Retrieved from the World Wide Web: http://logic.stanford.edu/kif/dpans.html.

Ksiezyk, R. (2000). Answer is just a question [of matching Topic Maps]. *XML Europe Conference*. Paris.

The Ontology Interchange Language. Retrieved from the World Wide Web: http://www.ontoknowledge.org/oil/

The Ontology Markup Language. Retrieved from the World Wide Web: http://www.ontologos.org/OML/OML.html

Pepper, S. (2000). The TAO of Topic Maps, finding the way in the age of infoglut. *XML Europe Conference*. Paris.

The Simple HTML Ontology Extensions. Retrieved from the World Wide Web: http://www.cs.umd.edu/projects/plus/SHOE/.

Sowa, J.F. (2000). *Knowledge Representation: Logical, Philosophical, and Computational Foundations*. Pacific Grove, CA: Brooks Cole Publishing.

Chapter II

Conceptual Confusions in Knowledge Management and Knowledge Management Systems: Clarifications for Better KMS Development

Michael Boahene
Holism Information Systems Management, Australia

George Ditsa
University of Wollongong, Australia

ABSTRACT

Knowledge Management and Knowledge Management Systems are slowly but surely capturing the attention of many organisations in a quest for competitive advantage. Like many other computing fads before them, there is no shortage of recipes by its proponents. This chapter discusses the emerging discipline of Knowledge Management in computing and explains the concepts underlying Knowledge Management Systems that will lead to a better development and implementation of these systems. In particular, it tackles the conceptual confusion about data, information, and knowledge, which appears to be

finding its way into the Knowledge Management literature. The terms, 'capta' (Checkland, Howell, 1998) and 'constructed data' (Flood, 1999), are used in analysing these concepts to clear some of the confusion surrounding them. The use of these terms also highlights our (the IT community) taking for granted assumptions about the hierarchical relationship and the more insightful emergent relationships.

INTRODUCTION

Every few years, the IT community comes up with a promised panacea to cure all ills. There was once the push for office automation, artificial intelligence, decision support, groupware, reverse engineering, MIS, B2B, B2C and now, it is KM - Knowledge Management. These are often brilliant concepts and while they all find their level of utility, usually more modest than their proponents' claims, they have by and large been misunderstood and misapplied, to the disadvantage of some stakeholders and, ultimately, investors. This misunderstanding is often characterised by a lack of foundational concepts about the development and management of information systems, of which knowledge management systems are now a particular type.

Knowledge Management Systems (KMS) are now being touted as yet another silver bullet. How can a would-be investor in a KMS realise its anticipated benefits and how would an implementor know they are on the right path, thereby avoiding this characteristic confusion that may inevitably snuff out the promise shown by this idea? The urgency for such a conceptual cleansing is echoed by White and Sutton (2001, p. 180) who note that, "the kinds of rationalist assumptions about knowledge creation and use, which characterise Knowledge Management, are inadequate." They suggest the need for a broader approach to, and definition of, knowledge as an essential pre-requisite to attempts to harness and exploit it: otherwise, the emerging discipline may also be consigned to the ranks of yet another 'management fad'.

This chapter looks at some concepts underlying Knowledge Management and suggests some ways of bringing the concepts to bear on Knowledge Management Systems. Following this introduction, the chapter first highlights the current state of affairs and then some of the conceptual confusion in the area of Knowledge Management. This is followed by a brief overview of a target environment, which Knowledge Management Systems are supposed to serve (i.e., help organise and manage). The chapter then continues by presenting a critical analysis of some terms which KMS thrives on. The chapter then presents a conceptual cleansing that will lead to the realisation of a better KMS.

Our analysis follows a systemic account that draws heavily on concepts and insights originating from the works of Hirschheim et al. (1995) concerning information systems development methodologies, Checkland's (1998) work concerning the nature of information systems and Flood (1999) and Senge's (1995) work concerning the organisation and management of complex systems.

Current State of Affairs

The implementation of Knowledge Management Systems has generally focused on the technological capabilities of data representation and access, to the detriment of foundational concepts about the generation of data itself. As noted by Yen (2001), of the many vital issues in knowledge management, knowledge representation has been studied more thoroughly than others. However, without a foundationally coherent and consistent understanding of data, information, knowledge and the organisation and the management of complexity within the target environment (Boahene, Ditsa, 2001), all the technological sophistication is unlikely to guarantee the realisation of any anticipated benefits.

By far, the literature on KMS has focused on the categorisation, classification and processing of invariances, assuming some relationship between data, information and knowledge. Hence, we have categorisations such as tacit and explicit knowledge, objective and subjective knowledge, certain and uncertain knowledge and so on. These categorisations—while interesting—are, however, of little value in providing insights into the conception and development of Knowledge Management Systems. The problem is that such categorisations do not distinguish between data originating from observations in the target environment, on one hand, and the 'knowledge-base' needed to make sense of the observations, on the other. As such, any given set of data may have characteristics of both.

White and Sutton (2001), in their inquiry into knowledge management in clinical practice within the NHS in Britain, make a similar observation when they note that no work was found which analysed types of clinical knowledge in such a way as to define which phenomena fell into which category and what the relative percentages were.

The Conceptual Confusion

A relationship between data, information and knowledge is widely recognised in the literature. This relationship is popularly recognised as a hierarchy where data, being plentiful, sits at the base, followed by information and then knowledge. However, the distinction often seems arbitrary. These terms are often used interchangeably, making it difficult to make sense of the emergent relationships that exist between them. This confusion has found its way into the knowledge management literature, where a diverse range of application systems lay claim to being Knowledge Management Systems.

Further, organisation and management are underpinned by thinking, which can be categorised in philosophical and sociological terms. From a philosophical perspective, there is positivism and phenomenology at opposite ends of a continuum. The positivist stance refers to a philosophical position characterised by a readiness to concede primacy to the given world as known through experimental evidence. The phenomenological stance, on the other hand, refers to the position characterised by a readiness to concede primacy to the mental processes of observers rather than to the external world (Checkland, 1981).

From a sociological perspective, there are functionalist and interpretivist views at polar ends of a continuum, yielding 'hard' and 'soft' systems thinking approaches to the organisation and management of phenomena (e.g., problem of choice in a dynamic environment). The functionalist view adopts a realist ontology and assumes that facts about the world exist and are waiting to be discovered; hence, knowledge is perceived as an immutable object that exists in a variety of forms (e.g., tacit, explicit) and reside in a variety of locations (e.g., individuals, culture, work routines). The interpretivist perspective maintains that reality is socially constructed; hence, knowledge is perceived as a process of knowing that is continually emerging, indeterminate and closely linked with practice (Detlor, 2001).

These philosophical and sociological viewpoints form the basis of all thinking and practice in the inquiry into a target environment, the selection of relevant data and the development of information systems that serve systems of purposeful action (e.g., managing complexity).

Can both viewpoints be right or is one right and the other wrong? Or, more importantly, how can each be leveraged off the other to deepen our understanding and reduce uncertainty in inquiries concerning the development of Knowledge Management Systems? To answer these questions we first need to understand the nature of the phenomena (i.e., data, information and knowledge) that fuels the creation, access, use and sustenance of Knowledge Management Systems.

Target Environment

Little attention has been paid to the nature of a target environment, which invariably gives rise to the management and organisational functions, which a Knowledge Management system is supposed to serve. To understand the emergent relationships between data, information and knowledge, we need to take a closer look at organisation and management, the reason for the generation of data in any target environment. A target environment being any bounded area in which we set out to intervene in a problem situation. In this environment, problem situations that arise do not come neatly packaged to fit into any predetermined classifications. These are messy, real world problems, as Checkland (1981) puts it. A target environment is characterised by complexity with elements exhibiting dynamic behaviour. According to Flood (1999, p. 86), "dynamic behaviour is capable of producing unexpected variety and novelty through spontaneous self-organisation. … a complex of variables interrelates with multiple feedback, which spontaneously creates a new order."

Senge (1990), however, makes an important contribution to understanding complexity in a target environment by distinguishing between two kinds of complexity in management situations, reflecting the nature of the target phenomena that Knowledge Management Systems aim to support. These he classifies as detail complexity and dynamic complexity. Detail complexity refers to situations where there are many variables; however, outcomes are predictable. Dynamic complexity refers to situations where cause and effect are subtle and where the outcomes of interventions over time are not obvious. As he points out, mixing many ingredients into a stew involves detail complexity, as does taking inventory in a retail store. But balancing market growth and capacity expansion or improving quality while reducing total costs and satisfying customers in a sustainable manner are examples of dynamic complexity problems.

In problems involving detail complexity, cause and effect are closely linked; therefore, it is possible to predict outcomes based on a given set of variables relevant to the problem situation. For instance, it is relatively easy to predict the composition and even taste of a hamburger given the proportionate mix and the order of introducing the ingredients (a problem of detail complexity). Using the taste of the hamburger, it is a lot more uncertain, if at all reliable, to predict if it would attract customers and, therefore, increase sales or the market share for the hamburger (a problem of dynamic complexity), because other factors such as market conditions and consumer behaviour may be at play in influencing the outcome.

Detail and dynamic complexity are the challenges that Knowledge Management Systems and, for that matter, all other information systems aim to help users organise and manage in problem situations.

The following section presents an analysis of the terms (*data*, *capta*, *information, knowledge and organisation and management*) on which Knowledge Management Systems thrive.

ANALYSIS OF TERMS IN KNOWLEDGE MANAGEMENT SYSTEMS

Data

Hirschheim et al. (1995, p. 14) defines data as "invariances with potential meaning to someone who can interpret them." According to Hirschheim et al., the basis of all communication technically, biologically or socially are invariances encoded in some medium and transmitted in many forms (e.g., waves, electrical currents).

The encoded invariances are received through our senses (e.g., vision, hearing, smell, touch, taste). It is important to note that following the receipt of invariances, via a communication medium through our senses, what is expressed as data may be represented as a word, sentence, number, sign, symbol or some other form of representation.

Hirschheim et al. distinguish between invariances that occur naturally, such as bird markings, and invariances created by humans for some purpose, such as letters and graphics. In this chapter, we shall concentrate on the invariances created by humans through observations (with our senses) or cognitive capabilities.

Also, through his analysis of Systems Thinking, Checkland (1981) makes an important contribution to the understanding of the nature of data. He distinguishes between two types of data. One that is independently verifiable (that which positivists and functionalists propose as a reality outside ourselves which actually exists) and one that is perceptive and, therefore, within oneself (that which phenomenologists and interpretivists propose as the continually negotiated truth).

Consider the following examples of data. If I observe an object (e.g., a dog), which other observers that I am not in collusion with can confirm, or a camera can record the same object as a dog, then I am prepared to say there is an immutable invariance that may be expressed as data (e.g., "This is a dog" or dog) which exist outside of ourselves and is real. This type of invariance seems to be what the functionalists refer to as data.

However, if I observe a dog and describe it as cute or beautiful or ugly, then while the fact remains that it is a dog (which agrees with the functionalists view of data), it can hardly be argued that 'a beautiful dog' is an immutable invariance, since it is my perception of the dog which may or may not be confirmed by any other observer. This type of invariance seems to be what the interpretivists refer to as data.

Capta

As Checkland and Howell (1998) point out, there could be a multitude of data (or invariances) pertaining to any particular object or phenomenon, but we choose, for one reason or another, to focus on a subset which is of interest to us at any time. They make a defining distinction between the multitude of data attributable to an object or phenomenon and the subset we choose to pay attention to. This, they refer to as 'capta'.

Flood (1999) complements this line of reasoning. He uses the term 'data construction' instead of 'data collection' to distinguish between the mass of data that could be attributed to a phenomenon or item of interest and the portion that is considered and chosen to be of interest. He points out rather understatedly that, "data is not waiting out there in volumes to be reaped like corn in an autumn harvest, but it is rather the product of a process of investigation" (p. 145).

For instance, of all the invariances that may be observed about dogs and represented as data, a breeder may choose to pay attention to (i.e., 'capta') colour, breed and origin rather than size, age or sex, as a result of some interests (e.g., breeding exotic dogs) that the breeder may have and the environment (e.g., locality, regulations, etc.) within which the inquiry is conducted. It is, however, possible that at some future time the breeder may choose to pay attention to a different subset of data if the environment or his/her interests change.

This distinction is important as it draws attention to the fact that the selection of a subset of all possible data about an object or phenomenon should not be taken for granted, since it defines boundaries of the target environment. More importantly, it also limits the subsequent insights that may be generated about the object or phenomenon. Therefore, the current assumption that 'data-warehouses' could be the repository of all data about an object or phenomenon in advance and 'mined' for insights is not very well grounded, because the bounded environment keeps changing.

In summary, data are the starting point in our mental processing. That is, invariances about an object or a phenomenon that could be paid attention to. 'Capta', on the other hand, are the result of selecting some for attention. The emergent property in the relation between data and capta being the decision to pay attention to the data that is selected because of a perceived interest.

Information

Having *constructed data (*through the process of investigation) or chosen to pay attention to a subset of the mass of possible data (*capta*) about an object or a phenomenon, we put it into context or attribute meaning to it. Hirschheim et al. (1995) contends that by themselves these invariances have no intrinsic meaning. The invariances acquire meaning through social conventions of individuals and communities. The invariances received are transformed through a process of meaning attribution (or interpretation) into information, which then triggers a behaviour. Attribution of meaning to 'capta' is a creative act and it may be argued that no two interpretations are ever quite the same. In other words, there is no guarantee that the same meaning will be attributed to the same observation by two individuals or even the same individual on different occasions.

For instance, at a dog show the dog breeder may observe, for argument sake, a red, white and blue striped chihuahua from France and attribute meaning such as, 'cute but not exotic', which triggers a 'don't buy' behaviour. Another may make the same observation, but attribute meaning such as, 'interesting, worth trying' and trigger a 'buy' behaviour.

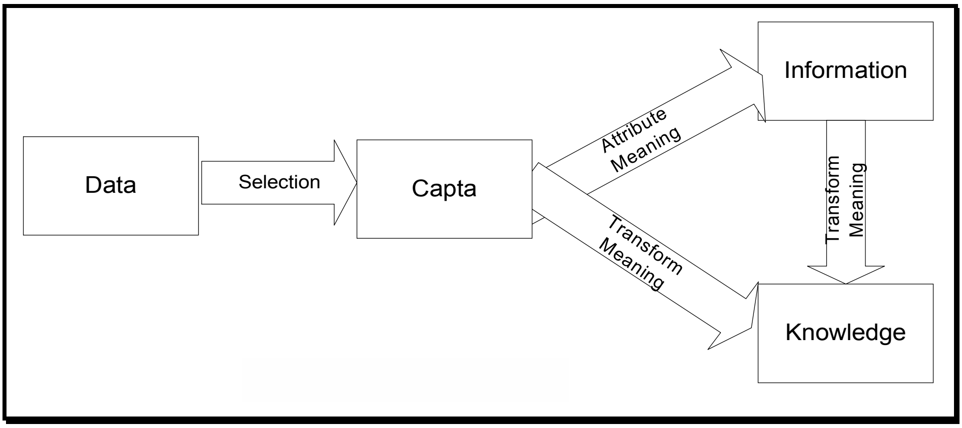
This complements the observations of Sutton and White (2001) when they point out that, technically, clinical observations can be readily translated into data and that data can be shared. However, accurate technical performance does not necessarily equate to transfer of knowledge. It rather gives a partly illusory and misleading representation.

In summary, information is created through the attribution of meaning (by individuals) to 'capta'. Information, therefore, is a far more personal, variable, esoteric and ephemeral concept, dependent on the receiver's point of interest and 'knowledge-base', which is private and only available to the individual. Information, however, should not be confused with knowledge.

Knowledge

'Capta' that has been generated as a result of a process of inquiry or observation, the meaning attributed to it and the behaviour that follows can all be transformed into a new 'form' exhibiting different emergent properties. This new 'form', also 'capta', is stored as part of a 'knowledge-base'. It enriches the 'knowledge-base' and may be used for further meaning attribution to new 'capta' on another occasion.

Figure 1: "Capta" Relationships



From the previous statements, we assert that there are two types of 'capta': one that is about observations, ephemeral meaning and behaviour pertaining to a target environment and one that enriches the 'knowledge-base'. The first type of 'capta' referred to as 'observation induced capta' is transformed into the second type of capta referred to as 'transformed capta'. The 'transformed capta' is represented as concepts, methods, beliefs, values and normative principles, forming a filter through which we perceive events and observations, thereby enabling us to attribute particular meanings to new 'observation induced capta'. This, however, does not preclude the 'garbage-in garbage-out' principle. If the 'knowledge-base' is unreliable, it is unlikely to support the effective attribution of meaning to new 'observation induced capta'.

This concept complements what White and Sutton (2001) noted as a process of knowledge generation and decision making by one of the participants in their study. The participant explains that, "following the initial discussion with the patient, I take the data collected [i.e., 'observation induced capta'] and put it in my knowledge base [i.e., transformed 'capta'] and conclude a number of things [i.e., further meaning attribution to 'observation induced capta'] about the present state of the individual" (p. 179).

With respect to 'capta', Hirschheim et al. (1995, p. 14) cite four types of speech acts (cf. Deitz, Widdershoven, 1992, cited in Hirschheim et al., 1995) following from Habermas' Theory of Communicative Action:

- To express how one feels or thinks (expressiva), e.g., I love pink dogs;
- To get someone to do something (orders, imperativa), e.g., When you see a pink dog, buy one;
- To appeal to others to obey accepted social norms (regulativa), e.g., Dogs should be well cared for; and

- To get someone to accept something as true (assertions about the external world, also called constantiva), e.g., Pink dogs are a money spinner.

'Observation induced capta', which may be captured in a raw form or deduced, manifest as expressiva or imperativa speech acts, while 'transformed capta', stored as part of a 'knowledge-base', manifest as regulativa or constantiva speech acts – accepted social norms and assertions of truth about the external world.

As a further example, let's go back to the information created by the breeder's observation. In speech acts, the information created is expressiva (i.e., 'cute' and 'not exotic') and the behaviour triggered, i.e., 'don't buy', is imperativa. But why does the breeder come to this conclusion? Perhaps the breeder, knowing that his/her clients are only attracted to mono colour, pure-bred dogs originating from hard-to-reach countries or higher profit margins for such dogs. Whatever the reasons (i.e., the 'Whys'), this knowledge expresses the breeder's assertions of truth about a perceived external world (i.e., constantiva).

In summary, knowledge is a reserve of 'transformed capta', expressed as constativa or regulativa that can be applied to new 'observation induced capta'. Knowledge may be personal or collective, but definitely more stable than information.

From the discussion so far, we recognise an emergent relationship between data, capta, information and knowledge as shown in the following diagram. The question then is, can computers automatically undertake the transformation of 'capta' into knowledge?

In the next section we present a conceptual cleansing which we hope will lead to a better understanding of the conception, development and implementation of Knowledge Management Systems.

Conceptual Cleansing

We have so far been laying the foundation from which to clarify the competing claims about knowledge management and the confusing manifestations of Knowledge Management Systems.

Knowledge Management Systems have been popularly defined by different writers from either a structural or functional perspective. From a structural point of view, Morse (2001) defines Knowledge Management Systems as follows: "Knowledge [management] systems take a large, diverse collection of document-based knowledge, provide a physical infrastructure for storing those documents and provide a logical structure for retrieving information" (p. 230). He also provides a functional definition as follows. "Knowledge [management] systems are centralised computer systems that store, structure and provide access to the corporation's document-based knowledge" (p. 230).

We find the structural perspective somewhat deficient, because of the variety of possible compliant components which do not particularly contribute to either a necessary or sufficient condition for the attainment of an effective knowledge management system. The functional perspective, although it gets us closer to a unifying definition, does not surface fundamental assumptions (e.g., beliefs and values) made about content which is necessary for the KMS to function adequately.

Knowledge management in any target environment may be viewed as an ongoing 'journey' rather than an end or a destination in itself. Knowledge changes over time since it is a synthesis of the perceptions of a target environment, which is in a constant state of flux. Further, in knowledge-intensive working environments where people deal with dynamic complexity, consensus building as an approach to decision-making is rarely the norm. However, most conventional KMS implementations assume and model interventions around consensus (as the dominant cultural approach to decision-making) and determinism – a characteristic of detail complexity.

Following from our earlier discussion about the philosophical and sociological perspectives of organisation and management of phenomena (and objects) and its relationship to data, it is apparent that the ontology and epistemology of systems developed to support problem situations will contain an indeterminate mixture of positivist (functionalist) and phenomenologist (interpretivist) stances. The ontology is concerned with the fundamental units (or elements) which are assumed to exist in a target environment. The units may be composed of hard tangible structures (e.g., dog, building, car) with a concrete material base (realism), or composed of malleable, vague phenomena (e.g., sale, agreement, service), which are socially constructed through an intellectual or cultural base of values and concepts (nominalism or idealism). The epistemology is concerned with how an investigator inquires into a target environment and sees phenomena (observation 'capta') in them (Hirschheim et al., 1995).

These will reflect the relative mix of detail and dynamic complexity requiring management in the problem situation. In practice, each polar end of the continuum is unlikely to capture the relevant nature of the target environment or managing complexity (detailed and dynamic) of problem situations arising within them.

To support the organisation and management of the requisite mix of detail and dynamic complexity in a target environment, we distinguish between four categories of information systems:

- Transaction Processing Systems – Capturing observation, observation induced and transformed capta.
- Information Management Systems – Consisting of observations and observation induced 'capta'. A base of expressiva speech acts, mainly supporting the recall of meaning-attribution.
- Knowledge-based Systems – Consisting of 'observation induced capta'. A base of codified meaning representing imperativa speech acts. Mainly to support the organisation and management of detail complexity.
- Knowledge Management Systems – Consisting of 'transformed capta'. A base of concepts representing regulativa and constantiva speech acts. Mainly

to support the organisation and management of dynamic complexity.

As a consequence of this distinction, we assert that there is only one type of Knowledge Management system. Defined from a content perspective, a Knowledge Management system is an organised collection of concepts, methods, beliefs, values and normative principles (i.e., ‘knowledge-base’) supported by material resources (e.g., technology). Our definition is similar to Hirschheim et al’s (1995) definition of an information systems development methodology. A ‘knowledge-base’ is used to make sense of invariances (i.e., ‘observation capta’), not to provide codified meaning about an object or phenomenon that has been chosen for attention. A ‘knowledge-base’ is the source of our ‘know-why’ (Boahene, 1999), used to organise and manage uncertainty in complex problem situations, which is an essential property of knowledge.

As a rule of thumb, Information Management Systems have the capability to provide answers to questions of ‘Where’, ‘Who’, ‘When’ and What’, while Knowledge-based Systems go a step further, providing answers to questions of ‘How’, but Knowledge Management Systems will have the capability to provide answers to questions of ‘Why’ and, in some cases, ‘How’.

Notwithstanding the dizzying array of application systems that claim to support knowledge management, if the system does not articulate a ‘knowledge-base’ that supports dynamic complexity, then it is not a KMS.

Since dynamic behaviour is characterised by unexpected variety and novelty through spontaneous self-organisation, solutions to issues and problems cannot be known *a priori*. We learn our way into the unknown. The ‘knowledge-base’ in a knowledge management system ought to provide the frame of reference that will be consistently used to provide insights that support the organisation and management of dynamic complexity in a target environment, that is, new and deeper understandings of problem situations and how to intervene in them.

Table 1: Rule of Thumb

System Type	Problem Situation	Typical Capability	Speech Act
Information Management	Detail complexity	Where,Who, When, What,	Expresiva
Knowledge-based	Detail complexity	How	Imprerativa
Knowledge Management	Dynamic complexity	How, Why	Constantiva Regulativa

Concepts in a 'knowledge-base' are structures used to classify, explain and give order to phenomena or an object in a target environment. As an example, Flood (1999) provides an insightful conceptual structure for deepening systemic appreciation of a problem situation. According to Flood, any investigation into a problem situation will use ideas from systems of processes, structure, meaning and knowledge-power. These different views may be combined to provide a panoramic view, which he terms prismatic thought.

Beliefs are inferences of 'truth' that we hold in esteem and values help us to justify and uphold those beliefs. These beliefs affect our attitude toward, and our perception of, phenomena and the environment in which it occurs. Truth, however, should not be viewed as unchanging. As Flood's concept of prismatic thought suggests, a target environment is determined by boundary judgment. Boundaries are mental constructs, which determine what is in view (and might be taken into account at the moment) and what is out of view (and thus excluded from consideration). As such, the determination of a target environment (i.e., bounded action area) and what is taken to be relevant and worthy of having knowledge about is influenced by beliefs and values, both of which may change (in space and time) as different complex mixes of variables come into view and others drop out of view. It, therefore, follows that knowledge also changes as truth is continually renegotiated.

Concepts, beliefs and values can be organised into coherent sets of technical and behavioural rules which guide an approach to investigating problem situations in a target environment. These rules may be expressed as methods and normative principles. These elements of a 'knowledge-base' are what transformed 'capta' is about.

The 'knowledge-base' so constructed with the support of material resources can then be used to make sense of the nature of what is known about a target phenomenon (e.g., problem situation and possible insights that can be acquired through different types of inquiry) and alternative methods of investigation (i.e., observation capta) and thereby intervene more effectively.

While computers may be used to deduce expresiva and imperativa speech acts, it is unlikely that they can be used to deduce regulativa or constantiva speech acts. However, a computer will be perfectly capable of capturing and storing all speech acts.

CONCLUSION

This chapter has discussed the emerging discipline of Knowledge Management in computing and explained the concepts underlying Knowledge Management Systems which we believe will lead to a better understanding for the development and implementation of these systems. An attempt has been made to clear some of the conceptual confusion surrounding data, information, and knowledge which appears to be finding its way into the Knowledge Management literature.

REFERENCES

Boahene, M. (1999). Information systems development methodologies: Are you being served? *Proceedings of 1999 Australasian Conference on Information Systems*. Wellington, New Zealand, 88-99.

Boahene, M., & Ditsa, G. (2001). The conception of an information system, *Proceedings of 2001 Information Resources Management Association International Conference*, Toronto, Canada, 81-84.

Checkland, P. B. (1981). *Systems Thinking, Systems Practice*. John Wiley & Sons.

Checkland, P. B., & Howell, S. (1998). *Information, Systems and Information Systems: Making sense of the field*. John Wiley & Sons.

Detlor, B. (2001). An informational perspective towards knowledge work: Implications for knowledge management systems. *Proceedings of 2001 Information Resources Management Association International Conference*. Toronto, Canada, 463-466.

Flood, R. L. (1999). *Rethinking the Fifth Discipline: Learning within the Unknowable*. Routledge.

Hirschheim, R., Klein, H. K, & Lyytinen, K. (1995). *Information Systems Development and Data Modeling: Conceptual and Philosophical Foundations*. Cambridge University Press.

Morse, R. (2001). Applying level of technology use models to knowledge systems use. *Proceedings of 2001 Information Resources Management Association International Conference*. Toronto, Canada, 230-234.

Senge, P. (1995). *The Fifth Discipline - The Art and Practice of the Learning Organization*. Random House.

White, D. A. & Sutton, Y.M. (2001). Knowledge management: A telling oxymoron? *Proceedings of 2001 Information Resources Management Association International Conference*. Toronto, Canada, 177-181.

Yen, V.C. (2001). A Hybrid Knowledge Mapping Structure and Its Applications. *Proceedings of 2001 Information Resources Management Association International Conference*. Toronto, Canada, 671-673.

Chapter III

A Framework to Study Knowledge Transfer During Information Systems Development (ISD) Process

K.D. Joshi
Washington State University, USA

Saonee Sarker
Washington State University, USA

ABSTRACT

The information systems development process (ISD) remains a topic of great interest for IS researchers, especially due to the increase in the number of ISD failures. The IS researchers suggest that one possible cause for the failure of ISD may be the lack of relevant knowledge transferred from the system users to system developers. However, IS researchers have not yet directed their attention toward examining the factors that impede the transfer of knowledge among the system users and developers. In order to understand the impediments

to the knowledge transfer process during ISD, it is crucial to systematically study how the nature of knowledge transfer unfolds during this process. This chapter provides a framework that allows researchers to study this phenomenon in a systematic fashion. Specifically, it identifies a comprehensive set of factors that influence the knowledge transfer process and posits a set of propositions that future research should examine.

INTRODUCTION

It is widely recognized that knowledge is one of the salient features of the emerging economy. Nonaka (1994, p. 14) suggests that, "It is widely observed that the society we live in has been gradually turning into a 'knowledge society'." Pan and Scarborough (1999, p. 55) argue that knowledge is the most important resource that "contributes to the competitive advantage of an organization." Hiebeler (1996, p. 22) argue that only those organizations that can develop best practices for managing knowledge will have a competitive advantage. Given the current focus of organizations and the nature of the competition, knowledge management (KM) is thus seen as one of the most important activities of an organization.

Knowledge management (KM) is not one specific activity, but a collection of multiple sub-activities referred to as ***knowledge activities***. KM can be defined as the application of these ***knowledge activities*** on knowledge resources that are constrained and facilitated by a wide range of factors. The knowledge activities identified and characterized by KM researchers include: knowledge acquisition, knowledge selection, knowledge generation, knowledge use, knowledge internalization, and knowledge transfer (Holsapple, Joshi, 2002). The focus of this framework is specifically on the aspect of ***knowledge transfer***.

The transfer of knowledge, i.e., to get the "right" knowledge to the "right" participant at the "right" time in the "right" form and at the "right" cost, is one of the greatest challenges of knowledge management. Greengard (1998) argues that the sharing of knowledge is one of the most important activities of knowledge management. A similar sentiment has also been expressed by Puccinelli (1998), who suggests that in order to reap benefits from knowledge management, it is important to consider the concept of knowledge sharing. Szulanski (1996) argues that knowledge transfer is extremely important especially in the current information age. Alavi (2000) suggests that one of the biggest reasons for focusing on knowledge transfer is that knowledge generation by itself cannot lead to superior performance for the organization. Rather, companies have to create value by using that knowledge, and knowledge can only be utilized if it is transferred successfully.

The knowledge transfer literature suggests that it is an extremely complex process and often witnesses tremendous difficulties (von Hippel, 1994; Zander, Kogut, 1995; Szulanski, 1996, 2000; Bresman, Birkinshaw, Nobel, 1999; Simonin, 1999). However, these studies examined the transfer of best practices among organizational units, between strategic alliances and partners. We are interested in extending their work by examining the knowledge transfer process in light of information systems development. Specifically, the focus of this chapter is to posit a framework that could form a foundation for future knowledge transfer research in the area of information systems development.

The information systems development process (ISD) remains a topic of great interest for IS researchers, especially due to the increase in the number of ISD failures (Guinan, Cooprider, Faraj, 1998). Researchers have suggested that different factors such as the user's inability to specify the necessary systems requirements (Boland, 1978), the developers' inability to elicit requirements from the users and to follow those requirements in systems design and development (Davis, 1982) as possible causes of failure of ISD. However, in spite of this realization, most of ISD research has focused on understanding the ways in which ISD processes can be made more efficient, examining the use of teams in ISD, and studying team dynamics occurring in ISD (Guinan et al., 1998; Janz, Wetherbe, Davis, Noe, 1997). Few studies have actually focused on the dimensions of knowledge transfer that may be impeding the successful transfer of knowledge between the users and the developers. Taking a knowledge management perspective, the framework presented in this chapter focuses on the specifics of the nature of knowledge, the characteristics of the users and the developers, and the characteristics of their relationship that affect the transfer of the system requirements knowledge during an ISD process.

This chapter is organized into three sections. First, a theoretical groundwork for this research is established. Second, a framework to study the knowledge transfer process during ISD is developed. Finally, the chapter conclusion is presented.

BACKGROUND

In this section, we discuss the existing literature on knowledge transfer, including the research on stickiness, that forms the foundation of our framework.

Knowledge Transfer

A considerable amount of research has been directed towards the transfer of strategic knowledge among alliances and partners, the transfer of best practices among organizational units, and technology transfer. Therefore, the knowledge and the insights gained from the past knowledge transfer research are used to develop the posited framework. In this section, we briefly summarize the theoretical background that forms the basis of our framework.

Szulanski (1996) examined the impediments to the transfer of best practices in a firm. This study developed a process model of knowledge transfer and captured the transfer barriers at different phases of the process model. The results of Szulanski's (1996) study show that the major barriers to knowledge transfer are: the lack of absorptive capacity of the knowledge recipient, the nature of the knowledge transferred, and the relationship among the source and the recipient. The independent and the dependent variables used in this study are listed in Table 1.

Zander and Kogut (1995) empirically studied the speed of knowledge transfer. Specifically, the focus of this study was to measure the speed at which manufacturing capabilities get transferred. The results of this study show that knowledge tacitness has a significant impact on the speed of transfer. The independent and the dependent variables used in this research are listed in Table 1.

Simonin (1999) studied the transfer of marketing know-how. Specifically, the study examined the role of knowledge ambiguity in the transfer of marketing know-how in international strategic alliances. This study showed that knowledge tacitness has a significant impact on knowledge ambiguity, and thus, on the knowledge transfer process. The independent and the dependent variables used in this research are listed in Table 1.

Bresman et al. (1999) conducted a study of knowledge transfer in international acquisitions. The results of this study show that communication and the frequency of meetings were significant predictors of knowledge transfer. Further, the impacts of knowledge tacitness and time elapsed since the acquisition varied based on the type of knowledge being transferred. The independent and the dependent variables used in this research are listed in Table 1.

Table 1: A Summary of Independent and Dependent Variables Used in Past Research Studies

Authors	Independent Variables	Dependent Variables
Bresman et al., 1999	Communication, frequency of meetings, knowledge tacitness, time elapsed, and size of unit	Knowledge transfer
Simonin, 1999	Tacitness, knowledge specificity, complexity, experience, partner protectiveness, cultural distance, and organizational distance. (Their framework uses collaborative experience, firm size, and alliance duration as moderators.)	Knowledge ambiguity
Szulanski, 1996	Causal [knowledge] ambiguity, unproven knowledge, motivation, recipient's absorptive and retentive capacity, unreliable source, barren organizational context, and relationship between the source and the recipient	Difficulty experienced during the transfer process (which he calls stickiness)
Zander & Kogut, 1995	Knowledge tacitness (codifiability and teachability), complexity, systems dependence, and product observability	Speed of transfer

Stickiness in Information Systems Development

In our framework, knowledge transfer refers to the process where the source (i.e., the system users) communicates the system requirements (the task-related knowledge required to build the system) to the recipient (i.e., system developers). ***Stickiness refers to the difficulty experienced in this process*** (von Hippel, 1994; Szulanski, 1996, 2000). In this framework, the users are the source of the knowledge and the developers are the recipients of that knowledge. The terms source (users) and recipients (system developers) are used interchangeably throughout this chapter.

Although, the information systems development research recognizes the existence of stickiness during the systems development process, information systems researchers have paid little attention to the understanding of the origins of stickiness. A systematic and focused examination of the factors that lead to stickiness during systems development can help address the problems that arise due to the lack of required knowledge transfer between the users and the developers. In this section, we discuss the causes of stickiness during the process of systems development.

The degree of stickiness in a transfer process is partially determined by the nature of knowledge (von Hippel, 1994). Moreover, Polanyi (1967) suggested that many human skills and much human expertise (i.e., knowledge) employed in problem solving are of a tacit nature. This tacit nature of knowledge makes the transfer process difficult (Nonaka, 1994, von Hippel, 1994). In an information systems development process, communication of system requirements involves explicating the user's knowledge of the tasks that is to be supported by an information system. The user's knowledge, which is embedded in human minds, in organizational culture, and organizational routines, can be tacit. Therefore, certain aspects of the user's knowledge can be hard to communicate or codify, and thus cannot be easily and readily transferred from the users to the system developers. Based on this premise, we argue that the user's knowledge needed by the developers to successfully build an information system is often sticky.

The degree of stickiness in a knowledge transfer process is also determined by the characteristics of the source and the recipient (Szulanski, 1996; Simonin, 1999; Bresman et al., 1999). These characteristics dictate *what* knowledge gets transferred by the users and *how* much of that knowledge gets internalized and used by the system developers. The absence of the appropriate attributes (of users and system developers) that facilitate knowledge transfer can contribute to the stickiness experienced during the knowledge transfer process. Examples of these characteristics include the experience of the users and the system developers, and the motivation of the users and the developers.

Lastly, the nature of the relationship cultivated by the source and the recipient over the system development process can affect the degree of stickiness experienced in transferring knowledge (Szulanski, 1996; Simonin, 1999). An arduous relationship can make the knowledge transfer process more difficult. On the other hand, a healthy relationship can facilitate the transfer process.

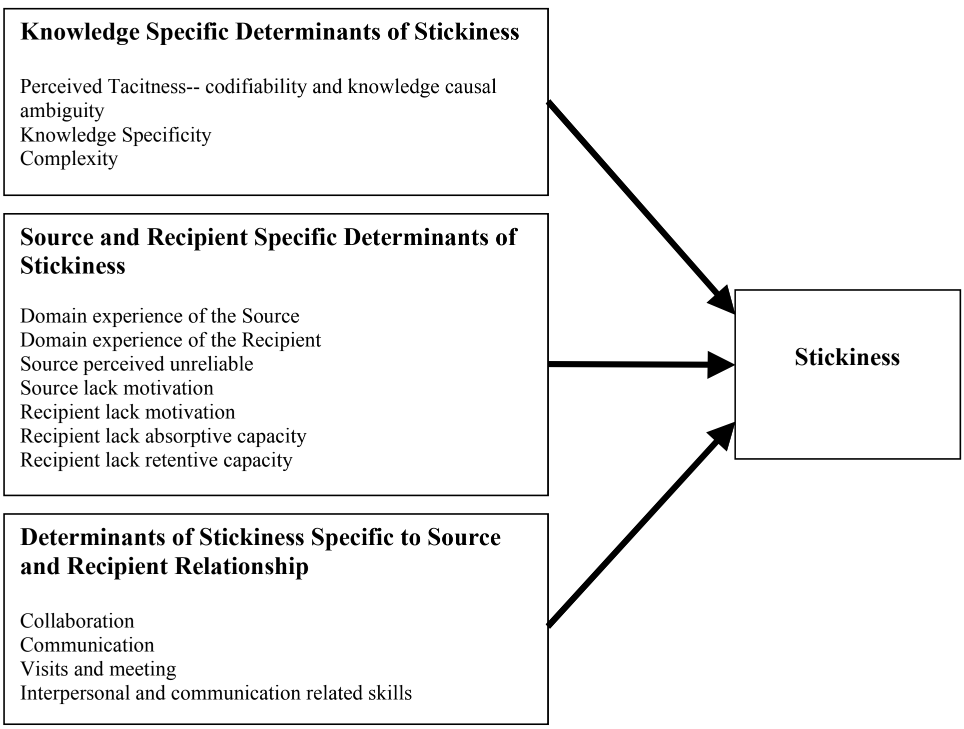
In summary, the above three factors, i.e., the nature of knowledge, the characteristics of the source and the recipient, and the relationship between them collectively conspire to cause stickiness during an information systems development process. In this chapter, we intend to discuss the role of each of these factors in creating stickiness.

THE FRAMEWORK

Overview

Past research suggests that the barriers to knowledge transfer are best predicted by examining the factors that cause stickiness. Stickiness is collectively determined by the nature of the knowledge, characteristic of the source and the recipient, and the relationship between them (Zander, Kogut, 1995; Szulanski, 1996; Bresman et al., 1999; Simonin, 1999; Szulanski, 2000). These constructs gauge different aspects that underlie the facility by which knowledge can be transferred from the source to the recipient during systems development. This section focuses on characterizing these three constructs and the relationship among them (see Figure 1).

Figure 1: Framework of Knowledge Transfer in ISD



Knowledge Specific Determinants of Stickiness

Knowledge specific determinants of stickiness refer to the nature and properties of the knowledge to be transferred that could impede the transfer process (Zander, Kougut, 1995; Winter, 1987). The three knowledge properties that appear to be salient during systems development are: knowledge tacitness, knowledge specificity, and knowledge complexity. In this section, these three factors are discussed in detail.

Tacitness

Knowledge tacitness refers to that aspect of knowledge that cannot be easily and readily communicated and/or shared (Polanyi, 1967; Nonaka, 1994). Tacit knowledge is embedded in an individual's action in a certain context and, therefore, cannot be easily codified. This knowledge attribute has been identified as a critical source of stickiness (Spender, 1996; von Hippel, 1994; Zander, Kogut, 1995; Szulanski, 1996). In summary, tacitness is the non-codifiable accumulation of knowledge that results in causal ambiguity (Szulanski, 1996; Simonin, 1999).

The systems development process involves capturing users' knowledge and embedding that knowledge into the system and/or using that knowledge to build the system. This knowledge is a combination of tacit and explicit knowledge. The tacit knowledge needed to build the system can be embedded in organizational routines (i.e., business processes that the system will support), culture, and organizational participants (Walsh, Ungson, 1991). Therefore, the tacit knowledge represented in these organizational knowledge resources is a source of stickiness in the systems development process.

In the knowledge transfer literature, tacitness has been characterized in a variety of different ways (Zander, Kogut, 1995; Szulanski, 1996; Bresman et al, 1999; Simonin, 1999). Since most of the past research focuses on transfer of best practices or strategic knowledge, the characterization of this construct is only partially relevant to the context of systems development. Therefore, in this framework, we characterize tactiness in terms of codifiability (Zander, Kogut, 1995) and causal ambiguity (Szulanski, 1996; Bresman et al, 1999; Simonin, 1999)

Codifiability: Codifiability in this chapter refers to the degree to which knowledge can be explicated, i.e., encoded into documents and/or software. In the past, the degree of tacitness is measured based upon whether knowledge can or cannot be codified and transferred into a formal, systematic language or representation (Choi, Lee, 1997; Zander, Kogut, 1995; Senker, Faulkner, 1996). Therefore, codifiability appears to be a sound measure of tacitness.

Proposition 1: The more difficult it is to codify the knowledge required to build a system, the greater the stickiness experienced during the systems development process.

Knowledge Causal Ambiguity: Basic ambiguity refers to the uncertainty of the nature of the causal connections between actions and results (Lippman, Rumelt, 1982). Knowledge ambiguity is defined as a similar lack of understanding of the knowledge needed to comprehend the logical linkages between actions and outcomes of a process (Simonin, 1999). Past research shows that knowledge ambiguity is attributable to the tacitness of the knowledge that is being transferred (Simonin, 1999; Szulanski, 1996).

The knowledge ambiguity in the systems development process is most likely to emanate from the ambiguity about: 1) the kind of knowledge needed in the development of a system; 2) the purpose and the benefits of the system; and 3) the task(s) that the system will support. A high knowledge ambiguity within the knowledge transfer process will decrease the chances of developers effectively absorbing the necessary knowledge needed to build the system. However, as the users and the developers interact with each other more frequently, we expect this ambiguity to attenuate.

Proposition 2: The greater the knowledge ambiguity in building a system, the greater the stickiness experienced during the systems development process.

Knowledge Specificity

Asset specificity refers to durable investments that are undertaken in support of specific transactions (Williamson, 1985). Knowledge can be viewed as an asset. Therefore, knowledge specificity is defined as specific skills and knowledge used in performing the task(s) that the system is going to support. Past research in the transfer of marketing knowledge has shown that knowledge specificity affects stickiness (Reed, DeFillippi, 1990; Simonin, 1999).

In the context of systems development, if the task(s) that are going to be supported by the system has high knowledge specificity, then transferring that specific knowledge from the users to the developers without the loss of critical information may be difficult. Hence, knowledge specificity becomes a potential source of stickiness in this context.

Proposition 3: The greater the knowledge specificity of the task(s) to be supported by a system, the greater the stickiness experienced during the systems development process.

Complexity

Complexity refers to the number of inter-dependent tasks, individuals, and resources linked to a particular knowledge asset that is being transferred (Zander, Kogut, 1995; Simonin, 1999).

Knowledge is more complex when it draws upon distinct and multiple sources of competencies. In the context of systems development, the knowledge is referred to as complex if the knowledge about the task(s) that the system will support is distributed across various individuals or departments. Knowledge complexity of the task(s) may make the transfer of the required knowledge more difficult or sticky.

Proposition 4: The more complex the knowledge needed to build a system, the greater the stickiness experienced during the systems development process.

Source and Recipient Specific Determinants of Stickiness

The source and the recipient specific determinants of stickiness refer to the attributes of users and system developers, which can potentially act as barriers to the process of knowledge transfer. These attributes and the relationship of these attributes to stickiness are discussed in this section.

Domain Experience of the Source and the Recipient

The experience of the source and the recipient favors the knowledge transfer process (Zander, Kogut, 1995). Zander and Kogut (1995) in their framework very effectively developed the argument that the accumulation of experience in an activity facilitates communication and understanding of the relevant knowledge. This experience, in turn, reduces stickiness by facilitating knowledge transfer.

In the context of systems development, the experienced users will be able to communicate the system requirements in an effective manner. The experienced system developers will be able to comprehend and use the communicated knowledge more effectively.

Proposition 5a: The less experienced the user, the greater the stickiness experienced during the systems development process.

Proposition 5b: The less experienced the developer, the greater the stickiness experienced during the systems development process.

Source Perceived Unreliable

A knowledgeable and trustworthy source is more likely to influence the behavior of a recipient (Szulanski, 1996). When the users are not perceived as knowledgeable or trustworthy, the developers are much less likely to use the knowledge communicated by the users. This lack of attention to users' needs can make the knowledge transfer process more sticky.

Proposition 6: The greater the unreliability of the users (source) as perceived by the developers (recipients), the greater the stickiness experienced during the systems development process.

Source and Recipient Lack Motivation

The users and/or the developers may not be willing to devote adequate time and resources needed to transfer the required knowledge. The users' disinclination to share crucial knowledge needed to build the system and/or developers' reluctance to absorb the knowledge communicated by the users, can impede the knowledge transfer process (Szulanski, 1996).

Proposition 7a: The lower the motivation of the users, the greater the stickiness experienced during the systems development process.

Proposition 7b: The lower the motivation of the developers, the greater the stickiness experienced during the systems development process.

Recipient Lacks Absorptive Capacity

The term absorptive capacity is defined as the capacity to utilize new knowledge (Cohen, Levinthal, 1990). The lack of this capacity increases stickiness (Szulanski, 1996). Cohen and Levinthal (1990) argue that absorptive capacity is a function of a person's prior related knowledge. Lack of absorptive capacity manifests in the recipient's inability to value knowledge conveyed to them and their inability to assimilate and use that knowledge. In the context of systems development, the system developers may not be able to distill and internalize the relevant knowledge communicated to them by the user because of the lack of absorptive capacity (i.e., prior knowledge of building systems). However, we expect that the developer's ability to grasp the user's knowledge will increase over time, i.e., the developer's absorptive capacity will be higher towards the end than during the initial phases of the systems development process.

Proposition 8: The lower the absorptive capacity of the developers, the greater the stickiness experienced during the systems development process.

Recipient Lacks Retentive Capacity

The transferred knowledge is valuable only when that knowledge is retained and used by the recipient (Glaser et al., 1983; Druckman, Bjork, 1991). In the context of systems development, the transferred knowledge is perceived to be retained, if it is used to build the system, and/or is represented in the system. Therefore, the ability of the system developers to embed the knowledge communicated to them by the users into a system reflects their retentive capacity. The absence of such an ability increases stickiness (Szulanski, 1996).

Proposition 9: The lower the retentive capacity of the developers, the greater the stickiness experienced during the systems development process.

Source and Recipient Relationship Specific Determinants of Stickiness

In order for the knowledge transfer process to be effective, it may require numerous exchanges and dialogues between the users and the developers. Therefore, effective communication among the users and the developers is very crucial. Past research suggests that effective communication alleviates anxiety caused by mis-information, facilitates interaction between individuals, and ensures that the process is explicated and transparent (Szulanski, 1996). All this is likely to create a collaborative environment within which knowledge can be effectively transferred.

Moreover, through interactions, the users and the developers create a shared meaning or context within which the transfer process can be facilitated. An arduous relationship due to the lack of communication and collaboration can create hardship in the transfer (Szulanski, 1996).

The success of interactions (i.e., exchanges and dialogues) between the users and the developers depend upon the following factors: frequency of the interaction, nature of the interaction, and the ease of communication (Nonaka, 1994; Szulanski, 1996; Bresman et al., 1999; Simonin, 1999). These factors may be measured in the ISD context as: 1) the extent of perceived collaboration between the users and the developers; 2) the nature of communication between them; 3) the frequency of communication between them; and 4) the interpersonal and communication related skills of the users and the developers.

Proposition 10: The more arduous the relationship between the user and the developer, the greater the stickiness experienced during the systems development process.

CONCLUSION

The chapter posits a framework that provides a generic description of knowledge transfer influences on ISD. Specifically, it elaborates on the nature of the ISD knowledge to be transferred, the characteristics of the system users and developers, and the constraining and facilitating aspects of the relationship between the users and the developers.

This chapter contributes to the field of knowledge management and information systems development by positing a framework and a set of propositions that can provide a foundation for future knowledge transfer studies related to systems development. In order for research on knowledge transfer in IS to generate cumulative knowledge, such a common perspective is required. Moreover, it extends past knowledge transfer research by positioning the stickiness construct in light of the information systems development process. Future researchers can now direct their attention to empirically examining the propositions presented in this chapter.

REFERENCES

Alavi, M. (2000). Managing organizational knowledge. In R.W. Zmud (Ed.), *Framing the Domain of IT Management: Projecting the Future Through the Past* (pp. 15-28). Cincinnati, Ohio: Pinnflex Educational Resources, Inc.

Boland, R. J., Jr. (1978). The process and product of system design. *Management Science, 24(9),* pp. 887-898.

Bresman, H., Birkinshaw, J., & Nobel, R. (1999). Knowledge transfer in international acquisitions. *Journal of International Business Studies*, 30(3), pp. 439-462.

Choi, C. J., & Lee, S.H. (1997). A knowledge-based view of cooperative interorganizational relationships. In P. Beamish & J. Killing, (Eds.), *Cooperative Strategies, European Perspectives*. San Francisco, CA: The New Lexington Press.

Cohen, W. M., & Levinthal, D.A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, *35*(l), pp. 128-152.

Davis, G. B. (1982). Strategies for information requirements determination. *IBM Systems Journal*, *21*, pp. 4-30.

Druckman, D., & Bjork, R. A. (Eds). (1991). *In the Mind's Eye: Enhancing Human Performance*. Washington, D.C.: National Academy Press.

Glaser, E. M., Abelson, H. H., & Garrison, K. N. (1983). *Putting Knowledge to Use*. San Francisco, CA: Jossey-Bass.

Greengard, S. (1998). Storing, shaping, and sharing collective wisdom. *Workforce*, *77(10)*, pp. 82-88.

Guinan, P. J., Cooprider, J. G., & Faraj, S. (1998). Enabling software development team performance during requirements definition: A behavioral versus technical approach. *Information Systems Research*, *9(2)*, pp. 101-125.

Hiebeler, R. (1996). Benchmarking knowledge management. *Strategy and Leadership*, *24(2)*, pp. 22-32.

Holsapple C. W., & Joshi, K. D. (2002). Knowledge manipulation activities: Results of a delphi framework , *Information and Management*, *39(6)*, pp. 477-490.

Janz, B. D., Wetherbe, J. C., Davis, G. B., & Noe, R. A. (1997). Re-engineering the systems development process: The link between autonomous teams and business process outcomes. *Journal of Management Information Systems*, *14(1)*, pp. 41-68.

Lippman, S., & Rumelt, S. (1982). Uncertain imitability: An analysis of interfirm differences in efficiency under competition. *Bell Journal of Economics*, *13*, pp. 418-438.

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

Pan, S. L., & Scarbrough, H. (1998). A socio-technical view of knowledge-sharing at Buckman Laboratories. *Journal of Knowledge Management*, *2(1)*, pp. 55-66.

Pinto, J. K., & Mantel, S. J. (1990). The causes of system failure. *IEEE Transactions of Engineering Management*, *37(4)*, pp. 269-276.

Polanyi, M. (1967). *The Tacit Dimension*. Garden City, NY: Anchor.

Puccinelli, B. (1998). Strategies for sharing knowledge. *Inform*, *12(9)*, pp. 40-41.

Reed, R., & DeFillippi, R.J. (1990). Causal ambiguity, barriers to imitation, and sustainable competitive advantage. *Academy of Management Review*, *15*, pp. 88-102.

Senker, J., & Faulkner, W. (1996). Networks, tacit knowledge and innovation. In R. Coombs, A. Richards, P. Saviotti & V. Walsh, (Eds.), *Technological Collaboration*. Cheltenham, UK: Edward Elgar.

Simonin, B. (1999). Transfer of marketing know-how in international strategic alliances: An empirical investigation of the role and antecedents of knowledge ambiguity. *Journal of International Business Studies*, *30(3)*, pp. 463-490.

Spender, J. C. (1996, *Winter*). Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal, 17,* pp. 77-91.

Szulanski, G. (1996, Winter). Exploring internal stickiness: Impediments to the transfer of best practice within the firm. *Strategic Management Journal,* 17 pp. 27-43.

Szulanski, G. (2000). The process of knowledge transfer: A diachronic analysis of stickiness. *Organization Behavior and Human Decision Processes, 82(1)*, pp. 9-27.

von Hippel, E. (1994). Sticky information and the locus of problem solving: Implications for innovation. *Management Science*, *40(4)*, pp. 429-439.

Walsh, J., & Ungson, G. (1991). Organizational memory. *Academy of Management Review*, *16(1)*, pp. 57-91.

Williamson, O. E. (1985). *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. New York: Free Press.

Winter, S. (1987). Knowledge and competence as strategic assets. In D. Teece, (Ed.), *The Competitive Challenge*. Cambridge, MA: Ballinger Publishing Company.

Zander, U., & Kogut, B. (1995). Knowledge and the speed of the transfer and imitation of organizational capabilities: An empirical test. *Organization Science, 6(1)*, pp. 76-92.

Section II

Management and Organisational Factors

Chapter IV

Knowledge Management Systems Acceptance

Fredrik Ericsson and Anders Avdic
Örebro University, Sweden

ABSTRACT

This chapter introduces a framework of knowledge management systems acceptance labeled Requirements of Acceptance Model (RAM). It argues that acceptance of knowledge management systems is dependent on perceived relevance, systems accessibility, and management support. Together these components constitute the RAM. Further, it argues that implementation of systems is at large a process of acceptance where the requirements of acceptance are attained. Finally, it argues that to achieve the requirements of acceptance, implementation should be iterative and cooperative between users and developers by continually developing, implementing, and testing prototypes

INTRODUCTION

Knowledge management is the name given to the set of systematic actions that an organization can take to obtain the greatest value from the knowledge available to it (Davenport, Prusak, 1998). *Systematic* means that knowledge management projects are intentional actions in an organizational context. *Value* means that knowledge management projects are measured according to how knowledge management projects contribute to increased organizational ability (Prieto, Gutiérrez, 2001; Goldkuhl, Braf, 2002). The raison d'être for knowledge management is that the key to competitive advantage for organizations in today's business world is organizations' ability to manage knowledge (Nanoka, Takeuchi, 1995; Davenport, Prusak, 1998). Knowledge management as an intentional and value-adding action is not easy to accomplish in practice (Scarbrough, Swan, 1999). Scarbrough and Swan (1999) present several case studies in knowledge management, successful and unsuccessful in their respective knowledge management project. A major point and lessons from the case studies is that prevalent approaches in knowledge management overstate technology and understate how technology is implemented and applied.

To succeed with a knowledge management project, comprising the development of information in a technology-based information system, some requirements have to be fulfilled. An important aspect in the development process is *system acceptance*. Implementation is at large a process of acceptance. Implementation is the process where the system becomes an integrated part of the workers' (who use the system) work practices. Therefore, implementation is essential to make a knowledge management project successful in order to attain increased organizational ability.

This chapter addresses these issues by answering the following question: *What are the requirements of acceptance of a knowledge management system?*

In order to systematically present requirements of acceptance of a knowledge management system we put forward a framework labeled *Requirements of Acceptance Model* (RAM).

The empirical research presented in this chapter has been conducted through a case study using interviews and conceptual analysis. The unit of analysis is a Swedish small to medium-sized manufacturing company. At the beginning of 2000, we initiated a knowledge management project in collaboration between the company and the researchers (the authors). The aim of the project is to create an information system managing knowledge about operational disturbances (Ericsson, Avdic, 2002; Ericsson, 2001a). The system is at present being implemented and we expect the system to be fully implemented at the end of 2002.

In this chapter we elaborate on how the system is to be used by workers in their work practices to utilize the organizational knowledge embedded in the system. The focus is on requirements to obtain system acceptance. We identify the requirements by elaborating on how the implementation of the system serves as a process of making workers accept and integrate the system into their work practices.

KNOWLEDGE MANAGEMENT SYSTEMS AND TECHNOLOGY ACCEPTANCE

In this section we provide broad definitions and a discussion of the topics to support our positions on the topics we address in the chapter. It is a clarification of our view on knowledge management and systems acceptance.

Knowledge Management

Work in knowledge management has a tendency to omit social or technological aspects by taking on one of two perspectives on knowledge management: the *anthropocentric* or the *technocratic* view (Sveiby, 2001; Swan, 1999). The anthropocentric and the technocratic views represent two extreme and contradictory views on knowledge management and can be summarized as "technology can" or "technology cannot." The gap or incompatibility between the anthropocentric and technocratic views depends on different worldviews, because of a difference of opinions concerning the notion of *knowledge*. The technocratic view conceives knowledge to be some organized collection of data and information and the anthropocentric view conceives knowledge to reside in humans, not in the collection (Churchman, 1971; Meredith, Burstein, 2000). Our conception of knowledge is that of the anthropocentric view. Taking on an anthropocentric view on knowledge management does not mean that we discard knowledge management technologies; we rather take on a balanced view on the subject. Further, to study knowledge management in Informatics ought to have much to offer in bridging the anthropocentric and the technocratic views to create a more integrated and balanced view on the subject. Informatics is much about technology in use, not technology alone (Verrijn-Stuart, 2001). Information technology can support knowledge management in organization through a number of different technological components, for example Intranets, Extranets, Data Warehouses, and Database Management Systems (Borghoff, Pareschi, 1998; Tiwana, 2000; Ericsson, Avdic, 2002). Understating information technology as a knowledge management tool is not a desirable situation since we want to recognize the potential technology has to offer as an information-processing instrument (in storage, processing and search capabilities). The point in taking on an anthropocentric view on knowledge management is not to lose sight of the knower who gives meaning to the information and data found in information technology-based knowledge management tools.

A knowledge management project can aim at different organizational levels, although affecting the organization as a whole. In our case study, the knowledge management project primarily concerns workers as opposed to management. We conceive workers and management as two different social groups within the organization. The workers work practice is standardized in character. Workers everyday jobs are known and to some extent governed by different instructions. The aim of the knowledge management project is to create an information technology-based information system managing knowledge about operational disturbances that occur in the workers' everyday jobs (Ericsson, Avdic, 2002). The system is developed using a collaborative approach between the workers who are to use the system and the developers. A collaborative approach is sometimes referred to as being characteristic of Scandinavian information systems research (Iivari, Lyytinen, 1998), pointing to the traditions that the research represented in this chapter departs from.

Information systems can include either operative or directive and decision support information (Langefors, 1966; Yourdon, 1989). Operative systems provide system users with information necessary in workers' daily work, while directive and decision support systems provide system users with information that improves the quality of decisions that workers make in daily work. *Knowledge managements systems* are systems developed to manage knowledge directly or indirectly to give support for an improved quality of a decision made in workers' daily work and, by extension, an increased organizational ability. A knowledge management system is typically directive. The users can deliberately refrain from using the system, thus user acceptance is crucial for the degree of usage of knowledge management systems.

Acceptance

Technology acceptance has been the subject of researchers such as Davis, Bagozzi and Warshav (1989). Davis et al. (1989) developed the *Technology Acceptance Model* (TAM) and later a revised version of the original model, TAM2 (Venkatesh, Davis, 2000). TAM is an explanative model explaining user behavior of computer technologies by focusing on perceived ease of use, perceived usefulness, attitude towards use, and behavioral intentions as determinants of user behavior. TAM2 is an extension of the original model, including external factors related to perceived usefulness.

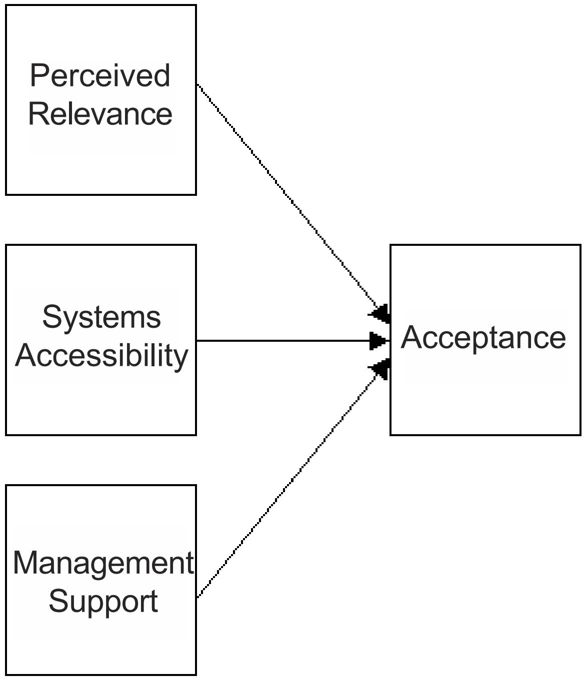
Our framework for system acceptance, Requirements of Acceptance Model (RAM), has some similarities with TAM and the later TAM2. RAM is, in comparison to TAM, descriptive in nature. Workers' work practice is treated as an integrated element of RAM, as opposed to not being treated as a determinant of system use in the original TAM and as an external factor in TAM2. Further, RAM covers acceptance of knowledge management systems and TAM/TAM2 cover a broad range of computer technologies. We developed RAM as a means to systematically acknowledge factors important in implementation of knowledge management systems to gain acceptance of such systems.

REQUIREMENTS OF ACCEPTANCE MODEL

In this section we describe the Requirements of Acceptance Model (RAM) as illustrated in Figure 1.

From our empirical research represented in this chapter we perceive *acceptance* to be a function of *perceived relevance*, *systems accessibility*, and *management support*. Together these elements constitute our framework RAM. In this section we present the requirements of acceptance in RAM.

Figure 1: The Requirements of Acceptance Model



Perceived Relevance

The workers, who are to use the system, have to *perceive* the knowledge management system as *relevant*. Since it is possible for workers to work without using the system, it has to be obvious that usage of the system implies *adding value to the work result*. An additional aspect of relevance related to perceived relevance is how the system should be *integrated in running work*, that is to make the system an integrated part of the workers' work practice.

In our case, the aim of the system is to reduce *operational disturbances* in production. An operational disturbance is a break in the chain of production (Ericsson, Avdic, 2002). In practice, operational disturbances are equal to a break in delivery of articles to customers. The workers perceive the system as positive since it relieves him or her from unnecessary problems. Still, it has to be proven that this really is the case and that it is not just an idea from management to increase control and tempo in the workers' working situation.

According to the argument above, perceived relevance is about workers, who are to use the system, perceiving the system as:

- adding value to the work results;
- being integrated in running work.

Accessibility

If the knowledge management system is to be accepted, *accessibility* has to be satisfactory. Accessibility is a question of who is to be the user, what action the system is to support, where users get access to the system, when the system is ready to use, and how the system's interface fulfills the goal of the system. The latter is also related to how the system's interface takes users' preferences into account.

Who is to be the user? It is vital to know who the user of the knowledge management system is. It is the worker or management? The relevance of knowing about who the user is, is a question about if the workers themselves should enter, search and retrieve the knowledge about operational disturbances represented in the system or if someone else is to do it.

In our case, the strategy has been to make it possible for the workers themselves to enter, search and retrieve knowledge about operational disturbances in order to make it as accurate and relevant as possible. The aim has been to make the knowledge represented in the system as close to the workers' work practice as possible by letting the workers themselves enter operational disturbances in the system. However, this has to be done with consideration to the other aspects about accessibility.

What actions are performed in the work practice that the system is to support? The nature of the actions workers perform in their work practice determines the possibilities to develop a knowledge management system (Ericsson, 2001b). The actions workers perform must not be too routine and standardized and not too unstructured. The same is valid for difficulty; actions must not be too difficult or not easy (Turban, 1993). Those actions that a system is to support must be possible and meaningful to *systematize*. To systematize is to find a functional representation of the actions and the knowledge embedded in the actions in order to be manageable in a system.

In the knowledge management arena much effort is put into defining what knowledge is in terms of how knowledge appears and behaves. It does not define what constitutes knowledge, itself. What constitutes knowledge relates to what Alvesson and Kärreman (2001) refer to as the vagueness of knowledge. The vagueness of knowledge is the difficulty in saying something distinct about the specific content of the knowledge. We can define the content of knowledge as knowledge about actions (Ericsson, 2001a,b). The content of knowledge is the knowledge embedded in the actions workers perform in their work practice.

In our case, the workers' work practice is centered on actions related to hydraulic presses and tools. Presses and tools are key artifacts in the production. A tool is rigged according to pre-specified instructions on a press to shape (cut or bend) raw material, such as steel, into different articles. Articles are the outcome of the production and are, as end products, delivered to customers. Tools rigged on a press shape the material in one or more operations to create an article. The outcome of operations in presses is articles; independent of whether the articles are subjected to further operations in another press or whether the articles are shipped to the customer. There are two categories of workers in the workplace: *setters* who set up presses and *operators* who operate presses. Actions the system is to support are operational disturbances workers experience when setting up and operating hydraulic presses. The nature of these actions is that they are clearly identified in the work practice, but not too routine and standardized, although having some resemblance with routine and standardized work, as often is the case in manufacturing companies.

Where users get access to the system is a question of the system's physical location. *The physical location* is an important decision that affects how the system can be used. The chosen physical location is highly dependent on who is to be the user. If the worker is to be the system user, the system has to be physically placed close to the working place. It is also relevant to account for the system's physical location to make the system an integrated part of the workers' work practice.

If the working environment is dirty and noisy, which often is the case in manufacturing companies, special measures have to be taken to secure hardware and software. In our case, the computers where we implement the system are close to the workers, but not too close to machinery or milieus that can cause the hardware and software to fail. Further, we determined the computers' physical location with the workers' work practice in mind to make the system an integrated part of their work.

The system must not be put into operation before a certain degree of usage is secured. The *time of usage start* is, therefore, dependent on the implementation.

The knowledge management system is developed using a *collaborative approach* between the workers who are to use the system and the developers. We realized the collaborative approach by continuously developing prototypes of the system, and as the prototypes evolve into a finished system, the system is implemented. In that sense, the implementation becomes an iterative phase when alternating between developing and implementing the system.

During daily work, workers have a choice between using the system in real-time mode (for example, by entering information whenever a disturbance occurs) or in batch-processing mode (for example, entering information at the end of the week). Further, the workers have the choice of whether to use the system or not. In that sense, users can intentionally refrain from using the system. Therefore, it is important that the system is not put into operation before a certain extent of usage is secured.

An important issue of systems accessibility is to decide how to design the *interface of the system* in order to fulfill the goals of the system. Design issues are dependent on who is to be the user of the system and when the system is to be used.

In our case, the workers are to use the system continually, which implies a simple design that meets with workers' preferences. Further, the design should clarify the functionality and relevant concepts found in the system. Functionality is related to entering, processing, and searching and retrieving knowledge about operational disturbances, and concepts are related to the concept of operational disturbances.

It is also relevant to decide how the system should be technically implemented. Existing hardware and software should be used to utilize users' prior experiences in using other systems in the organization. If possible, it should be relevant to acknowledge users' familiarity with the current technical environment.

According to the argument above, systems accessibility is about:

- knowing who the user is;
- systematizing the actions workers perform in their work practice that the system is to support;
- determining the system's physical location;
- securing a certain degree of usage before the system is put into operation;
- ensuring that the system's design meets the goals of the system.

Management Support

Management support is vital according to many models on information systems development, especially when the system is a directive/decision support system (Yourdon, 1989). In our case, the knowledge management project has management support. This implies that resources are available to conduct a thorough implementation. We discuss management support in more detail in the next section.

IMPLEMENTATION AS A PROCESS OF ACCEPTANCE

There must be a fit between workers' work practice and technology to get acceptance of knowledge management systems. The technology used to create a knowledge management system must fit the actions workers perform in their work practice. On an overall level, there must be a fit between technology and actions performed by individual workers, and between individual workers and the organization as a whole. Thus, forming a coherent whole consisting of, for example, different social groups within the organization. To implement a knowledge management system is an important activity where the requirements of acceptance are fulfilled.

The groundwork for acceptance has been made during the implementation of the system. In our case, workers who are to use the system have been engaged at an early stage of the development process. The point of including workers in the picture at an early stage is to make users of the system acquainted with the system and the purpose of the system. Further, this has also been a major opportunity for the workers to influence the system's design and content. The most prominent aspect addressed when involving workers at an early stage is that of choosing and determining the meaning of crucial *concepts* managed by the system. Crucial concepts managed by the system are the knowledge represented in the system, and by determining these concepts, knowledge represented in the system takes on a systematized character. Further, by involving the workers into the process of choosing and determining the meaning of crucial concepts managed by the system, the knowledge represented in the system do not lose its origin or meaning. The point is to keep the knowledge represented in the system within a frame of understanding or meaning, as perceived by workers.

To emphasize the implementation of the knowledge management system, we use the prototyping systems development methodology. Prototyping is usually a mean to develop a model of and identify a requirements specification of the final system, and typically includes collaboration between users and developers in an iterative mode (Smith, 1991; Andersen, 1994). In our case, we have an *evolutionary mode of prototyping,* where the prototype at some stage is considered to have the qualities worthy to be implemented on a full scale. Evolutionary prototyping is method attempting to bridge the gap between prototyping (development) and implementation (Göransson, Gulliksen, 2000). The knowledge management system development process is iterative in nature, consisting of different *development paths* (Ericsson, 2001a). Each path consists of *design*, *implementation*, and *user testing* of the system. Subsequent development paths have the prior development paths as inputs in order to trace changes made in the system to earlier paths.

The process involves management and workers who are to use the system. It should be noticed that management is not the direct users of the system. The aim of the system is to manage knowledge about operational disturbances in production. Thus, the system must be in line with the workers who are to use the system, since it is their knowledge about operational disturbances that is to be systematized in the system. Consequently, the system's success or failure is determined by users' acceptance of the system.

At first, we created a pilot group consisting of workers. We developed a first version of the system before we introduced the pilot group to the project. The knowledge management project initiative originates from management and the system was, in its first version, designed to raise critical issues relevant for management to consider before the development continued involving workers. Critical issues for management to consider are, for example, costs in undertaking the development process and effects related to organizational ability. Management must estimate if an increase in organizational ability outweighs the costs of undertaking the development of the system.

Having management support, regular meetings between workers who belong to the pilot group and developers took place after each development path. Since design, implementation and users testing the system occurs iterative, the system follows more development paths and becomes more and more integrated into the pilot group's work practice. In that sense, the issue of integrating system use into work is acknowledged before the process evolves by expanding the pilot group and finally including all workers.

Highlighting the workers' importance by using a collaborative approach in the development process can set pressure on management to take responsibility for their actions in initiating the knowledge management project in, for example, investments in computers easily accessed by the users in their working environment, changes in workers' work practice and education in computer use. We find this issue of responsibility important to acknowledge because a collaborative approach involving workers can give rise to expectations and demands. Further, management must authorize workers' expectations and demands. It is important to recognize the power structures in the organization and what changes implementation of systems bring about in power structures.

At present, the pilot group is in a final stage where final refinements are in focus to make the system complete. When the system is complete, the next step is to expand the pilot group and finally involve all workers. When that day comes, we foresee to have an accepted knowledge management system on full-scale basis due to acknowledging the issues of acceptance of knowledge management system as pointed out in this chapter.

CONCLUSIONS

To create acceptance of knowledge management systems, a framework labeled Requirements of Acceptance Model (RAM) has been formulated. Acceptance of knowledge management systems is a function of perceived relevance, systems accessibility, and management support. Together these elements constitute our framework, RAM. RAM is summarized in Table 1.

Table 1: Requirements of Acceptance Model (RAM) Specification

Perceived Relevance	Workers, who are to use the system have to perceive the system as: • adding value to the work results; • being integrated in running work.
Systems Accessibility	Systems accessibility is about: • knowing who the user is; • systematizing actions workers perform in their work practice the system is to support; • deciding the physical location where users get access to the system; • securing usage of the system before it is put into operation;

Our empirical research presented in this chapter reveals that implementing knowledge management systems by use of prototyping, supports the three aspects outlined in RAM. Perceived relevance and accessibility is supported by iterations where workers get acquainted with the system step-by-step in different development paths. Developing a preliminary design of the system, before the actual development process starts, emphasizes the aspect of managerial support.

A final concluding remark is that of what makes acceptance of knowledge management systems different from other types of systems development projects. We do not intend to cover such aspects in this chapter, but as a concluding remark we would like to put forward some aspects about this issue, since it may give good reason for the existence and relevance of the framework RAM. The framework emphasizes the workers whose knowledge is of interest to manage and systematize in a system by involving the workers at an early stage. The point in doing so is not only related to finding an appropriate interface of the system, but also to identify the concepts and content of those concepts the system is to manage. The concepts the system is to manage is the knowledge that is to be represented in the system. Consequently, by not taking the workers whose knowledge is of interest to manage into account, the concepts managed by the system lose meaning and understanding when workers make use of the system. A knowledge management system does not manage knowledge of its own –it is dependent on those who give meaning to and understanding of the knowledge represented in the system. In that sense, the scope of alternative courses of action in, for example, different systems development methodologies, can be said to be rare when it comes to developing knowledge management systems, but that is a different issue to reconcile.

REFERENCES

Alvesson, M., & Kärreman, D. (2001). Odd couple: Making sense of the curious concept of knowledge management. *Journal of Management Studies. 38* (7), pp. 995-1018.

Andersen, E. S. (1994). Systemutveckling – Principer, metoder och tekniker [Systems Development – Principles, Methods, and Techniques]. Lund: Studentlitteratur.

Borghoff, U. M., & Pareschi, R. (Eds.). (1998). *Information Technology for Knowledge Management.* Berlin Heidelberg: Springer-Verlag.

Churchman, C. W. (1971). *The Design of Enquiring Systems: Basic Concepts of Systems and Organization.* New York: Basic Books.

Davenport, T., & Prusak, L. (1998). *Working Knowledge: How Organizations Manage What They Know.* Boston: Harvard Business School.

Davis, F. F., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science. 35*(8), pp. 982-1003.

Ericsson, F. (2001a, September). Knowledge management systems development. Presented at the *43rd Annual Conference of the Operational Research Society*, University of Bath, UK.

Ericsson, F. (2001b, April). Knowledge management in manufacturing companies. Presented at *The Conference for the Promotion of Research in IT at New Universities and at University Collages in Sweden*, Ronneby Brunn, Sweden.

Ericsson, F., & Avdic, A. (2002). Information technology and knowledge acquisition in manufacturing companies: A Scandinavian perspective. In Coakes, E., Willis, D., & Clarke, S. (Eds.), *Knowledge Management in the SocioTechnical World; The Grafitti Continues.* London: Springer-Verlag.

Goldkuhl, G., & Braf, E. (2002). Organisational ability: Constituents and congruencies. In Coakes, E., Willis, D., & Clarke, S. (Eds.), *Knowledge Management in the SocioTechnical World. The Grafitti Continues.* London: Springer-Verlag.

Göransson, B., & Gulliksen, J. (2000). Användarcentrerad systemutveckling [User Centered Systems Development] (Technical Report 2000-004). Uppsala: Uppsala University, Department of Information Technology.

Iivari, J., & Lyytinen, K. (1998). Research on information systems development in Scandinavia: Unity in plurality. *Scandinavian Journal of Information Systems, 10*(1&2), pp. 135-186.

Langefors, B. (1966). *Theoretical Analysis of Information Systems*. Lund: Studentlitteratur.

Meredith, R., & Burstein, F. (2000). Getting the message across with communicative knowledge management. In *Proceedings of the Australian Conference on Knowledge Management and Intelligent Decision Support – 2000* (ACKMID'2000), pp. 43-55. Melbourne: Australian Scholarly Publishers.

Nonaka, I., & Takeuchi, H. (1995). *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation.* New York: Oxford University Press.

Prieto, I. M., & Gutiérrez, E. R. (2001). A contingency perspective of learning and knowledge management in organizations. In Remenyi, D. (Ed.), *Second European Conference on Knowledge Management*. Slovenia: Bled School of Management, pp. 487-502.

Scarbrough, J., & Swan, J. (Eds.). (1999). *Case Studies in Knowledge Management.* London: Institute of Personnel and Development.

Smith, M. (1991). *Software Prototyping – Adaptation, Practice and Management.* London: McGraw Hill.

Svan, J. (1999). Introduction. In Scarbrough, J. & Svan, J. (Eds.), *Case Studies in Knowledge Management.* London: Institute of Personnel and Development.

Sveiby, K-E. (2001, April). What is Knowledge Management? Retrieved June 28, 2002, from the Sveiby Knowledge Management Web site on the World Wide Web: http://www.sveiby.com.au/.

Tiwana, A. (2000). *The Knowledge Management Toolkit. Practical Techniques for Building a Knowledge Management System*. Upper Saddle River: Prentice Hall.

Turban, E. (1993). *Expert Systems and Applied Artificial Intelligence*. New York, MacMillan.

Venkatesh, V., & Davis, F.D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46, pp. 86-204.

Verrijn-Stuart, A. A. (2001). FRISCO – A framework of information system concepts – The Revised FRISCO Report (Draft January 2001). IFIP WG 8.1 Task group FRISCO. Retrieved June 28, 2002, from the FRISCO Report Website on the World Wide Web: http://www.wi.leidenuniv.nl/~verrynst/frisco.html.

Yordon, E. (1989). *Modern Structured Analysis*. Englewood Cliffs, NJ: Prentice Hall.

Chapter V

What Difference Does it Make: Measuring Returns of Knowledge Management

Abdus Sattar Chaudhry
Nanyang Technological University, Singapore

ABSTRACT

This chapter provides an overview of performance measurement in the area of knowledge management. Salient features of main measures have been described and their role in determining the return on knowledge management work highlighted. While Balanced Scorecard and Intangible Assets Monitor provide comprehensive coverage, several other measures are also in use. A recent study and review of applications of main KM performance measures in selected organizations showed several areas of commonality in the objectives of performance measurement and revealed differences in approaches to the application and presentation of various performance measures. Developing a measurement system for knowledge management is considered the key to the competitive success of the organization.

INTRODUCTION

It is becoming increasingly important that organizations are able to show the value of knowledge management applications by measuring the return on investment of knowledge management activities. A variety of approaches have been used for performance measurement. Most of these measures, however, seem to provide only a partial coverage towards the measurement of the impact of knowledge management work. The processes of knowledge management that underlie and contribute to the creation of knowledge assets and the success of the knowledge management projects have not been covered in depth and effectively by these measures.

This chapter highlights the importance of using appropriate measures to determine the value of knowledge management in an organization. Based on an extensive literature review, the chapter provides an overview of the main measures currently in use for measuring knowledge assets. The chapter also reports the results of a study carried out to review the use of KM performance measures in selected organizations. Commonalities of applications of performance measures are pointed out and the need for development of more relevant measures is stressed.

An extensive review of web sites and portals in the knowledge management area was carried out. Information was sought from selected organizations through interviews and e-mail communications for verification and validation purposes. The discussion is expected to be helpful in understanding and promoting the use of performance measurement in the context of knowledge management. With the growing importance of performance measurement, the examples of performance measurement systems used by organizations that are active in knowledge management will be useful in offering some practical insights into the use of performance measures to measure the impact of knowledge management, as well as serve to highlight the way these measures can be used to enhance the organization's overall performance.

Context

Measuring the impact of knowledge management (KM) processes is important in determining the benefits that can be reaped by appropriate KM efforts. O'Dell and Grayson (1998) identified measurement as one of the key enablers in their model for transfer of best practices. They defined the measurement as the process of creating and using indicators/measures to determine how each enabler impacts the best practice transfer process within the organization. Traditionally, organizations have used financial indicators for measurement. These indicators, however, are not adept at capturing the measurement of the intangible impact of knowledge management practices and processes on the organization. Some organizations have tried to measure learning and knowledge through the application of a combination of indicators such as customer satisfaction, financial performance, and job satisfaction, among various other measures. But most of these measures are not precise enough to assess the use of knowledge management and may only give a superficial view of the impact of KM. These measures also tend to commodify knowledge and capture it as a static and tangible asset.

Recently, there have been attempts to use the Balance Scorecard (Kaplan, Norton, 2001) and the Intangible Assets Monitor (Sveiby, 1996) to measure the intellectual capital. Barchan (1997) has cautioned that, even though measurement is essential in knowledge management, it is better not to just simply jump on the bandwagon without giving proper thought to what appropriate measures will be used. He stresses that it is pertinent to create an internal understanding of what the intangible assets are and what they mean to the overall performance of an organization (Barchan, 1998, 1999, 2000).

The identification of the performance measurement models in knowledge management and the characteristics of performance measures and their criteria will allow for the use of these indicators for comparative purposes. This will allow organizations to compare and benchmark their knowledge management work with other organizations. As an emerging area of importance in knowledge management, there is a dearth of information available on this aspect.

Wenger, McDermott, and Snyder (2000) discuss the benefits of KM measurement for communities of practice. They stress that measurement efforts are well worth the investment. Measures of value are instrumental for communities of practice to gain visibility and influence, and to evaluate and guide their own development. Measures legitimize the function of communities of practice in the organization, reinforce member participation, and provide a basis for prioritizing activities. Measures help communities translate the value of what they do for teams and business units into the *lingua franca* of the organization. These authors feel that measures support management processes that help to further integrate and institutionalize the role of communities in the organization. Communities need measures to know how they are doing and to guide ongoing efforts to become more vibrant and effective. It is, therefore, very important for knowledge professionals to be aware of the measures in use and to be comfortable in applying these measures to determine the value and impact of knowledge management in their organizations.

Major KM Measures in Use

Dhansukhlal and Chaudhry (2002) have summarized the features of major measures used in the area of knowledge management. Main measures in use include the Balanced Scorecard (BSC) and the Intangible Assets Monitor (IAM), and Skandia's Intellectual Capital Taxonomy (ICT) & AFS Business Navigator (ABN). These measures provide a comprehensive, developed and tested approach to performance measurement in knowledge management. A summary of salient features of these measures is given in the following section.

Balanced Scorecard (BS)

The Balanced Scorecard (BS), first developed by Kaplan and Norton in the early 1990s in the United States, represented a "method of measuring the performance of a firm beyond the typical financial measures." The Balanced Scorecard was designed primarily to take a more "balanced view" of internal performance measurement (Giaever, 1999). The Balanced Scorecard emphasized that financial and non-financial aspects are part of the information system for employees at all levels of the organization (MeansBusiness, 2000).

The Balanced Scorecard was a strategic management approach where a vision could be translated into a clear set of objectives or critical success factors and this allowed for the linking of corporate goals with direct performance measures within a framework specific to a firm. Each of the critical success factors formed the basis for key performance indicators, which then helped to measure each objective's performance, representing a broad range of outcome measures and performance drivers. This multi-faceted measurement and management tool has been used for communications, alignment, improvement and control. This tool has also been identified as one of the methods of measuring the impact of knowledge management.

It was best summarized by the BMA Group (2000) as a "management system that focuses on the efforts of people, throughout the organization, toward achieving strategic objectives" and could be used to motivate staff "to make the organization's vision happen." Essentially, the Balanced Scorecard is a concept helping to translate strategy into action (QPR Online, 2000). Olve, Roy and Wetter (1999) have pointed out the main measures, objectives, targets and initiatives need to be defined, as shown in Table 1.

For all these perspectives to operate in a meaningful way, a chain of cause and effect between the various objectives and measures through all of the four perspectives was worked out. For instance, an operational zed example given by the BMA Group (2000) was as follows: "Training and improving skills of operating staff (a learning and growth objective) could lead to a reduction in cycle times (an internal process perspective objective) that may lead to improved customer satisfaction and loyalty through shorter delivery times, and hence greater sales revenue (an objective of the customer perspective) leading to an increase in return on capital employed (an outcome measure in the financial perspective)."

Table 1: Measures in the Balanced Scorecard

Perspectives	**Focus Areas**	**Measures Used**
Financial Perspective	How do our owners see us?	Operating incomes, return on capital employed, economic value-added
Customer Perspective	How do our customers see us?	Customer satisfaction, customer retention, new customer acquisition, customer profitability, loyalty of customers, market share
Internal Processes	How effective and efficient are our business processes?	Quality, response time, cost, new product introductions, innovation processes
Learning and Growth Perspective	How well do we generate and adopt new knowledge?	Employee-based measures like employee satisfaction, retention, training and skills

The Balanced Scorecard approach can be used as one of the ways to measure performance of internal business processes. It would serve to assess the impact of knowledge management within the organization through the use of financial and non-financial indicators. The Gartner Group has estimated that 40 percent of Fortune 1000 companies would use some form of the Balanced Scorecard by the year 2000 (Shand, 1999).

Intangible Assets Monitor (IAM)

Sveiby was one of the first to develop a method for measuring intangible assets, in the 1980s, in an attempt to demonstrate how the intangible assets accounted for the difference between a company's market value and book value (Giaever, 1999).

This was sometimes referred to as "The Invisible Balance Sheet," which was a practical exercise for facilitating an understanding of the value of intangible assets. Sveiby's ideas formed the basis of a discussion centred on the "dollar value" of the organization's intangible assets and helped to shape and develop the Intangible Assets Monitor, a tool used by organizations to track and value their intangible assets. Swedish companies like Celemi and Angpanneforeningen AF were the first few companies to consider the value of intangible assets and measure the impact of their knowledge management initiatives through the use of the Intangible Assets Monitor. This method also contributed to the development of Skandia's Business Navigator. The Intangible Assets Monitor is comprised of three main focus areas, as shown in Table 2.

Table 2: Focus Areas of the Intangible Assets Monitor

Focus Areas	**Definitions**	**Examples**
External Structures (Customer capital)	Relationships between customers and suppliers.	Brand names, trademarks and reputation or image.
Internal Structures (Organizational capital)	Created by the employees and were therefore owned by the organization and adhered to.	Patents, concepts, models, computer and administrative systems, the informal organization, the internal networks and culture.
Individual Competence (Human capital)	One's ability to act in various situations.	Skills (including social skills), education, experience and values.

The various indicators for each of these parts of the Intangible Assets Monitor demonstrated change and have been categorized by the following areas of growth/renewal, efficiency and stability. Sveiby (1996) have highlighted various indicators of Intangible Assets Monitor.

Since 1995, the Intangible Assets Monitor has been used by Celemi to report their intangible assets as part of their annual report. Celemi realised early that their financial statements did not represent the true value of their firm (Barchan, 1998). Celemi worked with Sveiby to create a learning process that would simulate the real-life challenges of managing a knowledge-driven company and help people understand the nature of this unique business environment, as well as the value of their own intangible assets (Barchan, 1998). The main philosophy behind Celemi's business strategy was that they "generated profits not by selling a product, but by selling their capabilities, experience and expertise" (Barchan, 2000). Celemi used the three aspects of the Intangible Assets Monitor in their measurement: the customers represented the external structure, their people represented their competence and the organization represented the internal corporate structure. Using the Intangible Assets Monitor, Celemi monitored and used the valuation of both their financial aspects and intangible assets to help their organization to grow as explained by Margaret Barchan, Celemi's President and CEO (Barchan, 1997).

There are several similarities in the Balanced Scorecard and Intangible Assets Monitor, though the models have been developed independent of each other. Giaever (1999) pointed out that the main proposal for both approaches was that non-financial measures must complement the financial indicators.

Skandia's Intellectual Capital Taxonomy & AFS Business Navigator

This worldwide-known approach was one of the first attempts to measure and present the intellectual capital in an organization attributable to the use of knowledge management processes. Developed in 1993 by Leif Edvinsson of Stockholm-based Skandia Insurance, the first corporate Director of Intellectual Capital, this represented the world's approach to reporting the company's intangible assets through an integrated intellectual capital model. As a spin-off of the Konrad Group of the Swedish Knowledge Companies, this method relied primarily on non-financial indicators to monitor and publicly present their intangible assets.

Originating from the Swedish Konrad School, this approach combined Sveiby's conceptual framework with the presentation format of the Balanced Scorecard to produce the accounting term of "Intellectual Capital," instead of the use of the term "intangible assets" used by the former approach. A fifth focus for human resources had also been added to the original four found in Kaplan and Norton's Balanced Scorecard model (Olve, Roy, Wetter, 1999). This integrated intellectual capital model permitted the definition and classification of intangibles not shown in the balance sheet and tried to detect hidden costs, incomes and values to increase the transparency of intangibles. This model was built on the difference between market capitalization and assets, which gave rise to the business's intellectual capital (Huang et al., 1999).

Since 1994, Skandia has used non-financial ratios and published them in their annual reports. This was published as a supplement to their annual report in 1994, known as "Visualizing Intellectual Capital in Skandia" (Olve, Roy, Wetter, 1999). With much support from management and the effort to give a high profile, such supplements to subsequent annual and biannual reports have also followed every six months (Olve, Roy, Wetter, 1999). Table 3 defines key indicators of the Intellectual Capital Index.

Table 3: Key Indicators of the Capital Index

Type of Capital	Definitions	Key Indicators
Organizational (Structural) Capital	Physical assets that impacted the organization's capability to effectively create and produce knowledge	Number of accounts per employee and administrative costs per employee.
Customer (Relational) Capital	Increased customer retention and satisfaction and the ability of employees to be ready to anticipate and meet customer demands	Number of accounts, number of brokers and number of lost customers.
Human Capital	Knowledge, skill and capability of individual employees to provide solutions to customer problems	Personnel turnover, proportion of managers, proportion of female managers and training / education costs per employee.
Development/Renewal Focus	Ensuring human performance was reaching its full potential through investment in individual as well as organizational learning	Satisfied employee index, marketing expense / customer and share of training hours.

Other Measures

The Business Excellence Model was not specifically designed for the measurement of knowledge management. However, it has many elements that are useful and relevant to today's knowledge-based organizations and has been used by some organizations to gauge their business excellence and efforts in knowledge management. The overall view of the framework followed by the specific enablers and results produces innovation and learning (The Business Excellence Model, 1994).

Intellectual Capital Index (ICI), introduced by Goran and Johan Roos of the London-based Intellectual Capital Services Limited (Skyrme, 1999) is similar to Balance Scorecard. Shand (1999) states that ICI forces managers to define what activities are important. It covers all the intangible resources that contribute to the creation of value for the organization including knowledge, competence and skills, working methods, processes and systems. ICI also emphasizes a culture that support the people, the image in the marketplace and relationships with customers, alliance partners and suppliers.

The Montague Institute provided a synopsis of the various methods of measuring intellectual capital in terms of 12 techniques that could be used to value intangible assets. These include: relative value, balance scorecard, competency models, subsystem performance, benchmarking, business worth, business process auditing, knowledge bank, brand equity valuation, calculated intangible value, micro lending, and colorized reporting (Measuring Intellectual Assets, 1998). These techniques represent various ways in which intangible assets could be measured to show the impact of knowledge management. It is interesting to note that most of the measures are non-financial. This appears to be recognizing that knowledge management is an intangible object and requires special measures to measures its impact on business processes.

The American Productivity and Quality Center (APQC) collaborated with several companies to find real-world examples of measures and suggested a five-stage process for measurement highlighting the importance of best practices (Hartz et al., 2001). These steps include stages of: Enter and Advocate, Explore and Experiment, Discover and Conduct Pilots, Expand and Support, and Institutionalize Knowledge Management. These guidelines highlight different steps that could be used to measure the impact of knowledge management during different stages of the life cycle.

Dhansuklal and Chaudhry (2002) highlighted that though there were many models for measuring the impact of knowledge management, as well as the intellectual capital and intangible assets within the organization, application of these measures for measuring the value of knowledge management work was a real challenge. They conducted a study of the application of major KM measures in selected organizations (Chaudhry, Dhansukhlal, 2002). A summary of their findings is produced in the next section of this chapter.

Application of Measures by Selected Organizations

Chaudhry and Jasna (2002) studied the use of major measures in *FUJI XEROX*, *MICROSOFT CORPORATION*, *INFOSYS TECHNOLOGIES*, and *ARTHUR ANDERSEN*. A checklist containing major areas related to performance measurement was used to guide the data collection.

FUJI XEROX developed "Eureka" to respond to the problem faced by technicians not being able to solve problems. Microsoft developed a blueprint for the "Digital Nervous System." *ARTHUR ANDERSEN* focused knowledge management in the area of business consulting. *INFOSYS TECHNOLOGIES'* knowledge management was introduced as a "Learn once, Use anywhere" paradigm. The knowledge management initiatives of these organizations seem to have been guided by a clear-cut vision and appropriate value propositions. It appears from the statements on their web sites, that knowledge management in these organizations was not viewed as an additional function, but rather as an enabler to facilitate their internal business operations. Their knowledge management work seems to be at a level suitable for review of performance measurement in this area.

In *FUJI XEROX*, the purpose of measurement was to track the progress of the Eureka system. More than 150,000 problems were solved using Eureka. In *MICROSOFT*, real knowledge management solutions began by objectively looking at the firm's strategic strengths, weaknesses and goals for clues where knowledge management would have high impact and should provide specific, measurable benefits in the critical areas of the organization. In *INFOSYS*, the main purpose was to provide a value to the off-balance-sheet assets of the company and to show the financial and non-financial parameters that determined long-term success. In *ARTHUR ANDERSEN*, the purpose was to justify the outcome of investments in knowledge management and the resources in terms of the involvement of teams in knowledge management.

The selected organizations used a different set of performance measures, but there was an element of commonality in the indicators used to measure the impact of knowledge management. *FUJI XEROX* focused on the areas of deployment, knowledge content, and productivity; *MICROSOFT* emphasized Products & Services Design & Development, Business Planning, and Employment Management; *INFOSYS* selected external and internal environment as their main focus; and *ARTHUR ANDERSEN* focused on Strategy, Process and Culture. Measures used by the organizations included in this study are given in Table 4.

As shown in Table 4, each of the organizations had adopted and developed a different performance measurement mechanism to suit the needs and focus areas of their knowledge management initiatives. In the case of *FUJI XEROX, MICROSOFT* and *ARTHUR ANDERSEN*, customized performance measurement systems were developed pertaining to the different focus areas. In *FUJI XEROX*, detailed measures were observed for each topic area. For *MICROSOFT*, the measures were divided among the key areas of the organization. Measures were defined in quantifiable form for the key areas of the knowledge management framework in *ARTHUR ANDERSON. INFOSYS* adopted already available performance measurement models.

Table 4: Performance Measures Used by Selected Organizations

FUJI XEROX	**MICROSOFT**	**INFOSYS**	**ARTHUR ADNDERSEN**
Deployment # Of users connected % Of users updating weekly	Product & Services Design & Development Product success rate Cycle time Low design rework	Customers (External Structure) Growth/renewal (revenue and new customers)	Strategy Time saved in proposals and engagements
Knowledge content and quality # Of solutions submitted Number days taken to validate solutions	Customer & Issue Management Customer satisfaction Needs captured in products Breadth of service coverage	Organization (Internal Structure) Growth/renewal (IT and R&D investments) Efficiency (proportion of staff and sale) Stability.(average age of support staff)	Process Number of contributions Contributors Organizing office People accessing documents Usefulness of documents
Productivity # Of customer problems solved % Reduction in service hours % Reduction in parts dollars Total $ saved in cost of service and support	Business Planning Discovering trends Crisis response times Competitive awareness Acting on complete information	People (Competence) Growth/renewal (education index) Efficiency (value added per employee) Stability (average age of all employees	Culture People reaction about knowledge management

Table 5: Presentation of Performance Measurement Results

FUJI XEROX	MICROSOFT	INFOSYS	ARTHUR ANDERSEN
Names of author and validator available in databases	Results presented and used through the Knowledge Management Platform	Intangible Assets Score sheet is used to evaluate the market worthiness of a company	Measurement of knowledge sharing behavior of staff is included as a section in the staff appraisal

Table 6: Follow-up Actions for Knowledge Management Initiatives

FUJI XEROX	MICROSOFT	INFOSYS	ARTHUR ANDERSEN
Worldwide Customer Service Global Program Hall of Fame for Authors (cash and trophy) and Hall of Fame for Validators (cash rewards for outing and trophy)	Use of technology as a foundation for managing knowledge assets and bringing people together in a dispersed organization	Embarked on a number of initiatives aimed at taking the prevailing knowledge sharing culture to even greater heights	Use of formula to translate knowledge management initiatives into dollars and cents to reinforce KM culture by making people see the benefits

In order to demonstrate the results of the performance measurement systems in place, various formats and techniques were used. A summary of presentation formats is given in Table 5.

Each of the selected organizations defined follow-up actions that defined the use of performance measurement results and ensured that measurement played a crucial role in the knowledge management processes. The follow-up actions are given in Table 6.

The follow-up mechanisms seem to ensure that the measurement systems continue on regular basis. These also help in further enhancing and promoting the knowledge sharing culture. Regular knowledge management surveys helped these organizations to assess the levels at different times and also translated the results into monetary value to justify knowledge management investments.

Commonalities in Applications

Despite having different performance measurement systems, there were several common elements between the systems. The main emphasis in all the systems was on the customer and this emphasized the customer orientation of the models. In *FUJI XEROX,* the topic area of productivity related to the number of customer problems that were solved. In *MICROSOFT*, one of the perspectives was on customer and issue management, where customer satisfaction, needs and breadth of service coverage were measured. In *INFOSYS,* the external structure related to their customers and aspects relating to customers were also reflected in growth/renewal, efficiency and stability. In *ARTHUR ANDERSEN*, the measures were also tied to the customer in that retrieving the right knowledge at the right time would enable them to meet their client needs.

Another common emphasis in all the performance measurement systems was that the contribution of people was recognized as an important factor that needed to be measured. This was evident in all models used by these organizations. In *FUJI XEROX,* the three topic areas of deployment, knowledge content and quality and productivity related to the technicians involved. In *INFOSYS*, people were one of the key areas of the monitoring system in terms of their competence. Under this measure, the education index of employees, value added per software engineer and employee and the average age of employees were measured to derive a valuation of the intangible assets of the organization. In Arthur Andersen, individual knowledge-sharing behavior and the usage of the corporate intranet were measured.

KM performance measurement systems in the organization under review did take into consideration intangible factors in their measurements and attempted to quantify, where practical. For instance, *FUJI XEROX* tried to quantify the intangible factor of knowledge content and quality by measures like number of solutions submitted by country and number of days to validate the solutions. Similarly, *INFOSYS* used percentage of revenue from image-enhancing, customer sales from the five largest customers over the total revenue, and value-added per software engineer in measuring the intangible aspects of growth/renewal, efficiency ad stability in the internal and external structure and competence of people. *ARTHUR ANDERSEN* tried to translate all the key areas of the knowledge management framework into measurable indicators, e.g., time saved in new product development/regulatory processes, time to implement a best practice and number of mistakes made twice.

The performance measure used by the organizations selected for this study varied. Some used established systems like the Balance Scorecard and Intangible Asses Monitor, while others developed their own systems of measurement. The emphasis was no longer solely on financial measures, but on the inclusion of intervening, non-financial measures. The focus, however, still seems to be on measuring the intellectual capital and assets, rather than the actual processes of knowledge management. It is understandable that measuring the KM processes is a complex task and is not easily quantifiable, but nonetheless important and essential to make the measurement more useful.

SUMMARY AND CONCLUSIONS

There are various ways in which the impact of knowledge management can be measures using different criteria and dimensions. Major measures used for assessing the KM performance by the organizations (e.g., Balance Score Card, Intangible

Assets Monitor, and Intellectual Capital Index) focused on the general aspects related to knowledge management work, e.g., infrastructure, technology, culture, and people. While useful in highlighting the value of KM in general, these measures only provided a partial assessment of the impact of knowledge management in organizations. To provide a comprehensive coverage of the measurement of knowledge management processes, emphasis needs to be placed on examining the processes and developing measures that are more specific to measure the steps involved in these processes.

The measurement system adopted by *FUJI XEROX* for their Eureka system could be considered a step in the right direction. It does emphasize capturing and measuring tips and sharing and using knowledge in terms of quantified statistics. Similarly, *ARTHUR ANDERSEN* demonstrated commendable efforts in converting intangible knowledge management concepts into measurable criteria. However, these performance measures should go beyond valuation of intellectual assets and the concept of intellectual capital and focus on the value of the knowledge management processes. These should help measure how different steps in these processes make a difference in the success of knowledge management efforts. Some lessons may be drawn from existing performance measurement systems like the Balance Scorecard and the Intangible Asset Monitor in terms of the perspectives and measures they highlighted. For instance, the four perspectives adopted by the BSC provide a holistic way of measuring different systems within the organization and identifying the major stakeholders. Likewise, IAM may be useful to use the valuations of intangible assets at different periods of time to see if there has been an improvement, and if this could be attributed to the use and implementation of knowledge management within that organization.

In drawing up a blueprint for a measurement system, it is vital to define the purpose of measurement relating to the needs and structure of the knowledge management initiative of the organization. More mature knowledge management initiatives will use a knowledge management framework or paradigm to provide guidelines for the initiative. In contrast, organizations new to knowledge management may have neither yet developed nor be using a well-defined knowledge management framework for their initiatives. Either quantifiable or more intangible measures can be used, depending on the needs of the organization and the purpose of the measurement system. Martin (1999) rightly pointed out that there is no one set of measures applicable to all firms, or even within a company. What is being measured currently may change, owing to changes in the external environment or in the company's direction. Companies should not give up on measurement. Developing a measurement system for knowledge management may well be the key to the competitive success of the organization, allowing it to manage more effectively and efficiently what it can measure.

REFERENCES

APQC. (2001). *Performance Measurement Benefits.* Retrieved March 15, 2001 from the World Wide Web: http://www.apqc.org/pm/pmbenefits.cfm.

Barchan, M. (1997). *Growing A Knowledge Company: Answers To Frequently Asked Questions About Measuring & Managing Intangible Assets.* Retrieved from the World Wide Web: http://www.celemi.com/articles/texts/growingknowledge.asp.

Barchan, M. (1998). *Capturing Knowledge For Business Growth.* Retrieved from the World Wide Web: http://www.celemi.com/articles/texts/capturingknow9811.asp.

Barchan, M. (1999). *Measuring Success in a Changing Environment.* Retrieved from the World Wide Web: http://www.celemi.com/articles/texts/measuring success9906.asp.

Barchan, M. (2000). *Uncovering Hidden Assets.* Retrieved from the World Wide Web: http://www.celemi.company/ia.asp.

The BMA Group Pte Ltd. (2000). *Balanced Scorecard*. Retrieved March 22, 2001 from the World Wide Web: http://www.bma.com.au/balscore.html.

Business Excellence Limited. (1994). *The Business Excellence Model*. Retrieved March 23, 2001 from the World Wide Web: http://www.businessexcellence.co.uk/business-excellence-model-framework.htm.

Chaudhry, A. S., & Dhansukhlal, J. (2002). Measuring the impact of knowledge management. *IRMA 2002 International Conference.* 19-22 May 2002, Seattle, Washington, USA.

Dhansukhlal, J., & Chaudhry, A. S. (2002). Performance measures for knowledge management. *Journal of Information & Knowledge Management. 1*(1), pp. 27-39.

Giaever, H.M. (1999). *Knowledge Based Economy In DNV.* Retrieved March 23, 2001 from the World Wide Web: http://research.dnv.no/KnowEco/intellectual_capital_metrics.htm.

Hartz, C., Sammis, S., Hofer-Alfeis, J., Lopez, K., Raybourn, C., & Wilson, J. N. (2001). *Measurement For Knowledge Management.* Retrieved March 27, 2001 from the World Wide Web: http://www.apqc.org/free/articles/dispArticle.cfm?ProductID=1307.

Huang, K.-T., Lee, Y. W., & Wang, R. Y. (1999). *Quality Information and Knowledge*. New Jersey: Prentice Hall.

Kaplan, R., & Norton, D. (2001). *The Strategy-Focused Organization: How Balance Scorecard Companies Thrive in The New Business Environment.* Boston: Harvard Business School Press.

Martin, W. (1999). Approaches to the measurement of the impact of knowledge management programmes. *Journal of Information Science*, 26, pp. 21-27.

MeansBusiness. (2000). *Effective Performance Measures*. Retrieved March 19, 2001 from the World Wide Web: http://www.meansbusiness.com/Finance-and-Profitabilty-Books/Effective-Performance-Measurement.

Measuring Intellectual Assets. (1998). Retrieved February 21, 2001 from the World Wide Web: http://www.montague.com/le/le1096.html.

O'Dell, C., & Grayson, J. (1998). *If Only We Knew What We Know: The Transfer Of Internal Knowledge And Best Practice*. New York: The Free Press.

Olve, N.-G., Roy, J., & Wetter, M. (1999). *Performance Drivers: A Practical Guide To Using The Balanced Scorecard*. Chicester: John Wiley & Sons.

QPROnline. (2000). *What is Balanced Scorecard?* Retrieved June 1, 2001 from the World Wide Web: http://www.qpronline.com/balancedscorecard/bsc_introduction.html.

Shand, D. (1999). *Return On Knowledge.* Retrieved March 15, 2001 from the World Wide Web: http://www.destinationcrm.com/km/dcrm_km_article.asp?id=601&ed=4&2F1%2F99.

Skyrme, D. (1999). *Knowledge Management - Performance*. Retrieved March 23, 2001 from the World Wide Web: http://www.skyrme.com/ppt/access/sld005.htm.

Sveiby, K.-E. (1996). *The Intangible Assets Monitor*. Retrieved from the World Wide Web: http://www.sveiby.com.au/IntangAss/CompanyMonitor.html.

Sveiby, K.-E. (1997). *The Balanced Scorecard (BSC) and the Intangible Assets Monitor*. Retrieved March 15, 2001 from the World Wide Web: http://www.sveiby.com.au/BSCandIAM.html.

Wenger, E., McDermott, R., & Snyder, W. (2000). *Cultivating Communities of Practice: A Guide to Managing Knowledge*. Boston, Massachusetts: Harvard Business School Press.

Chapter VI

Technology and Knowledge Management: Is Technology Just an Enabler or Does it also Add Value?

Helen J. Mitchell
Unitec, New Zealand

ABSTRACT

Technology, having made rapid and extensive advances particularly in the area of communications, has opened opportunities for the gathering of information and providing a means through which knowledge can be shared. Organisations are recognising that information and knowledge will have an important bearing on where they are going in the future. While technologies are a means to link functional areas providing effective conduit for information and the sharing of knowledge, people within the organisation must be well trained in the use and understanding of technology for maximum benefit to be gained. Referred to frequently as just being an enabler, technology does add value. Without technology, organisations would find it very difficult to access the vast amount of information that is available in the external environment. They would not be able to link people both internally and externally for the sharing of knowledge and it is through sharing of ideas that new innovations emerge. While technology can be identified as an enabler it also adds considerable value to the management and operation of organisations.

INTRODUCTION

Rapid and extensive advances in technology, particularly in the area of communications, have had a considerable impact on the way organisations operate. Providing a means through which information can be gathered with relative ease, developments in technology have provided pathways for the accessing of vast amounts of information. Information, however, is static unless action is taken through the application of knowledge to translate it into something with meaning and on which action can be taken. Organisations are repositories of information and knowledge, be it through the expertise of their staff or the systems and processes of operation. From the time they commence business they accumulate information about the markets in which they operate, yet the stock of knowledge held by organisations is so often not exploited in a way that would bring considerable benefit. The range of technologies now available provide organisations not only with the means for gathering data and information, but they can also be utilised as a conduit for knowledge to flow through the organisation. Technology has opened up ways for knowledge to be shared, providing organisations with the means to improve and increase their business opportunities.

Frequently technology is referred to as 'just an enabler', but can it also be a value-adder? It is perhaps useful to consider whether technology is simply providing organisations with the means through which they have greater access to information and whether it is opening up avenues for the sharing of knowledge that will lead to greater value for the organisations and its customers. An exploratory study looked at the range of technology used by organisations and where they are at regarding the use of technology for the management of knowledge. Reference is made to the results of that study.

Information and Knowledge

In their paper, Evans and Wurster (1997, p. 71) referred to changes that had taken place over the previous 10 years as organisations adapted their "operating processes" to "information technologies," recognising that accessing information was going to have an important bearing on where industries would be going in the future. It was during this period of time that technology was moving forward at a rapid rate and organisations were investing huge sums of money in information technology. It is perhaps worth posing a question: "Were organisations getting a sufficient return on their investment?" While the technology of the time focused on cutting transactional processing costs, it was also acknowledged that a wealth of data was available in organisations that could be presented in a way to provide information with the potential to add considerable value to the business.

In the study undertaken, information was defined as facts and data organised to describe a particular situation or problem. The definition being used for knowledge is the one by Davenport and Prusak (1998, p. 5):

> *Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms.*

While the definition for knowledge may appear lengthy, it does cover the issues that are relevant to the managing of organisations.

Of the information infrastructure, it is suggested by Brook Manville, Director of Knowledge Management for McKinsey, and quoted by Amidon (1997, p. 87), that it "must not focus on collecting and disseminating information, but rather on creating a mechanism for practitioners to reach out to other practitioners." Amidon then refers to the major change from information processing to knowledge processing that has taken place "which includes the concepts of learning tools, intelligent electronic coaching, decision-making systems, and more." This evolving of expectations indicates that organisations are not only expecting more from technology, but also becoming more reliant upon it.

Connectivity is suggested by Evans and Wurster (1997, p. 73) as providing the most important change in the information revolution. "What is truly revolutionary about the explosion in connectivity is the possibility it offers to unbundle information from its physical carrier." As suggested by them, this provides considerable advantage over traditional methods of providing information, where it generally went no further than the person receiving it or was "…constrained to follow the linear flow of the physical value chain" (p. 73).

According to Teece (1998, p. 60), the linking of the functional areas of the organisation will bring together previously "fragmented flows of data" to provide real-time information about the external environment. How useful the information is to the organisation depends very much on how it is used and what knowledge is applied to it to provide the organisation with a valuable asset. With interest growing beyond information *per se*, organisations have looked to technology to progress towards the development of knowledge management systems.

However, no matter how sophisticated technology becomes, the knowledge to develop technology and to make business decisions resides in the minds of humans. Bhatt (2001, p. 68) refers to business managers who believe computers and communication technologies are the means through which to harvest knowledge from organisations data repositories, while other managers say knowledge "resides in human minds and, therefore, employee training and motivation are the key factors to knowledge management." The development of technology has taken the drudgery out of the search and analysis of data and is capable of converting it into information to which knowledge can be applied. Organisations, even those using technology at a basic level, have access to information that previously would have been too difficult to obtain. For organisations that have developed their use of technology to sophisticated levels, there is a mine of information to be interpreted to become useful knowledge.

Technology and knowledge, however, do not stand in isolation. There are many interacting factors, not least of which is the environment in which the organisation operates. According to Bhatt (2001, p. 69), the "…pattern of interaction between technologies, techniques and people is unique to an organization." Such uniqueness is important because it is not easy to replicate. The organisation that promotes the value of the knowledge, skills and competencies of its people and recognises the importance of technology is providing well for its future (Carneiro, 2000; Bhatt, 2001). Staff well trained in the use and understanding of technology and who have a high degree of business knowledge along with a strong motivational factor is a valuable asset to an organisation.

From a productivity perspective, Grant (2000) indicates the value of digital technology. He refers to knowledge no longer being held exclusively by people. Codification and use of technology provides the opportunity for knowledge replication. While costly to create, replication and distribution can be reduced to almost "zero marginal cost" (Grant, 2000, p. 32). Grant suggests that "…explicit knowledge offers greater potential for value creation because of its replicability potential." He goes on to say that gains in productivity through turning tacit knowledge to codified knowledge and the ability to replicate it globally are "fundamental to the rapid rates of economic growth experienced during the past few decades" (p. 34). In the long term, and with the arrival of new technologies, the rate of productivity growth is likely to accelerate (Grant, 2000).

However, having the technologies available is not enough. People have knowledge and it is people who use technology. Sharing knowledge provides opportunities for idea generation and technology can provide the means for enabling knowledge to flow through the organisation so that it can be shared with others.

Sharing Knowledge

In an article by Nonaka (1991, p. 99), he refers to the knowledge spiral and talks about articulation and internalization (extending tacit knowledge by making it, where appropriate, explicit) as critical steps in the spiraling of knowledge. Seven years later Nonaka and Konno (1998) reinforce Nonaka's previous views that knowledge creating is a spiraling process leading to new knowledge. An environment in which knowledge sharing is encouraged leads to the creation of new knowledge, but as Marshall, Prusak and Shpilberg (1996) indicate it is not easy to encourage voluntary sharing of knowledge by employees. An organisation that does develop a knowledge-sharing environment increases the opportunities for the creation of new ideas that have the potential to add value to it. However, as Brand (1998) of 3M and Martiny (1998) of HP Consulting indicate, the environment must be such that people are keen to share knowledge and to benefit from the knowledge of others. Bhatt (2001), referring to the need for the distribution and sharing of knowledge throughout the organisation, suggests that interaction among technologies, techniques and people have a direct bearing on the effectiveness of the distribution of knowledge. He warns that traditional command and control management styles and supervised knowledge distribution are approaches that do not lend themselves well to the transferring of knowledge. What is required, he says, is a horizontal organisational structure with an open door policy and empowerment to provide for knowledge flow. Motivation is a key factor and if it is within the environment, knowledge management systems will be used. If motivation is not present, no matter how sophisticated the system, sharing and learning is unlikely to occur.

Range of Technologies

According to Frappaola and Capshaw (1999, p. 44), "Knowledge management refers to the practices and technologies that facilitate the efficient creation and exchange of knowledge on an organizational level." Technology has also changed work practices and anecdotal evidence suggests organisations do realise that well managed and readily accessed databases have a wealth of knowledge that can provide a valuable differentiator. However, many do not have the means or perhaps staff with the skills to mine the databases to maximise their value.

Organisations also need to be aware that, "Another major thrust of the information age is the switch in emphasis from the mass-production, high-volume, faceless transaction mode of the industrial age to a far more intimate level of customer interaction" (Hurley, Harris, 1997, p. 170). The trend is towards "…one-to-one marketing, mass customization and database marketing" (p. 170) and organisations need to move in line with this trend. For many organisations this suggests committing to greater investment in order to have the ability to access that information and take action to create value.

Technologies making an impact and mentioned by Fahey and Prusak (1998, p. 265), are data warehousing, groupware, and client-server systems. The purpose of groupware is to enable people to work together and from the view of Shani, Sena and Stebbins (2000) it has been designed to meet the requirements of team performance and capabilities. They also suggest it allows for the development of team creativity. They make reference to the view of Shulman (1996) that groupware along with other technologies is changing the nature and dynamics of the work environment.

From the literature it would appear that Lotus Notes® is a favoured medium for sharing knowledge (Davenport, 1997; LaPlante, 1997; Fahey, Prusak, 1998). In distinguishing between the use of Lotus Notes® and the Web-based intranets, Davenport (1994, p. 123) refers to Hewlett-Packard's policy that, "Notes should be used for discussion-oriented applications" and the Web for publishing purposes. A useful aspect of Lotus Notes®, according to Shani et al. (2000), is that it allows for interaction and sharing of information that is highly unstructured in nature.

A number of writers - Allee (1997), Amidon (1997), Marshall (1997), Watt (1997), Davenport and Prusak, (1998) - refer to the intranet as providing channels through which organisational knowledge can flow and providing a medium for the sharing of knowledge within the organisation. Organisational benefits of the intranet enable staff to readily access up-to-date information that previously was not readily available. For example, having policies and procedures on line means that when updates are enacted everyone has access to the most current information. It is also a means through which information relevant to various aspects of the business can be disseminated, thus keeping staff informed and encouraging openness and transparency by the organisation. Email is now well accepted as a quick and easy way for staff to communicate, but there are dangers associated with it, not lease of which are poorly constructed messages leading to unexpected problems and a reduction in personal interaction among staff. However, it is a useful and valuable medium of communication.

Getting people together for meetings, especially when staff is scattered over distances, is expensive in terms of time away from the workplace, cost of travel and personal time away from home. Electronic conferencing provides the means of getting people together without the costs of time and travel. While such conferences may not quite emulate meetings at which people personally attend, they do provide a valuable means for bringing people together for a discussion.

Reference is made by Beckett (2000) to the 'Data warehousing knowledge set' containing reference data, defined as market trends, operational data and customer performance needs. From this 'knowledge set', actions can be taken that ultimately benefit stakeholders and customers. While the 'knowledge set' may be considerable, its value only becomes realistic when there is in place the means to allow for the free flow of knowledge throughout the organisation and there are the people who can interpret it and recognise there is value to be gained from it.

Organisations more and more need to have greater knowledge about both their internal operations and the external environment. Gathering information about competitors and customers, analysing, summarising and comparing, then interpreting it, provides the means to measure performance in the market place. Whether operating in a stable or uncertain situation, knowledge greatly assists decision-making and may well provide for identifying a possible competitive advantage (Carneiro, 2000). The impact of technology on methods of production have greatly improved the operational side of business and enhanced industrial development. Technology enables the automation of routine tasks and provides benefits for co-ordination resulting from improved communication systems.

Evans and Wurster (1997) refer to technology as changing the relationships between customers and organisations because it is now possible for customers to have access to the same information, for example in the financial markets. While technology has opened up avenues to the customer to search for opportunities and products that may better serve their needs, the opportunity is also open to the organisation to exploit the potential of the technology to create greater value to its customers. For the organisation, customers are a valuable source of knowledge and it is important to build and maintain relationships. Amidon (1997) refers to "Innovating with the Customer" (p. 122) and recommends the value of working closely with customers and integrating their knowledge with that of the organisation.

Technology - Enabler or Value Adder

If technology is just an enabler, what is it that adds value to the organisation? While technology as an enabler is very much to the fore in 3M, they recognise that knowledge management does not come about solely through the provision of technology and say, "People have to be motivated to access and share information and to convert that information into knowledge" (Brand, 1998, p. 17).

Binney (2001, p. 33) has provided an article in which he addresses the question about knowledge management investments. What has emerged is the KM spectrum, developed as a result of his experience working with organisations to understand knowledge management and what part it can play within their organisations. Having explored the literature, Binney identified KM applications placing them into "six common categories to establish the elements of the KM spectrum" (p. 34). The elements are: transactional; analytical; asset management; process based; developmental; and innovation/creation knowledge management (p. 35). Explaining how the placement of each application was made, Binney (2001) then adds the enabling technologies. Uses for the spectrum are identified by Binney as first providing assistance so that "individuals and organizations better understand the KM landscape; and second, to plan KM-related investment strategies based on the framework" (p. 38). The KM spectrum provides organisations with the means for identifying their present position and to make use of the framework to map their future investment in knowledge management. Looking below the surface of the KM spectrum, the development of technology clearly emerges, but also emerging is the realisation that through technology value has been added to organisations. Take away technology and organisations could not operate effectively, nor would they survive; they have become dependent upon technology.

From the human perspective, technology, initially regarded as a threat to livelihood, has in fact removed the tedium associated with many routine tasks (Carneiro, 2001). Technology has opened up avenues for many new careers and this development continues as new technology emerges. The advent of the World Wide Web brought a host of exciting careers, particularly in the area of design for people with a creative flair. So while technology may be regarded as a means of relieving tedium, it has also provided opportunities for creative expression. Job opportunities also abound in the area of technology support, offering many and varied roles for people to take up. New technology emerging in the future will surely provide even more prospects for careers not yet dreamed of and even more uses it can be put to not yet imagined.

Beckett (2000) makes reference to the work being done at Phillips Fox where knowledge of senior lawyers is being captured through the use of information technology. Combining this captured knowledge with existing repositories of both internal and external information has considerably reduced the time spent on case research. He goes on to point out that some knowledge and data may have greater importance than other knowledge and data, that part of the 'corporate memory' may in fact be outside the firm and that the 'corporate memory' will include elements of both tacit and explicit knowledge. The work at Phillips Fox clearly illustrates how a company is making excellent use of technology.

Lloyd (1996, p. 576) refers to the use by organisations of world-wide networks and says new technology is "the catalyst which is forcing all organizations to re-evaluate what they know, what they do with that knowledge and how they continually add value (or not) to that knowledge in meeting changing customer needs." Technology has advanced considerably since Lloyd made this comment and it will continue to evolve in the years ahead, providing for greater enrichment of organisational operations. While the cost of 'keeping up' with technological developments has always been a problem for organisations that have made a strong commitment to technology, others recognise that they need to work smarter with what they have. While technology has become an essential part of any business, there does come a point when continuous upgrading and endless investment needs to be tempered.

While there is no doubt that technology has provided the impetus for the growth of the information age, technology should not be regarded as a dominant partner. As Pemberton (1998, p. 60) comments, "The IT exponents of KM tend to downplay the central role of human factors in KM" and provides a reminder that, "IT doesn't itself create knowledge any more than does a library, an office, or a classroom." Management, however, generally recognises the power of technology to assist knowledge mining of data repositories, consisting of point of sale, credit card and special promotional sales data, to provide knowledge on which to base future decisions (Bhatt, 2001). To emphasise the position of technology, Watt (1997) refers to the comment by Fran Ergonon of Price Waterhouse LLP that, "Technology is a key enabler but is not in itself knowledge management" (p. 18). The view of Ward (1996, p. 17) is that, "the real value is in linking people together, not in the technology itself." However, it also needs to be remembered there is no guarantee that employees will make use of technology, nor will it encourage the sharing of knowledge if employees do not feel inclined to do so. It must not be forgotten that sharing of knowledge does not occur just through the use of technology; it is more likely to occur as a result of face-to-face social interaction.

Technology has provided the means of communication and interaction for those too far away to meet in person, and in doing so has added value – technology and the efficiency of people is increasing and the flow of knowledge has been enhanced (Bhatt, 2001). Combining knowledge and information technology are major success factors in strategic planning formulation (Carneiro, 2000). However, information will only have value if the person examining it has the knowledge to interpret it in a meaningful way. If not, the information will be valueless and remain dormant.

Taylor (2002) reports that an Internet survey carried out recently by the Ministry of Economic Development suggests that in the last 21 months Internet usage has risen considerably. The survey shows that of firms having six or more staff 56 percent now have their own website and 91 percent are using email. It appears that businesses are turning more and more to technology as a means through which to improve communications and increase opportunities.

Exploratory Research

The purpose of the exploratory research was to identify the status of knowledge within organisations and to discover what technology was used for the purpose of accessing information and sharing knowledge. From an independently prepared database of the top 500 companies in the country, 400 were randomly selected and 26 organisations involved in government and local government activities and professional companies were added, making a total of 426 organisations surveyed. A questionnaire was the instrument used and the response rate was 20 percent. For the purpose of the analysis, the organisations were divided into the following categories:

19 Primary Sector
27 Goods Sector
40 Service Sector

From six factors – Technology, Skills and Competencies, Research and Development, Information, Knowledge, Intellectual Capital – organisations were asked to select the most important factors now and predict the most important in five years.

Skills and Competencies consistently ranked first both now and in five years. While technology did not rank as being the most important factor at the time, in the future organisations did see technology increasing in importance. Knowledge, in most instances, did not show up in the 'most important category'. There was no relationship between the size of the organisation and the importance of the factors.

Information gathered revealed that almost all organisations had in place client databases to gather information about their customers. The study asked organisations whether they were using the approach of data warehousing as a means of providing information that could enhance their business and gain a competitive advantage through identifying patterns of customer needs. Of the organisations surveyed, 20 percent indicated they were using or considering the data warehousing approach to provide them with information. The remaining 80 percent had not integrated systems to this extent and relied on client/customer databases to gather and record information about customers.

Two-thirds of the organisations surveyed have an intranet. Use of the intranet appeared to be for the dissemination of general information or for obtaining specific information. Although a very useful medium for sharing knowledge, organisations did not appear to have progressed to the stage where they were using it as a useful tool for dialogue. Several organisations intimated they were either in the process of setting up an intranet system or would be doing so within the next year. A small number of respondents indicated they had groupware and Lotus Notes® was mentioned frequently. Asked about technology used to assist with the gathering and sharing of knowledge, organisations responded with the following: email, databases, intranet and internet, and in a very few cases, workflow systems, enterprise resource planning systems, share drives and networks.

A question about sharing knowledge revealed that organisations encouraged the sharing of knowledge, particularly in the government sector, and the view of CEOs is that employees are willing to do so. Rewarding staff for the sharing of knowledge was not considered necessary by the majority of respondents, although a few did, in fact, do so. Rewards took the form of recognition and thanks, financial, travel, dinner for two and consideration in performance appraisal.

The study identified that organisations are aware of the value of customer knowledge and are prepared to work closely with customers to develop new products—and the trend appears to be that they are, in fact, doing so. Two respondents added to the information they provided, explaining that important technological developments had occurred as the result of working closely with their customers. The developments had added considerable value to their businesses and those of their customers.

As expected from the study, every organisation uses technology in some way or other, although the level of sophistication varies considerably. It is clear that using technology to share knowledge has not developed to any great extent, although the use by some organisations of Lotus Notes® indicates they are attempting to do so. Setting up a sophisticated knowledge management system is expensive and as many of the organisations surveyed fit the categories of micro, small and medium sized, the cost would be beyond their means.

CONCLUSIONS

Is technology just an enabler or is it also a value-adder? From the literature and the findings of the study, it appears that technology is regarded as an enabler rather than a value-adder. Yet, the continual movement in technological progress as shown in Binney's KM spectrum clearly identifies the developments that have taken place in technology to enhance the operation of business. Through these developments, value is being added. However, it may be that technology is so much taken for granted that its value is not realised. Organisations only need to think of the disruption and damage to business when a power blackout occurs or when they are affected by flood or earthquake damage. It is at such times that they realise their dependence upon technology and the value it provides to their business.

All organisations are making use of some form of the technologies that are now available. However, whether they are at a sophisticated level or fairly simplistic, it seems many are not using their technologies as effectively as they could. While in reality it is people who add value through the application of their knowledge, productivity will only increase if people using the technology are thoroughly trained in its use and are comfortable with it. Well trained staff use the technology to maximise its benefit for the job they are doing and increase the potential to enhance productivity. Technology will then have added value and the organisation will have gained value from its investment.

Organisations need information for decision-making and technology has opened many avenues through which it can be gathered. Technology also provides an excellent medium for the dissemination and sharing of knowledge. While much knowledge sharing is through face-to-face social interaction, technology provides for the sharing of knowledge among those who, because of distance, are unlikely to have the opportunity for such socialisation. Sharing of knowledge leads to the creation of new ideas and organisations grow through the development of those ideas into new products and services and becoming more innovative in their systems and processes. While the role of technology may be that of enabler and the role of staff is to add value through the knowledge they have, technology provides a medium through which staff can be 'brought together' to share their knowledge, so perhaps it should also be considered a value-adder!

REFERENCES

Allee, V. (1997). *The Knowledge Evolution: Expanding Organizational Intelligence.* Butterworth-Heinemann, USA.

Amidon, D. M. (1997). *Innovation Strategy for the Knowledge Economy: The Ken Awakening*. Butterworth-Heinemann, USA.

Beckett, R. C. (2000). A characterisation of corporate memory as a knowledge system. *Journal of Knowledge Management, (4)*4, pp. 311-319.

Bhatt, G. D. (2001). Knowledge management in organizations: examining the interaction between technologies, techniques, and people. *Journal of Knowledge Management*, *(5)*1, pp. 68-75.

Binney, D. (2001). The knowledge management spectrum – understanding the KM landscape. *Journal of Knowledge Management (5)*1, pp. 32-42.

Brand, A. (1998, September). Knowledge Management and Innovation at 3M. *Journal of Knowledge Management*, *(2)*1, pp. 17-22.

Carneiro, A. (2000). How does knowledge management influence innovation and competitiveness? *Journal of Knowledge Management*, *(4)*2, pp. 87-98.

Davenport, T. H. (1994, March/April). Saving IT's Soul: Human-Centred Information Management. *Harvard Business Review*, pp. 119-131.

Davenport, T. H. (1997, June 15). Known Evils: Common pitfalls of knowledge management. *CIO*, pp. 34-36.

Davenport, T. H., & Prusak, L. (1998). *Working Knowledge*. Harvard Business School Press, USA.

Evans, P. B., & Wurster, T. S. (1997, September-October). Strategy and the New Economics of Information. *Harvard Business Review*, pp. 71-82.

Fahey, L., & Prusak, L. (1998, Spring). The Eleven Deadliest Sins of Knowledge Management. *California Management Review*, *(40)*3, pp. 265-275.

Frappaola, C., & Capshaw, S. (1999, July). Knowledge Management Software: Capturing the Essence of Know-How and Innovation. *The Information Management Journal*.

Grant, R. M. (2000). Shifts in the world economy: The drivers of knowledge management. In Despres, C., Chauvel, D. (Eds.), *Knowledge Horizons*. Woburn, MA: Butterworth Heinemann.

Hurley, M. A., & Harris, R. (1997). Facilitating corporate knowledge: Building the data warehouse. *Information Management & Computer Security*, *(5)*5, pp. 170-174.

LaPlante, A. (1997, June 2). Sharing the wisdom. *Computerworld*, pp. 73-74.

Lloyd, B. (1996). Knowledge management: The key to long-term organizational success. *Long Range Planning*, *(29)*4, pp. 576-580.

Marshall, C., Prusak, L., & Shpilberg, D. (1996, Spring). Financial risk and the need for superior knowledge management. *California Management Review*, *(38)*3, pp. 77-101.

Marshall, L. (1997, September/October). New opportunities for information professionals. *Online*, pp. 93-98.

Martiny, M. (1998, Autumn). Knowledge management at HP consulting. *American Management Association, Organizational Dynamics*, *(27)*2, pp. 71-77.

Nonaka, I. (1991, November-December). The knowledge-creating company. *Harvard Business Review*, pp. 96-104.

Nonaka, I., & Konno, N. (1998, Spring). The Concept of "Ba": Building a foundation for knowledge creation. *California Management Review*, *(40)*3, pp. 40-54.

Pemberton, J. M. (1998, July). Knowledge management (KM) and the epistemic tradition. *Records Management Quarterly*, pp. 58-62.

Shani, A. B., Sena, J. A., & Stebbins, M. W. (2000). Knowledge work teams and groupware technology: learning from Seagate's experience. *Journal of Knowledge Management*, *(4)*2, pp. 111-124.

Taylor, K. (2002, May 17). Businesses embrace opportunities of the Internet. *NZ Herald*, C3.

Teece, D. J. (1998, Spring). Capturing value from knowledge assets: The new economy, markets for know-how, and intangible assets. *California Management Review*, *(40)*3, pp. 55-79.

Ward, A. (1996, March/April). Lessons Learned on the Knowledge Highway and Byways. *Strategy and Leadership*, pp. 17-20.

Watt, P. (1997, August). Knowing it all. *Intranet*, pp. 17-18.

Chapter VII

Knowledge Management: The Missing Element in Business Continuity Planning

Denise Johnson McManus
Wake Forest University, USA

Charles A. Snyder
Auburn University, USA

ABSTRACT

This chapter provides a new perspective for Knowledge Management applications within organizations. The relevance of knowledge management components in disaster planning has been underscored by the large-scale terror attacks of September 11, 2001. The objective of the chapter is to provide a different perspective on the risk management category of business continuity planning or disaster recovery. Specifically, the authors show how most plans ignore or downplay the essential requirement for the organization to preserve its critical knowledge resources in the event the possessors of that knowledge are killed. Most proponents of Knowledge Management have neglected this important facet of the field. At the same time, the risk management and disaster recovery fields have ignored the important contributions of Knowledge Management to a viable business continuity plan.

INTRODUCTION

As the horrific events of September 11, 2001 in New York City, Washington, DC, and rural Pennsylvania unfolded, the first thoughts of most were likely for the victims of terror on such a huge scale. In the aftermath of the tragedy and destruction, many survivors had to turn to restoring businesses. Much was written about disaster recovery and business continuity planning as people struggled to regain the essential systems that underlie the modern organization. One aspect of this restoration that has typically been ignored is that of organizational memory management—a crucial part of Knowledge Management (KM). The importance of knowledge as a critical resource continues to gain recognition in the business world. This chapter discusses the need for KM programs in order to cope with large scale disasters such as the World Trade Center attacks.

BACKGROUND

This is really a dual topic as it contains the topics of both KM and risk management. The major focus is on the need for the addition of corporate memory management to complete any business continuity plan. The terrorist attacks of 9/11 have forced many to re-examine their disaster recovery plans.

For the first time, organizations have had to confront the massive loss of intellectual capital. Even if disaster recovery plans had provisions for software, equipment and networking, the plans could not be executed without knowledgeable people. Terrorist attacks have underscored the importance of adding knowledge management or corporate memory management components to make a comprehensive business continuity plan. In order to understand the domains of business continuity planning and KM, it is necessary for us to provide some definitions of the concepts. In the following section, we begin by defining KM.

KNOWLEDGE MANAGEMENT

Unfortunately, KM has a variety of meanings both in the literature and in practice. Some definitions are provided here. Knowledge management is the utilization of "the collective knowledge, experience and competencies available internally and externally to the organization whenever and wherever they are required" (Fearnley, Horder, 1997, p. 25). They have considered KM to be a supportive process comparable to the management of people. It includes the systematic generation, capture and transfer of knowledge and learning for the application and benefit of the whole organization. We believe that knowledge is similar to potential energy in providing the basic competence to perform. A manager's major concern should be centered on the knowledge required to perform the organization's critical processes and tasks. Knowledge Management is the discipline that focuses on capturing, organizing, filtering, sharing and retaining key corporate knowledge as an asset. "KM is the sharing of information and wisdom between global business units and their support organizations" (Griffiths, 1997, p. 62). Dorothy Yu, a global consulting partner at PricewaterhouseCoopers, defines KM as "the art of transforming intellectual assets into business value" (Zerega, 1998, p. 61). Knowledge management is the ability to realize increased returns from business competencies," according to Kirk Klasson, director of knowledge-management solutions at Cambridge Technology Partners (Zerega, 1998, p. 61). The lack of effective management of knowledge could be because most organizations are still struggling to comprehend the KM concept (Holsapple, Joshi, 1997).

> *To make knowledge work productive will be the greatest management task of this century just as to make manual work productive was the greatest management task of the last century. The gap between knowledge work that is left unmanaged is probably a great deal wider than was the tremendous difference between manual work before and after the introduction of scientific management (Drucker, 1969, p. 272).*

Thus, our focus is on the management of the corporate memory that is required for superior performance of those critical processes. This becomes even more important as the world's forces engage in war activities and human knowledge bases leave the organization.

BUSINESS CONTINUITY PLANNING

Business continuity planning is often equated with external forces, such as natural disasters, that present the risk of power disruption, building destruction or worse (McManus, Carr, 2000). Less obvious is the risk inherent with a terrorist attack as devastating as the horrific events experienced by the United States on September 11, 2001. Risk is inherent in any organization, in any operation, in any situation where the goal is continuity.

There are expected situations that cause downtime. However, there are disastrous events that are much more difficult to plan for that can cause total disruption in business. Examples of these interruptions of business are shown in Table 1.

The cost of downtime, whether the result of disastrous or normal situations, has a widely varying impact on the organization depending upon the industry. According to Kelly (2002), the Energy and Telecommunications groups are exceptionally vulnerable to downtime—with revenue at risk of 2.17 million dollars per hour for energy and 2.066 million dollars per hour for telecom companies as displayed in Table 2.

Table 1: A Categorization of Disasters (Source: Adapted from Aberdeen Group in Kelly, 2002)

	Normal Situation	**Disaster Recovery Situation**
Time Down	* Minutes per year	* Hours of day per event
Infrastructure Threat	* Disk failure * Network congestion * Application performance	* Earthquake * Blizzard * Fire * Flood
Willful Threat	* Computer viruses * Hacking	* Disgruntled employee * Terrorist attack

Table 2: High Cost of Downtime (Source: Adapted from Meta Group in Kelly, 2002)

Industry	**Revenue/hour**	**Revenue/employee-hour**
Energy	$2,817,000	$589
Telecomm	$2,066,000	$187
Manufacturing	$1,610,000	$134
Finance	$1,495,000	$1,079
Info Tech	$1,344,000	$184
Insurance	$1,202,000	$370
Retail	$1,107,000	$244
Pharmaceutical	$1,082,000	$167
Chemicals	$704,000	$194
Transport	$668,000	$107
Utilities	$643,000	$142
Health Care	$636,000	$142
Media	$340, 432	$119
Retail	$1,107,000	$244

An essential component of any sound Information Resources Management program is that of Business Continuity Planning or, in a more limited sense, Disaster Recovery Planning. These programs are emplaced to ensure that a business can continue to operate after a disaster. From an information technology perspective, the plans deal with restoring capability so that essential IT supported functions can be carried out. An important part of the recovery planning should be on the KM aspects that enable the systems to function. What are these aspects? What are the specific tasks that managers need to perform? How should managers address the KM tasks?

As stated by Dickerson (2001), "In the coming days and weeks, businesses that lost employees in the attack are faced with realities of rebuilding business infrastructure to serve their customers amid the bottomless grieving for their colleagues. The loss of so many people means a catastrophic loss of intellectual capital." Therefore, even companies that have a good disaster recovery plan are struggling to implement that plan. While the total cost of damage to a company's equipment and facilities can easily be determined, intangible damage, such as the cost of downtime and the loss of intellectual capital, are difficult to measure. Not only are companies faced with the loss of employees and loss of the business infrastructure, but also they are struggling with the rebuilding efforts due to a lack of available company employees that can implement the plan. This solidifies the necessity to capture relevant knowledge that can be engaged during such catastrophic disasters as experienced on September 11, 2001.

KM ASPECTS OF CONTINUITY PLANNING

Information technology managers have long advocated certain practices that make a business capable of restoring IT-based aspects of the business in disaster situations. Some of the most basic practices are backup, especially of critical applications. However, most disaster recovery plans that rely on conventional backup, outdated testing, narrow redundancy, etc., are woefully inadequate to comprehensively cover enterprise needs (Grygo et al., 2001). With catastrophic disasters such as massive terrorist attacks, there is a huge human dimension in addition to the technical one. In some cases, the majority of the human resource may be lost in addition to the destruction of IT and facilities. As Kearns (2001) stated, "it is not pleasant to contemplate, but what would your company do in the event that you and your entire department were wiped out?"

One rather recent aspect of KM could be considered the idea of an *alumni network* for a company. Because talented people do not stay in one organization forever, the alumni network helps to maintain contact with them even when they are gone. The alumni network is designed to engender lifelong affiliation. Eventually, some of the alumni that possess critical organizational knowledge may want to return or may be in the position of being advisors. Therefore, there is a new movement to build alumni networks. Even if the people do not return to the company, the company may be able to bring their knowledge back (Canabou, 2002).

In an interview (Scannell, 2001), the head of IBM's disaster recovery center, Ted Gordon, stated that the basic disaster recovery plan was insufficient when the whole fabric of how the business operated was disrupted, rather than just getting computers back up and running. He said that, "Every company has to take stock of exactly how they do business, where it is most critical for them to keep that part of the business running, and what the processes are that support that…technology is not as big a risk as is the way we use technology to do business—it is the emphasis on the people, and our dependency on them, and how we choose to operate."

Companies must conduct risk assessment and manage the risk potential from all aspects of the company, i.e., personnel, technology. In the traditional disaster recovery plan, it was the responsibility of management to determine where unexpected and undesired consequences were likely to occur. The assessment was often focused on the interruption of technology, process, or procedures. "The technological inability to communicate with customers and suppliers is devastating, which can prevent the company from staying in business. By detecting and recognizing risks, the result of adverse consequences will be less catastrophic" (McManus, Carr, 2000, p. 3).

Johnson (2002) has pointed out that traditional disaster recovery plans are unable to keep up with the speed of doing business today. He advocates continuous processing architecture (CPA). CPA is a complete, high availability concept that allows instant failure recovery as well as storage. Provided adequate separation of the required redundant systems, the systems, applications and data should survive. However, a CPA may be just another piecemeal solution when a comprehensive, complete strategy is needed.

Comprehensive plans are designed to eliminate unnecessary decision-making immediately following the disaster. This plan is only effective if the appropriate personnel are available to invoke the actions necessary to continue the business. The companies in the World Trade Center experienced immediate problems from the terrorist attack and will continue to experience difficulty for months, even years, and potentially may never recovery, because of the tremendous loss of intellectual capital.

Few firms have been so deeply and irrevocably devastated by the World Trade Center attack as KBW. In all, 67 of the firm's 172 New York-based employees died or are still missing. They accounted for nearly a third of KBW's 224 employees. In a stroke, the firm lost more than 400 years of professional experience and much of its leadership. Gone are five of nine board members, including KBW's directors of equity trading, bonds, and research, along with its most prominent and influential financial analysts. Those missing or dead were responsible for 40% of KBW's annual revenues, which reached $125 million last year. In addition to the human loss, the firm lost its headquarters and every shred of paper documentation that existed there (Byrne, 2001).

Many companies in the World Trade Center may have the ability to recover their technological losses quickly, however, not their intellectual losses. In an interview with Howard W. Lutnick, a Cantor Fitzgerald Securities executive, he indicated that 68% of the intellectual assets of the company were lost in the tragedy. "The government bond trader had almost its entire New York staff wiped out on September 11" (Powell, 2001, p. 68). The company did not lose the critical data of the company, however, they did lose customer contact personnel, which will ultimately affect their supply chain management and CRM capabilities. It is apparent that the knowledge of the personnel of Cantor Fitzgerald Securities is a necessity to stay in business.

> *"Nothing can compare to the enormity of our loss of life," said Mr. Lutnick. "This tragic event has taken from us over one third of our employees (approximately 700), including half of our senior leadership. However, what we have learned from this horrendous act is that it is impossible, to destroy the spirit of our family and together we are forging ahead. We will remain the market leader with the foremost electronic trading platform in the world and in doing so honor the integrity of those employees, executives, family and friends we have lost"* (Business Wire, 2001).

Although valuable data was stored in various applications, the employees with the knowledge of creating and using this information were killed in the attack and their knowledge died with them. Therefore, these examples indicate the necessity to store the data in a data warehouse and manage the knowledge for future use. In an effort to replace the personnel, the company will encounter tremendous risk that includes the inability of the new employees to perform at the appropriate level, as well as the risk of a start-up company stealing the business.

"Risk International's Mr. Wellman advised employers to spread staffers around and to 'minimize decision-making' to protect against catastrophes. Businesses that had all or most of their workforce in a single location violated a fundamental risk management principle, 'concentration of risk'" (Bradford, 2001, p. 21). How can survivors restore the firm's presence and ability to do business? "In a disaster, companies may be able to get the IT side up, but what about the rest of the company? What about management and production?" (Kovar, 2001, p. 71). One measure that managers need to address is that of harvesting the crucial knowledge of their best performers and preserving it. This should be a priority undertaking, as it may prove vital for survival in an era where terrorism poses new risks.

KNOWLEDGE MANAGEMENT TASKS

Knowledge management has been a popular concept for several years; however, there are many definitions and controversies about the scope, content, and implementations still clouding the issues. In this regard, we believe that the scope and content may be clarified by delineation of KM tasks that are important for business continuity planning. Consequently, we list tasks that are relevant within this context.

Since managers are interested in capturing relevant knowledge about the key processes of their firms, it is now apparent that this should be part of the strategic goals of the company (Snyder, Wilson, McManus, 2000). An organization's knowledge base and continuity plan needs to contain relevant (expert) knowledge that can be made available during a disaster. Peter Drucker (1993) stated in his book *Post Capitalist Society*, "The basic economic resource is no longer capital, nor natural resources. It is and will be knowledge." Managers are trying to understand what this means as they move their companies and information technology departments from strategies of data management, to information management, to knowledge management. Organizations are now striving to establish knowledge management systems to assist in the dynamic business environment.

To appreciate the problem with expertise retention, consider the dilemma that suddenly arises when highly valued employees leave the organization unexpectedly, as experienced by many companies on September 11. You want to retain that person's expertise, generally viewed as his or her knowledge (Snyder, Wilson, McManus, 2000).

Corporate Memory Management is an integrated set of processes whereby the hidden insights from top performers are converted into specific, actionable know-how that is able to be transferred to thousands of employees via software (Snyder, Wilson, 1997). The process follows a sort of life-cycle approach (Snyder, Wilson, McManus, 2000). The parts of the process are:

Focus

The first step is to determine the existing explicit knowledge and implicit knowledge that is needed for the focal process. What are the know-how content priorities for this process? Then a formal project plan must be created to capture the information. This capturing process maintains the brain of the organization regardless of downsizing, attrition or resignation of employees.

Find

Another one of the initiating steps involves finding top performing people and their critical activities. The top performers will be identified as a way to determine the source of critical actions. The nature of the person that is being sought and the output of that person's activities create knowledge as opposed to a simple action.

Elicit

Once identified, an understanding of these activities will be elicited from the key individuals. The activities of the top performers are educed and logically mapped in the knowledge harvesting process. KM must uncover the rules of decision within the activities of key performers.

Organize

The knowledge must be arranged in a coherent or systematic form. This procedure of structuring the knowledge into orderly and functional processes allows anyone in the organization to retrieve the necessary information quickly and efficiently. It is this inherent method that allows the organization's knowledge to be carried forward for future use of various applications within the company.

Package

The determination of how to properly package the knowledge so that it can be available when and where needed is a necessity. We must assess the best packaging form, e.g., an Electronic Performance Support System (EPSS). This process collects and preserves information or data on a particular subject within the organization. This is a non-trivial process because the application will have to be expertly structured to glean knowledge from the action of the user and ignore everyday data and information. These knowledge processes are recorded in a database that is accessible through a software package. Software can be used by anyone, increasing the organization's ability to make effective use of all harvested know-how.

Share

Sharing brings different aspects to the value and use of knowledge and will likely lead to the seeking and capturing of other knowledge and uses of previous and new knowledge not formerly considered. This captured knowledge can be distributed throughout the organization to individuals or groups that may require this relevant information. Throughout this sharing process, a corporate repository is developed where tangible "intellectual capital" of an organization can be captured and exchanged. This sharing phase allows individuals to track activities while significantly increasing efficiency and effectiveness of existing groupware for any organization.

Apply

The purpose of a KM system is to allow people other than the key players to use the same decision rules. Once these decision rules have been elicited and captured, they are only of value if we have a way to apply the newly-gained knowledge. It is the employees of the firm that may request or seek assistance, employment or admission of a specific task. By creating these applications through the knowledge harvesting process, these employees can seek that assistance from the database of knowledge that has be gained and stored from the experts of the organization.

Evaluate

Evaluation must be performed in order to determine the effectiveness of the applications. Appraisal of the resulting captured knowledge will occur during its application and sharing. In sharing the knowledge, it will be evaluated—a process that should be continuous so that the total database can be kept up-to-date, relevant and as small as possible. The organization needs to evaluate its learning systems and their contribution to useful knowledge. At the most basic level, learning should be evaluated by assessing the impact on individual performance.

Adapt

The KM system must incorporate the ability to adapt to new knowledge so that it can be refreshed. To maintain this core asset, knowledge, software is utilized to record the knowledge and activities of the company experts. By instantly recording all input information generated during the learning sessions, these processes increase the organization's ability to make effective use of all harvested know-how. Therefore, when a crisis occurs, the organization's knowledge can be shared with others. This sharing process allows for a quick recovery. The combination of these harvesting processes can significantly reduce time and result in improved thinking and decision-making when a company is faced with a disaster.

A few case studies were used by Wilson and Frappaolo (2000) to illustrate the application of the approach. One case is of particular interest in the present context. This case is titled "Before A Key Employee Walks Out the Door." In this case, the firm was forewarned of the imminent departure of one of its key individuals. The firm recognized the importance of capturing his intimate knowledge of a critical process and proceeded to work through the parts of the Knowledge Harvesting process cited above. This is the sort of procedure that all firms need to go through before there is a known loss of knowledge if they are to build survival capabilities.

A MANAGER'S KM CHECKLIST

Companies are already thinking about IT lessons. They "will most likely reconsider centralizing key personnel at a single office—one company lost its entire disaster recovery team of nine people in the attack" (Wagner, 2001, p. 15). Using some of the steps of Knowledge Harvesting, Inc., model as a basis, we have a series of actions for managers. One of the first tasks involves simply identifying the organization's key or critical processes. We would suggest that these processes be evaluated and ranked along a criticality scale in order to determine the areas for priority focus. A checklist can provide a normative model for managers.

1. Identify Key Organizational Processes
2. Rank-Order with Most Critical Processes First
3. Assess Organizational Readiness (From: Assessing Readiness, 1999)
   a. Determine Knowledge Orientation
   b. Assess Climate for KM
   c. Assess Culture
   d. Determine the Degree to Which Daily Operations Support Change

    e. Assess Information Architecture Ability to Support Change
    f. Determine Leadership Support for Change
    g. Determine the Scope and Magnitude of Change
4. Develop KM Plan
5. Select a Proof-of-Concept Process Project
    a. Employ a Proven Methodology
    b. Select a Doable Project
6. Implement Proof-of-Concept Project
7. Evaluate Proof-of-Concept Project
8. Extend KM Implementation to Priority Processes
9. Ensure Integration and Update is Ongoing

These steps can assist managers in their efforts to harvest and preserve essential knowledge surrounding the organization's key processes. The checklist is a suggested model for managers to follow in adding an essential KM element in their business continuity plans. Only by doing this, can firms ensure that they can recover from unexpected disasters such as large-scale terrorism.

FUTURE TRENDS

There are parallel trends that impact this topic. First, the events of September 11, 2001 have caused many firms to reevaluate their business continuity planning because of the scale of disaster caused by terrorists. Firms have had to rethink their total disaster planning and business continuity planning to face the possibility of massive loss of intellectual capital, even if their computing facilities were able to be restored rapidly. The second impact has been the very fact that the loss of intellectual capital can mean that even if all other aspects of computing and telecommunications are backed up, these efforts are futile if firms are without skilled or knowledgeable personnel.

Future research might include building a profile of business continuity plans. An examination of those plans that are executed could determine the impact of inclusion or exclusion of KM facets. Future research would include a study of the knowledge components that should be included in business continuity planning.

CONCLUSIONS

The disastrous effects of the events that occurred on September 11, 2001 will drive companies not only to consider the importance of traditional disaster recovery plans, but also to incorporate a knowledge management component that may have been overlooked in the past. The loss of intellectual capital has virtually crippled some companies, with no recovery possible. In the last ten years, a major disaster has been reported somewhere in the United States as well as the world, every year. The size of the disaster is not the determining factor of staying in business; it is a comprehensive business continuity plan that will determine the success of most companies. Firms must go farther than building a disaster recovery plan in the face of new threats. They need a comprehensive business continuity plan that includes the possibility of massive loss of knowledge. This plan must address organizational memory management. The technology infrastructure can be replaced, the physical facilities can be rebuilt, but it may be impossible to recover the loss of expertise unless there has been a concerted effort to harvest that knowledge and have it packaged so that the essence of the experts' implicit knowledge is preserved.

REFERENCES

Bradford, M. (2001, September 24). Attacks put focus on crisis plans. *Business Insurance*, 39, pp. 18-22.

Business Wire. (2001, October 4). eSpeed's chairman discusses the company's business.

Byrne, J. (2001, October 8). How much loss can a firm take? *Business Week*, 3752, p. 68.

Canabou, C. (2002, May). Gone, but not forgotten. *Fast Company*, 58, pp. 28-30.

Dickerson, C. (2001, September 21). Boundless generosity. *InfoWorld*, 25.

Drucker, P. (1969). *The Age of Discontinuity*. New York: Harper and Row.

Drucker, P. (1993). *Post-Capitalist Society*. New York: Harper & Collins.

Fearnley, P., & Horder, M. (1997). What is knowledge management? Knowledge Management in the Oil & Gas Industry. *London Conference Proceedings Notes*.

Griffiths, E. (1997, February 13). Knowledge Management for Global Operations—and its Impact. *Knowledge Management in the Oil and Gas Industry*, pp. 61-70.

Grygo, E., Prencipe, L., Schwartz, E., Scannell, E., & Krill, P. (2001, September 17). IT recovery efforts forge ahead. *Infoworld*, 38, p. 17.

Holsapple, C.W., & Joshi, K.D. (1997, July, 1-21). *Knowledge Management: A Three-Fold Framework*. KIKM Research Paper No. 104.

Johnson, J. (2002). The case for a CPA. *Software Magazine*, 22(1), pp. 16-17.

Kearns, D. (2001, September 24). Disaster recovery: Are you ready? *Network World*, 39 , pp. 22-23.

Kelly, D. (2002). Mindset change. Business continuity: Against all odds. *Network World Advertising Supplement*, pp. 8-10.

Kovar, J. (2001, September 10). When disaster strikes. *The Newsweekly for Builders of Technology Solutions*, 962, pp. 70-77.

McManus, D. J., & Carr, H. H. (1999, June). Risk and the need for disaster planning. *Information Systems Management Journal*, 1-01-55, p. 1-7.

Powell, B. (2001, Oct. 1). New world order: Battered but unbroken. *Fortune*, 6, pp. 68-80.

Scannell, E. (2001, September 19). Boss of IBM's disaster recovery center tells what he learned from last week's crisis. Retrieved from the World Wide Web: www2.infoworld.com/articles/hn/xml.

Snyder, C. A., & Wilson, L. T. (1997). Technology advances supporting electronic performance support systems. Proceedings, Symposium on Operations Research, pp. 1-6.

Snyder, C.A., Wilson, L. T., & McManus, D.J. (2000, Spring). Corporate memory management: A knowledge management process model. *International Journal of Technology Management*.

Wagner, M. (2001, September 24). Disaster's aftermath – IT scrambles to restore order – World trade center tenants use lessons from 1993 bombing, quickly switch over to backup systems. *Internetweek*, 879, p. 15.

Wilson, L., & Frappaolo, C. (2000, April). After the gold rush or intelligent KM. Implicit knowledge management: Intelligent enterprise. Retrieved from the World Wide Web: www.knowledgeharvesting.org*/home.htm*.

Zerega, B. (1998, July 27). Art of knowledge management. *InfoWorld*, p. 61.

Chapter VIII

Rewards: Do They Encourage Tacit Knowledge Sharing in Management Consulting Firms? Case Studies Approach

Ricky Laupase
Edith Cowan University, Australia

ABSTRACT

This chapter will discuss as to whether reward systems will effectively facilitate the sharing and transfer of tacit knowledge amongst consultants in management consulting firms. A research framework was based on the 'tacit knowledge conversion' model given by Nonaka and Takeuchi (1995) and the 'reward classifications' model by VonKortzfleisch and Mergel (2001). The framework suggests that, with effective implementation, reward systems would encourage the tacit knowledge sharing. A typical example of knowledge-intensive *organisation is a management consulting firm in which its success depends heavily on the sharing of tacit knowledge amongst its consultants. Seven senior management executives from different international management consulting firms who have had extensive experience in the consulting industry were interviewed. The study found that reward systems do encourage consultants to share knowledge with each other. It is also found that informal meetings and also offering non-material or 'soft' rewards are often cited as a more effective approach to encourage tacit knowledge sharing.*

INTRODUCTION

Knowledge management is an important task for individuals, groups and organisations, as it adds value to the existing data and knowledge. With careful and effective utilisation, the knowledge can be used as a new weapon to gain competitive advantage (KPMG Consulting, 1999). As expressed by Drucker (1993), "knowledge is the only meaningful resource today; the traditional 'factors of production' have not disappeared, but they have become secondary." In other words, knowledge has become one of the most important resources of an organisation, in addition to factor of production, which needs to be managed to gain competitive advantage.

A management consulting firm is a typical example of a highly knowledge-intensive organisation, as its success depends upon the knowledge and expertise of its consultants (Apostolou, Mentzas, 1999). Its knowledge is the intellectual wealth of consultants that provides avenues to give advice and provide the tools to resolve clients' problems, thereby generating income. Hence, the sharing of knowledge among consultants is becoming critical to gaining a competitive advantage in the new knowledge-based economy (Chaudhry, Ng, 2001).

Knowledge sharing can be done through an interaction process, for example, through face-to-face meetings in which one person's tacit knowledge is transferred and becomes another person's knowledge (Nonaka, Konno, 1998; Nonaka, Takeuchi, 1995). However, this interaction process alone is not sufficient to motivate knowledge sharing. Reward systems also play an important part in motivating the consultants' active participation in knowledge sharing (VonKortzfleisch, Mergel, 2001). This study aimed to observe as to whether reward systems motivate consultants to effectively facilitate tacit-to-tacit knowledge sharing and to establish the effective way to motivate consultants in the sharing process.

This chapter begins with a discussion of transfer of tacit knowledge. The discussion will then lead to an analysis of a tacit-to-tacit knowledge sharing model as proposed by the researcher. The research design and findings will also be explained, followed by a suggestion for future research. For the purpose of this chapter, the phrases 'tacit-to-tacit knowledge' and 'tacit knowledge sharing' will be used interchangeably.

TACIT-TO-TACIT KNOWLEDGE SHARING

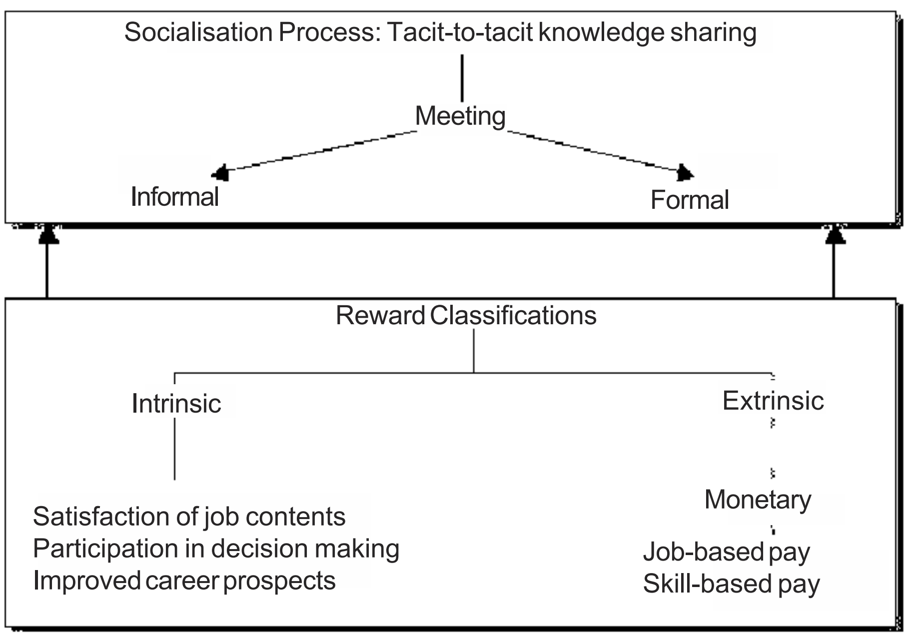
Tacit-To-Tacit Knowledge Sharing

This study is based on the spiral evolution model developed by Nonaka and Takeuchi (1995) in which the process of tacit-to-tacit knowledge conversion is characterised by the 'socialisation' process. Tacit knowledge is subjective and experience-based knowledge that cannot be expressed in words, sentences, and numbers. It is personal and often context-specific and is hard to formalise and communicate to others (Choo, 1998). It also permeates individuals' personal and work lives. A good example of tacit knowledge is the ability to drive an automobile.

Tacit knowledge includes know-how, crafts, insights and intuitions gained through experience and participation in an activity for an extended period of time (Nonaka, 1994; Nonaka, Takeuchi, 1995). Tacit knowledge also has important cognitive dimensions, such as mental models, beliefs and intuitions. Hence, this type of knowledge is created by using past experience in new contexts.

In a socialisation process, the sharing of tacit-to-tacit knowledge is not conducted through written instructions, but through face-to-face communication such as through a dialogue of a meeting, either formal or informal (VonKortzfleisch, Mergel, 2001). However, according to Probst, Raub, and Romhardt (1999), an adequate reward system needs to be introduced to ensure knowledge sharing or exchange between consultants.

Figure 1: The Tacit-to-Tacit Knowledge Sharing Model



Nonaka, Takeuchi, 1995 and VonKortzfleisch, Mergel, 2001

A study of 'exchange' as part of economic transaction argues that a person has different ways of action to get the best value at the lowest cost from any completed transaction (Hall, 2001b). For example, consultants evaluate what can be acquired in the event of sharing knowledge among them, because their time and energy are valued highly to involve in that type of interaction. The exchange theory (Molm, 2001), which comprises actors (e.g., consultants), resources (e.g., reward), and processes (e.g., tacit-to-tacit knowledge sharing) support the framework of tacit knowledge sharing.

The tacit-to-tacit knowledge sharing model used in this study is based on Nonaka and Takeuchi (1995) and VonKortzfleisch and Mergel (2001). The model is illustrated in Figure 1.

Reward Systems

Without compensation and benefits, people are often reluctant to share their valuable knowledge and expertise. Huseman and Goodman (1999) have indicated several reasons as to why people, in this case consultants, may be reluctant to share their knowledge:

- they are often afraid that other people will take the credit for the knowledge;
- they may be afraid of losing the power asserted by their tacit knowledge, which may later be documented and available to all;
- they may belong to an organisation that supports individualism and competition; or
- they may be afraid the 'wrong' knowledge is transferred and will harm others.

Thus far, sharing knowledge may be considered a peripheral process and something that people do after office hours. However, knowledge sharing can be treated more formally when compensation and benefit plans are provided (Davenport, Prusak, 1997). The knowledge sharers realise that their time and energy that are taken to share knowledge must be exchanged with valuable return (Cohen, 1998) so as to eliminate and/or hinder 'free riders' (Dyer, Nobeoka, 2000). In other words, people who are willing to share their knowledge would withdraw from sharing knowledge activity if there is no or lack of compensation and benefit. They are less likely to give up their scarce resources (e.g., consultants' time and energy to share knowledge) for free.

It is then argued that the best way to motivate consultants to share their knowledge is to reward them (Wah, 1999). The reward should be based on effective measurements (i.e., employees' level of motivation and performance in knowledge sharing activity) in which consultants that engage in the knowledge sharing activity will be measured (Robbins, Barnwell, 1994). For example, consultants are more motivated to share their knowledge by either verbal, written or practical methods when they understand that appropriate rewards are provided as compensation.

A reward is defined as a situational condition which can motivate employees in a company to perform certain tasks with the expectation of receiving something in return (VonKortzfleisch, Mergel, 2001). In this case, the situational condition refers to sharing of knowledge between consultants (Hall, 2001a). The rewards can take many forms, such as: monetary, recognition, time off, work selection, empowerment, promotion, and development. Reward triggers motivation, that is, the readiness to behave in a particular way. In particular, it stimulates individuals to act according to organisational objectives (Hackman, Oldham, 1980).

Rewards can be either extrinsic or intrinsic (Deci, 1971; Lepper, Greene, 1978). Extrinsic rewards are material rewards, such as monetary remuneration, that are measured by job- and/or skills-based indicators. The higher the level of skill, the higher the monetary remuneration. For example, in management consulting firms, partners have higher remuneration packages than consultants because partners attract new clients while consultants do the work to resolve the clients' problems. The knowledge required to attract new customers is regarded as superior.

Intrinsic motivators are non-material rewards, such as job satisfaction, participation in decision making processes, and improved career prospects (VonKortzfleisch, Mergel, 2001). Hall (2001a) refers these as 'soft' rewards that offers certain recognition from peers in the event of sharing effective knowledge. The shared knowledge that is significant to the growth of a firm will enhance the reputation of sharers amongst their peers. For example, in management consulting firms, non-material or soft rewards may be: being included in planning committees, being offered professional development opportunities, being recognized through enhanced reputation, or more flexible working hours.

THE RESEARCH

This section will explain the research method and design adopted and report the findings of the impact of reward systems on the knowledge sharing process in formal and informal meetings. The impact of intrinsic and extrinsic rewards on knowledge sharing process will also be discussed. The discussion will then follow on to a suggestion for future research.

For the purpose of this research, a case study approach was selected, as it enables an investigation of a phenomenon in its natural setting (Yin, 1989). In this case, the setting was a consulting firm where knowledge sharing between managements was observed. The most appropriate method to motivate consultants in the sharing processes was also investigated. Interviews were conducted by using semi-structured questionnaires to provide the interviewees with 'freedom' to respond to the questionnaires (Gorman, Clayton, 1997), thereby, achieving more rigorous results.

Previous researches by Hargadon (1998) and VonKortzfleisch and Mergel (2001) found that reward systems play an important role in the knowledge-driven industry with regard to knowledge sharing and reuse. Furthermore, knowledge sharing processes take place when new tacit knowledge is created through shared experiences (Nonaka, Toyama, Konno, 2000). This research examined the process of sharing tacit knowledge and how the reward systems support that process.

The interviews took place during 2001 and were conducted over six months, due to the availability of consultants who were extremely busy with their client commitments. The researcher interviewed 1 partner and 6 directors from seven international management consulting firms. These consultants were global players who have had consulting experience worldwide (i.e., in South East Asia, Australia, and the U.S.) and who have been working in the industry between 10 and 20 years. The interviewees have been employed by their current firms from three to 20 years. The interviews were transcribed from tape recorders and Nud*ist software was used to assist in the analysis of the transcriptions. Each interview took 45 to 60 minutes and was held in a meeting room, a lobby, or a café.

The questionnaires were developed with the objectives of gaining insights into the knowledge conversion process during socialisation. Data were then gathered to examine to the following propositions:

- *Proposition one*: Informal meetings encourage consultants to transfer tacit knowledge.
- *Proposition two*: Reward systems motivate consultants to share their tacit knowledge.
- *Proposition three*: Intrinsic rewards motivate consultants to share tacit knowledge more effectively than extrinsic rewards.

Proposition One: Informal Meetings Encourage Consultants to Transfer Tacit Knowledge

The study found that all interviewees agreed that knowledge sharing is more likely to occur in informal meetings, rather than in formal meetings. Formal meetings within the consulting firms generally involved a discussion of new opportunities, allocation of consultants to projects, updates on on-going projects, and addressing problems. Evidently, they did not deliberately support the sharing of new tacit knowledge. Typically, the agenda of a formal meeting would require an experienced consultant to provide information, such as how a successful project was conducted, but the agenda did not actually involve a discussion or the participation of attendees of the meeting.

In an informal meeting, however, consultants were able to discuss an issue without pressure to adhere to the agenda of meeting. The uptake of knowledge could occur immediately as consultants could communicate directly with each other. This created an informal network that assisted consultants to do their job more effectively. For example, if a consultant is assigned to do a project without the appropriate experience, the person can then contact a colleague informally to obtain any information related to a previously similar project. If a colleague is unable to assist, he/she could then direct him/her to the appropriate person to discuss the project with who would be immediately available. This process then encourages further informal meetings so that any important information for the project can be obtained. This example implies an informal network that is critical for consultants.

To summarise, all interviewees agreed to the proposition questioned that informal networks were significant and allowed for the sharing of new tacit knowledge with others in their consulting firms. Formal meetings were regarded as being only partially successful for sharing tacit knowledge.

Proposition Two: Reward Systems Motivate Consultants to Share Their Tacit Knowledge

The study also found that there were no reward systems specifically designed to encourage the transfer of new tacit knowledge. Interviewees indicated that performance evaluations were conducted once or twice per year to assess the consultants' skills and performance in terms of the number of hours they spent on a particular project, but not in terms of their willingness to share their tacit knowledge.

The study also revealed, however, that professional development sessions were often held to share their knowledge. Consultants were provided with monetary remuneration to attend these sessions to help provide information related to the firm's objectives and the staff self-development. A 'standard' measurement, such as a competency-based appraisal, was used to measure each consultant's improvement in terms of their knowledge, skills, and attitudes to sharing that knowledge. The appraisal was conducted once or twice a year in each firm investigated.

In this type of appraisal, consultants were assessed in respect of their knowledge, skills, and attitudes to sharing their knowledge and how they apply these attributes to their jobs. The purpose of this measurement was to rate the consultants' capabilities in achieving the highest personal and professional growth within the firm. The evaluation would help the consultants to improve his/her capabilities to deliver their work in a more effective manner.

A positive attitude to self-development via knowledge sharing between consultants would help shape the organisation's culture, policy and common value, which over time will positively affect the behaviour of consultants. This behaviour eventually would shape the 'mental model' of consultants. A mental model is the consultants' perception of the environment which could guide them to achieve their objectives. A positive mental model would assist them to perform their jobs professionally and, also, to resolve clients' problems effectively.

With respect to reward systems, 85% of the interviewees agreed that rewards motivate them to share their knowledge because they believed that they need to be rewarded for contributing their 'valuable' experience. Those who disagreed thought that knowledge sharing would create disharmony within the firm as shown previously in the 'reward systems' section above.

Proposition Three: Intrinsic Rewards Motivate Consultants to Share Tacit Knowledge More Effectively Than Extrinsic Rewards

All interviewees agreed that intrinsic rewards, such as satisfaction with job content, participation in decision making process, and improved career prospects, encouraged them to share their knowledge with other consultants. The intrinsic rewards give them the sense or feeling of being more respected and satisfied when they were awarded for their achievement and acknowledged by peers nationally and internationally. Such respect and acknowledgment increased self-confidence and improved professional growth.

Often, consultants who participated in decision-making processes were treated respectfully within the firm. Such treatment encouraged personal growth and supported the transfer of tacit knowledge to other consultants. Most interviewees appreciated being invited to share their opinions in a decision-making process, as it created a sense of being valued by the firm. All interviewees responded that a promise of better career prospects, as part of an intrinsic reward system, increased their willingness to share knowledge with others because it removed the fear that others would take the credit for the knowledge.

DISCUSSION

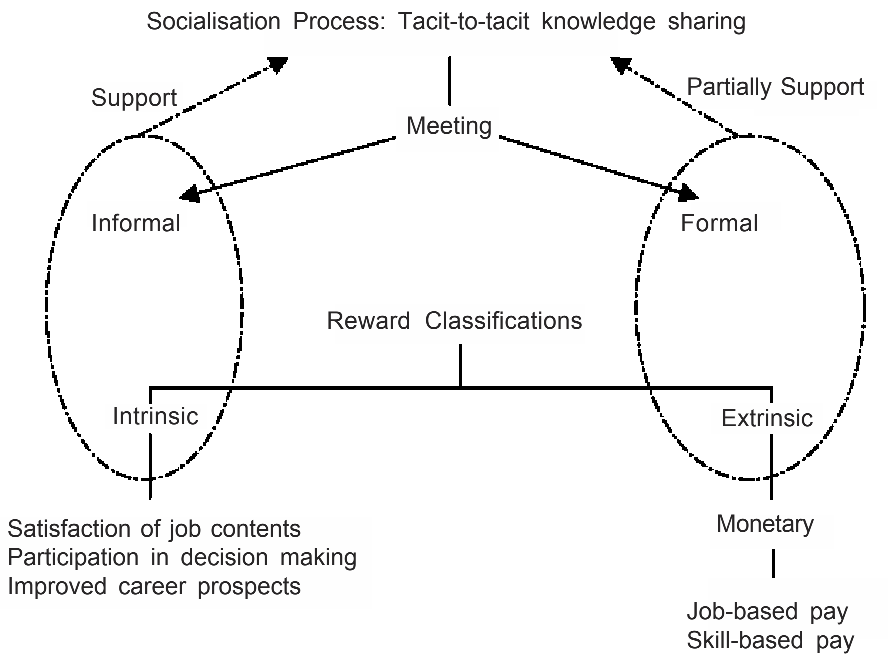
The result of the study also enabled the researcher to improve the model (illustrated in Figure 1) as shown in Figure 2.

The study found that informal meetings (i.e., the dotted lines on the left hand side) are significant in facilitating the knowledge sharing process. Consultants are more comfortable to share their tacit knowledge in an informal environment, as they felt that it was easier to engage with the sharer by asking further questions. This was seen to encourage self-determination and ability of consultants to perform well.

On the other hand, a formal meeting (i.e., the dotted lines on the right hand side) hinders knowledge sharing between consultants, because too often the more experienced consultants do not actually convey sufficient information and allow enough time for discussion with other colleagues. This type of environment inhibits the transfer of tacit knowledge among consultants, which later can have a negative impact on the competitive capacity of the firm.

Another finding from the study also uncovered that management consulting firms under investigation do not use reward systems to encourage the transfer of tacit knowledge among consultants. Moreover, the performance evaluations conducted annually and twice a year were not designed to measure tacit knowledge sharing among consultants. The consultants' performances, however, were more likely to be measured by the number of hours they spent on a particular project, but not in terms of their willingness to share their tacit knowledge.

Figure 2: The New Tacit-to-Tacit Knowledge Sharing Model



Consultants were more attracted by monetary, rather than non-monetary, remuneration to attend professional development sessions. These sessions were designed to assist consultants in sharing their tacit knowledge. As part of the development sessions, firms used competency-based models to measure consultants' improvement in knowledge, skills, and attitudes to sharing tacit knowledge. These models allow consultants to demonstrate their professional improvement by answering well-designed, standardised questions.

Given the choice of receiving intrinsic or extrinsic rewards, consultants were in favour of receiving the former. They highly regarded the feeling of satisfaction by being recognised for an award, as well as having an enhanced reputation by peers. The public recognition of an award achievement and enhanced reputation encouraged consultants to share their tacit knowledge. Being invited to participate in any decision-making process also motivated consultants to share knowledge and, hence, created a sense of belonging to the firm and also increased their self-confidence and willingness to perform their jobs effectively. Being promised better career prospects could remove the feeling of fear that others might take the credit for the shared knowledge. Consultants felt more appreciated as professionals when they can clearly understand their career paths.

CONCLUSION AND FUTURE RESEARCH

This study found that reward systems motivated consultants to share their tacit knowledge with others in a firm. Informal meetings were regarded as highly significant in the socialisation process for sharing tacit knowledge through shared experiences. To encourage effective knowledge sharing, consultants prefer to receive intrinsic rewards, which include appreciation and respect from others, rather than the extrinsic rewards.

During the investigation, an antecedent, i.e., infrastructure, emerged to become a significant variable in the knowledge-sharing process. It seemed to indicate a new method to share knowledge in management consulting firms. For example, an infrastructure might be a framework for doing a consulting job effectively from the beginning to the end. The framework was used to ensure that consultants learned new knowledge and share the knowledge amongst themselves. In other words, a framework resembled a 'path' that a consultant should follow in completing a task on a project in the consulting practice. Its main purpose was to force consultants to change their behaviour (i.e., to share tacit knowledge) during a project implementation. To change one's behaviour by sharing his/her knowledge that was gained through hard work, without proper rewards, was considered a critical challenge.

The participants believed that this infrastructure would have been more successful in addition to the reward systems. This is a challenge for any consulting firm, because they need to determine whether a proper infrastructure would encourage consultants to share their tacit knowledge of one's own free will. Further research that investigates as to whether a more significant infrastructure, together with non-material rewards, will be most effective in encouraging and motivating consultants to share tacit knowledge would enrich the existing body of knowledge in the area.

REFERENCES

Apostolou, D., & Mentzas, G. (1999). Managing corporate knowledge: A comparative analysis of experience in consulting firms (Part 1). *Knowledge and Process Management*, *6*(3), pp. 128-138.

Chaudhry, A. S., & Ng, S. (2001, May). *Knowledge Management In The Corporate Sector: A Study of Knowledge Sharing Practices in a Multinational Company*. Paper presented at the Managing Information Technology in a Global Environment, Canada, 20-23.

Choo, C. W. (1998). *The Knowing Organization: How organizations use Information to Construct Meaning, Create Knowledge, and Make Decisions*. New York: Oxford University Press.

Cohen, D. (1998). Toward a knowledge context: Report on the first annual U.C. Berkeley forum on knowledge and the firm. *California Management Review*, *40*(3), pp. 22-39.

Davenport, T. H., & Prusak, L. (1997). *Information Ecology: Mastering the Information and Knowledge Environment*. New York: Oxford University Press.

Deci, E. L. (1971). The effect of externally medicated rewards on intrinsic motivation. *Journal of Personality and Social Psychology, 18*(2), pp. 105-115.

Drucker, P. (1993). *Post-Capitalist Society*. New York: Harper Business.

Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. *Strategic Management Journal, 21*(3), pp. 345-367.

Gorman, G. R., & Clayton, P. (1997). *Qualitative Research for the Information Professional: A practical handbook*. London: Library Association Publishing.

Hackman, J. R., & Oldham, G. R. (1980). *Work Redesign*. Massachusetts: Addison-Wesley.

Hall, H. (2001a). Input-friendliness: Motivating knowledge sharing across intranets. *Journal of Information Science, 27*(3), pp. 139-146.

Hall, H. (2001b). Social exchange for knowledge exchange. Paper presented at the Managing Knowledge: Conversations and critiques, 10-11 April, University of Leicester Management Centre, Edinburg.

Huseman, R. C., & Goodman, J. P. (1999). *Leading with Knowledge: The Nature of Competition in the 21st Century*. London, New Delhi: Sage Publishing.

KPMG Consulting. (1999). *Knowledge Management Research Report 2000*. UK: KPMG.

Lepper, M., & Greene, C. N. (Eds.). (1978). *The Hidden Costs of Rewards: New Perspectives on the Psychology of Human Motivation*. New Jersey: L. Erlbaum Associates.

Molm, L. D. (2001). Theories of social exchange and exchange networks. In G. Ritzer & B. Smart (Eds.), *Handbook of Social Theory,* London: Sage, pp. 260-272.

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

Nonaka, I., & Konno, N. (1998). The concept of "Ba": Building a foundation for knowledge creation. *California Management Review, 40*(3), pp. 40-55.

Nonaka, I., & Takeuchi, H. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford University Press.

Nonaka, I., Toyama, R., & Konno, N. (2000). SECI, Ba and leadership: A unified model of dynamic knowledge creation. *Long Range Planning, 33*, pp. 5-34.

Probst, G., Raub, S., & Romhardt, K. (1999). *Managing Knowledge: Building Blocks for Success*. Chicester: Wiley.

Robbins, S. P., & Barnwell, N. (1994). *Organisation Theory in Australia*. New York, London, Sydney: Prentice Hall.

VonKortzfleisch, H. F. O., & Mergel, I. (2001). Getting over "knowledge is power": Incentive systems for knowledge management in business consulting companies. Paper presented at the Managing Information Technology in a Global Environment, Canada.

Wah, L. (1999). Behind the buzz. *Management Review, 88*(4), pp. 16-19+.

Yin, R. K. (1989). *Case Study Research: Design and Methods* (Revised ed.). Beverly Hills, CA: Sage Publications.

Chapter IX

An Exploratory Analysis of Information and Knowledge Management Enablers in Business Contexts

Karen Nelson and Michael Middleton
Queensland University of Technology, Australia

ABSTRACT

This chapter explores the factors limiting organizational information and knowledge management (IKM) through the perceptions of IKM practitioners. The authors propose that a number of organisational factors – which for them are enablers – have the ability to influence IKM project outcomes. It follows that explication of these enablers in an integrated framework could, therefore, be beneficial for practitioners. This chapter itemises 10 candidate enablers identified from a review of the literature and explored in previous research work. The authors discuss the findings of two exploratory surveys, which indicated that all ten enablers were perceived as important to the performance of IKM. However, the amount of management attention required by each enabler appears to be IKM project specific.

INTRODUCTION

Information systems, business professionals and academics have become increasingly fascinated with a seemingly new phenomenon[1], knowledge management. While some authors believe KM to be merely a reinterpretation of information management (IM), and others believe it to be just another management fad[2], independent writers with a business focus, such as Senge (1990), Peters and Waterman (1992) and Drucker (1993), and the IT research organisation – Gartner – have articulated sensible reasons to explain why organisations should embark on knowledge management (KM) projects. The reasons given for these projects are based on a premise that knowledge and the capability to manage it are the most crucial elements in sustaining or improving organisational performance.

Regard for knowledge as a strategic resource is well documented (for example, von Krogh, Roos, Kleine, 1998) and corroborates Nonaka and Takeuchi's 1995 theoretical framework, which as Magalhaes (1998, 101-102) puts it, is based on an understanding that business advantage arises from the ability of an organisation to create new knowledge. Several case studies have been reported that show support for this idea, [for example, the Skandia AFS case (Marchand, 1998) and Nonaka, Umenoto and Sasaki (1998)]. Although the overall number of empirical studies in KM is low, recent quantitative evidence has further substantiated these cases by showing a direct relationship between effective information and knowledge management (IKM) practices and corporate performance (Marchand, Kettinger, Rollins, 2000). Furthermore, well-organised IM and KM are seen to be complementary (Blumentritt, Johnston, 1999; Marchand, 1998) with both required to operate effectively to ensure adequate supply of both "old and new knowledge" (Stephens, 2000).

The purpose of this chapter is to present the results of some exploratory research that aimed to understand which organisational factors IKM practitioners believe are enablers for IK activities. This work is part of a larger research project, which aims to develop a multidimensional integrated framework for IM and KM, and to test the application of this framework within business contexts.

BACKGROUND

Integrated Information and Knowledge Processes

The relationship between data, information and knowledge existing at various points along a continuum (leading to wisdom) has been discussed and debated for some time. Although there is some confusion in the use of these terms, most authors agree that knowledge is the ultimate result of the capture of raw facts (data), applying specific context and purpose to it to produce information, and finally applying one's own terms of reference to produce knowledge within the minds of individuals. Tuomi (1999) challenges this view, and proposes that knowledge comes first and is used to create data. His view is that individual knowledge is represented in the design of databases and, as such, information is derived from the data contained within these repositories.

Some authors find that making a distinction between the three information stages is unwarranted and does not provide any benefit. Others, although they agree that making a distinction is largely unnecessary, create boundaries for their work in a specific area by providing definitions. Still others (including the authors of this paper) believe that effective IM and KM activities rely on a sound understanding of these stages and what they mean. We have, therefore, adopted definitions from Marchand (1998) for this paper:

- Data are context free and can always be shared because the receiver cannot or does not interpret them (e-mail is data to those who do not share the context for its interpretation).
- Information includes all documents and verbal messages that make sense or can be interpreted by organisational members and is never context or value-free. Information always encompasses an act of transfer or sharing among people and involves interpreting representations of our own or others knowledge and is context specific for use and application.
- Knowledge is always personal – it resides inside peoples' heads. Knowing means not only to understand or believe, but also to use or apply that knowledge. In an organisational context, knowledge conversion processes depend on human-to-human or human-to-technology interactions (Nonaka, Takeuchi, 1995). Knowledge use emphasizes personal interpretation and understanding and is context specific for expressing beliefs and commitments.

According to Marchand (1998), knowledge is converted to information for communication and transfer, which means the two are inextricably linked in a complementary and co-dependent relationship. Therefore, in practice, it is not enough to talk about KM as an isolated construct, but that effective management of knowledge should be based on sound information management *and* knowledge management processes, as well as addressing elements of the information environment, such as culture, behaviour, information politics and technology. Therefore, information management focuses on the acquisition, capture, sharing and use of essentially tangible information, while knowledge management focuses on the creation and identification of intangible information so it can be shared with others, or for conversion to tangible information. The approach used for managing knowledge in organisations reflects a focus on either sharing or conversion, and these approaches are known respectively as personalisation or codification strategies (Hansen, Nohria, Tierney, 1999; Davenport, Grover, 2001).

Issues, Controversies, Problems

Information, knowledge and their application within organisational or enterprise contexts are the subject of a large (and ever-increasing) number of publications

(Davenport, Prusak 1998; Dixon 2000; Housel, Bell, 2001; Marchand, Kettinger, Rollins, 2001). A recurring theme is that a number of "factors" are critical for successful implementation of IM and KM initiatives. A review of literature in both the IM and KM areas revealed the range of elements that are regarded by academics and practitioners as constituent parts (our candidate enablers) of IM and KM frameworks[3]. These candidate enablers often include, but are not limited to: information and information technology architectures (McGee, Prusak, 1993), individual behaviours (Bonner, Casey, Greenwood et al., 1998) organisational culture, policy and strategy and information politics (Davenport, Eccles, Prusak, 1992; Davenport, 1997; Norton, 1994; Orna, 1999; Strassman, 1995), people management (including roles and responsibilities) (Ichijo, von Krogh, Nonaka, 1998; Broadbent, 1997; Standards Australia, 1999), and processes (Marchand, Kettinger, Rollins 2000). Some authors have addressed various groupings of enablers because it is believed to be "unlikely that the adoption of new titles, procedures or technology alone will produce sustainable competitive advantage" (Nonaka, Umenoto, Sasaki, 1998). Davenport (1997) presented a holistic view of organisational information environments in his model of an information ecology, which incorporated many, but not all, of the enablers mentioned above.

Table 1: Candidate IM and KM Enablers from the Literature

Candidate IM & KM Enabler (& Code)	Scope	Examples of Reference to Enabler in Literature
Information Architecture (IA)	Elements that define what information the organisation has, what it needs to achieve its goals, and what should be done with information and / or knowledge. (Tools include: information maps, directories, yellow pages, etc.)	McGee and Prusak, 1993; Orna 1999; Davenport 1997
Information Behaviour (IB)	How individuals behave and are encouraged to behave in respect to information, for example how information sharing, exchange, use and communication occurs between individuals.	Davenport 1997; Bonner Casey and Greenwood et al., 1998; Orna 1999
Organisational Culture (OC)	How "the way things are done" affects IM and KM.	Brooking 1999, 112; Bertels and Savage 1998; Davenport 1997; Ichijo, von Krogh and Nonaka 1998; Orna 1999; Standards Australia 2000; Norton 1994
IM Processes (IMP)	Activities focused on managing tangible information.	Orna 1999; Marchand et al. 2000; Davenport 1997; Standards Australia 2000
IT Practices (ITP)	Management of IT to support IM and KM.	Marchand et al. 2000; Brooking 1999; Orna 1999; Standards Australia 2000
KM Processes (KMP)	Activities focused on the capture and sharing of knowledge held within the minds of individuals.	Marchand et al. 2000; Standards Australia 2000; Ichijo, von Krogh and Nonaka 1998
People Management (PM)	Interventions to create environments that enable and encourage people to create, share and use knowledge, for example dynamic teams, role rotation, reward and recognition programs, training and education.	Broadbent 1997; Brooking 1999; Ichijo, von Krogh and Nonaka 1998; Standards Australia 2000
Information Policy and Strategy (IP&S)	High-level formal statements that explicitly assert the organisation's intent for information and or knowledge and provide guidance about the overall approach to information and or knowledge.	Strassman 1995; Davenport 1997; Orna 1999; Standards Australia 2000
Information Politics (IP)	Organisational activities and behaviours specifically related to the power information instills and how these are managed to ensure effective information and knowledge use.	Marchand et al. 2000; Strassman 1995; Davenport, Eccles and Prusak 1992, Davenport 1994, 1997
Organisational Structures (OS)	Formal roles, responsibilities and authority for IM and KM.	Bertels and Savage 1998; Blacker, Crump and McDonald 1998; Ichijo, von Krogh and Nonaka 1998; Davenport 1997; Orna 1999

These candidate enablers, each with a scope statement and examples of the sources in which they were identified, are provided in Table 1. The scope statements in this table derived to set boundaries for the purpose of defining the categories in the practitioner surveys. These statements are not intended to limit the interaction and co-dependencies that may exist between many of the enablers.

Ideally, each key enabler in an information environment would be designed and operate optimally to facilitate effective IKM, but this aim is difficult and impractical to achieve. Not only do these enablers constitute a substantial portion of the fabric of organisations but, also, the ubiquitous nature of IK means that their management need permeates all business processes. This ideal position is further complicated by potential co-dependencies between the enablers (for example, strategy, politics, organisational structure and people management) and the need to manage resistance to change when attempting to transform enablers, such as culture and behaviour. Yet, the need to address some of these enablers seems inherent in any IKM initiative.

Solutions and Recommendations

Firstly, an understanding of the emphasis IKM practitioners place on each of the candidate enablers would assist refinement of a proposed IKM framework. Secondly, a comparison of management attention required for these enablers and the situation in a sample of organisations would be informative regarding awareness and progress towards the ideal situation described above.

Two exploratory surveys were used in this study to explore practitioners' perceptions of the candidate IKM enablers. Both surveys required qualitative and quantitative responses and were pre-tested, piloted and administered by e-mail to a group of individuals unknown to the authors, but who were members of an active KM forum.

Survey 1 consisted of nine questions. Questions 1-7 requested qualitative information such as occupation, professional affiliation, employer type, and some demographics (age and gender). Question 8 contained a series of 50 principle statements, which the respondents were asked to rate on a 5-point Likert scale to indicate their perceived importance to IKM. The 50 items were made up of five descriptive statements for each enabler. These statements were derived from the literature and were seen as adequately describing each enabler in the pre-test and pilot stages. The participants were not aware of the list of candidate enablers at this stage and, as such, the links between the statements and enablers were not made visible in the survey. In addition, the five statements for each enabler were distributed throughout the question. Question 9 invited respondents to include additional principles that they thought were important and had not been addressed in Question 8.

Survey 2 consisted of seven questions. Question 1 presented the list of ten candidate enablers (accompanied by scope statements) and required respondents to indicate their significance to IM and KM effectiveness (using a 7-point Likert scale).

Question 2 asked respondents to rank the relative importance of the enablers from 10 (most important) to 1 (least important), while Question 3 requested additional enablers. In Question 4, the set of 50 principles used in Survey 1 was reused and this time respondents were asked to indicate (again, using a 7-point Likert scale) how well the statement reflected the situation in their organisation. Questions 5 and 6 focused on position titles and organisational size, while Question 7 asked for descriptions of IM and KM projects.

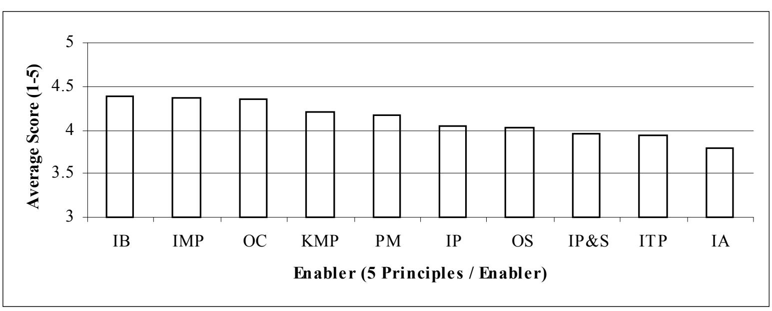
These exploratory surveys did not attempt to derive factor interrelationships. Rather, questions were associated with the perceptions of specific enablers. Copies of the survey forms are available from the authors.

Survey 1 Results

There were six respondents in the pilot group (100% response rate) and 20 respondents in the sample group (21% response rate), which was a low response rate, but, for the purposes of this exploratory work, we felt adequate. The pilot and sample group were assessed separately and as no differences were found, the results were pooled (26% response). The ten most important principles, their average score (out of five) and the enabler that they represent are listed below.

- Sharing information (4.77) - IB.
- Identifying the information needed to meet business objectives (4.73) - IMP.
- Demonstrating appropriate information behaviours at senior levels (4.69) - IB.
- Making key business information accessible throughout the enterprise (4.65) - IP.
- Open communication between people (4.58) - OC.
- A strong affinity between the espoused and experienced culture (4.58) - OC.
- Meeting the information needs of core processes (4.54) - IMP.
- Capturing learning from past experiences (4.50) - KM.

Figure 1: Enabler Importance by Principle Statement



- Investing in employee training, skill enhancement or education (4.50) - PM.
- Making decisions that support the firm's mission or goals / Encouraging collaboration between IT, content and HR managers (4.46) – OC/OS.

The data collected about the importance of principles allowed us to extrapolate the enabler rankings from this initial survey. The values in this figure were calculated by averaging all the statement scores for each of the enablers. Figure 1 illustrates that the aggregated average for all enablers was over 3.5 on the 5-point scale used, with the scores ranging from 4.39 for information behaviour to 3.79 for information architecture.

Survey 2 Findings

The second survey was pre-tested for accuracy and then piloted with the survey one pilot group before being distributed to the 21 respondents from the previous survey. Fifteen responses were obtained (71% response rate).

Figure 2: Ranking of IM and KM Enablers

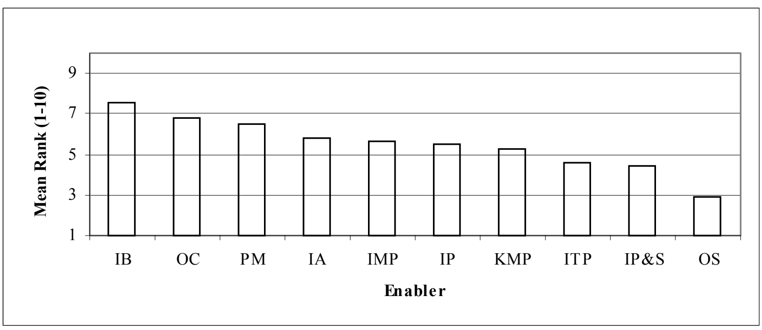
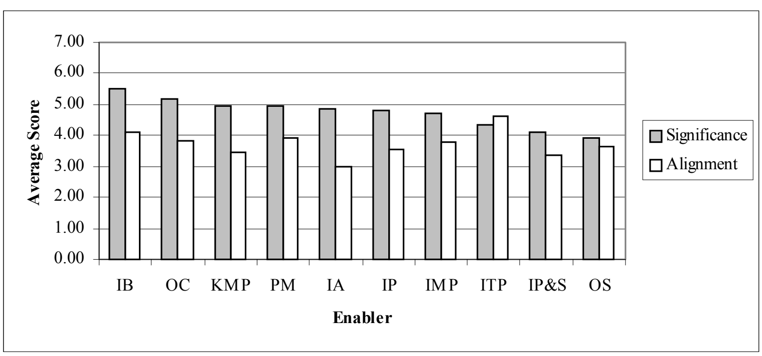


Figure 3: Comparison of Enabler Significance and Organisational "State of Practice"



The importance ranking of the enablers is shown in Figure 2. The most highly ranked enablers were information behaviour, organisational culture and people management. The least highly ranked enablers were information technology practices, information policy and strategy, and organisational structure.

Two sets of data are shown in Figure 3, significance and organisational alignment. Firstly, the respondents saw that nine of the 10 enablers were seen as significant to the ultimate success of IKM, and that these organisational aspects required some type of planned attention to ensure IKM initiative success. It was only seen necessary to pay attention to organisational structures when problems arose. Secondly, Figure 3 shows the degree of alignment between the IM and KM enablers and the actual situation in the sample group of organisations. Alignment was assessed using a seven-point Likert scale where a seven meant that the principle statement was highly aligned with the organisation's circumstances and one indicated no alignment between the organisation and the statement. Responses from 14 organisations were used to provide the alignment score for each enabler (no data was received from one organisation for this question). For the organisations surveyed, an average score of close to five indicates good alignment with the enabler, while scores nearer to three indicate some degree of alignment between the organisation and the enabler.

Figure 3 allows a visual comparison between (1) the significance of each enabler and (2) the organisational "state of practice" for that enabler.

DISCUSSION

The results of Survey 1 indicated that practitioners recognised the relevance of 50 principles seen to be important to IKM. The data, when aggregated for each enabler, shows a ranking of enablers from most to least important in terms of IKM; however, the small number of responses precludes any statistical inference. Another limitation of this first survey is that the statements used to gauge the importance of each enabler were derived from the literature and, as such, were contrived to correspond to a single candidate enabler. Despite these limitations, we believe this data indicates that all ten candidate enablers were seen as important for the facilitation of sound IKM, and this initial exploratory assessment provided us with a foundation on which to base further research activities.

Although the response rate for survey two was quite high (71%), the sample size once again prohibits statistical data analysis. However, the main purpose of Survey 2, which was to inform the researchers prior to embarking on interview and case study processes, was achieved. Although the order of enablers in Figure 1 (importance of enabler by principle), Figure 2 (ranking of enablers), and Figure 3 (significance of enablers) differs, the data does indicate that all ten enablers are seen as having an important role to play in the overall performance of organisational IKM activities. Furthermore, practitioners were able to distinguish between what is theoretically ideal (Question 8 in Survey 1) and the actual "state of practice" regarding that principle in their organisation (Question 4 in Survey 2). We have shown the alignment data alongside the significance data to indicate the gap between the ideal and actual situations in our sample organisations. Further interpretation of this data could be used to show the fit against an aggregated benchmark for each organisation and enabler. This data could be then used by organisations to focus their IKM strategies. The data also suggest that a large quantitative data collection and analysis may produce some significant differences between theory and practice in this area.

FUTURE TRENDS AND CONCLUSION

This exploratory analysis of IKM frameworks in business contexts has provided answers to the two issues questions posed. The data from the two exploratory surveys confirmed that participants saw ten organisational factors as having a role in enabling information and knowledge management activities. The surveys also indicated that there are gaps between the significance of IKM enablers and the actual situation in our sample of Australian organisations. The true value in these findings lies in the opinions, understandings and experiences of the IKM practitioners underpinning the quantitative data. So, the quantitative data proved useful to inform the authors before engaging the respondents to the second survey in an interview and case study process.

As expected, this study raises a number of further challenges that we will be pursuing. Firstly, a clear distinction between the processes required to manage information and knowledge is needed. Secondly, we need to gather more data to confirm the integrated framework and its component enablers. Thirdly, we will elaborate on the characteristics of the candidate enablers. Fourthly, we will describe the impact of each key enabler on IKM initiatives after organisational assessment in further case studies. Finally, (for now) we plan to describe the role of each enabler within IKM.

The overall goal of this on-going research is to provide practical guidelines to assist organisations to optimize their environments so that the outcomes of IKM projects are beneficial to them. This exploratory study has provided the foundation to achieve this goal.

REFERENCES

Bertels, T., & Savage, C. (1998). Tough questions on knowledge management. In *Knowing in Firms: Understanding, Managing and Measuring Knowledge*, G. von Krogh, J. Ross & D. Kleine (Eds.) London: Sage, pp. 7-25.

Blacker, F., Crump, N., & McDonald, S. (1998). Knowledge, organisations and competition. In *Knowing in Firms: Understanding, Managing and Measuring Knowledge,* G. von Krogh, J. Ross & D. Kleine (Eds) London: Sage, pp. 67-86.

Blumentritt, R., & Johnston, R. (1999). Towards a strategy for knowledge management. *Technology Analysis and Strategic Management, 11*(3), pp. 287-300.

Bonner, M., Casey, M-E., Greenwood, J., Johnstone, D., Keane D., & Huff, S. (1998). Information behaviour - A preliminary investigation. *Proceedings of IRMA 1998, Effective Utilisation and Management of Emergent Technologies,* Medhi Khosrow-Pour (Ed.), Boston, MA: Idea Group Publishing, pp. 68-79.

Broadbent, M. (1997). The emerging phenomenon of information management. *Newsletter of the Arts Libraries Society of Australia and New Zealand,* 45, pp. 16-32.

Brooking, A. (1999). *Corporate Memory: Strategies for Knowledge Management*. London: Thomson International Business Press.

Davenport, T., & Prusak, L. (1998). *Working Knowledge: How Organisations Manage What They Know*. Boston: Harvard Business School Press.

Davenport, T. H. (1997). *Information Ecology: Mastering the Information and Knowledge Environment.* New York: Oxford University Press.

Davenport, T. H., Eccles, R.G. & Prusak, L. (1992). Information politics. *Sloan Management Review, 34*(1), pp. 53-65.

Davenport, T. H., & Grover, V (2001). General perspectives on knowledge management: Fostering a research agenda. *Journal of Management Information Systems, 18*(1), pp. 5-21.

Dixon, N. (2000). *Common Knowledge: How Companies Thrive by Sharing What They Know,* Boston: Harvard Business School Press.

Drucker, P. (1993). *Post Capitalist Society*. Oxford: Butterworth-Heinemann.

Hansen, M., Nohria, N., & Tierney, T. (1999). What's your strategy for managing knowledge. *Harvard Business Review ,77*(2), pp. 106-116.

Housel, T. & Bell, A. (2001). *Measuring and Managing Knowledge*. Boston: McGraw-Hill.

Ichijo, K., von Krogh, G., & Nonaka, I. (1998). Knowledge enablers. In *Knowing in Firms: Understanding, Managing and Measuring Knowledge,* G. von Krogh, J. Ross & D. Kleine (Eds.). London: Sage, pp. 173-203.

Marchand, D. (1998). Competing with intellectual capital. *Knowing in Firms: Understanding, Managing and Measuring Knowledge.* G. von Krogh, J. Ross & D. Kleine (Eds.). London: Sage, pp. 253-268.

Marchand, D., Kettinger, W., & Rollins, J. (2000). Information orientation: People, technology and the bottom line. *Sloan Management Review, 41*(4), pp. 69-81.

Marchand, D., Kettinger, W., & Rollins, J. (2001). *Information Orientation: The Link to Business Performance*. Oxford: Oxford University Press.

Magalhaes, R. (1998). Organisational knowledge and learning. In *Knowing in Firms: Understanding, Managing, and Measuring Knowledge*. G. von Krogh, D. Kleine & M. Venzin (Eds.), London: Sage, pp. 87-122.

McGee, J. & Prusak, L. (1993). *Managing Information Strategically,* New York: John Wiley & Sons.

Nonaka, I. & Takeuchi, H. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. London: Oxford University Press.

Nonaka, I., Umenoto, K., & Sasaki, K. (1998). Three tales of knowledge-creating companies. In *Knowing in Firms: Understanding, Managing and Measuring Knowledge*. G. von Krogh, J. Ross & D. Kleine (Eds.), London: Sage, pp. 146-172.

Norton, R. (1994). Organizational cultures and their relevance to the information organization. *ASLIB Proceedings, 46*(4), pp. 173-176.

Orna, E. (1999). *Practical Information Policies*, 2nd ed., Aldershot, Gower.

Peters, T., & Waterman, R. (1992). *In Search of Excellence: Lessons from America's Best Run Companies,* New York: Warner Books.

Polanyi, M. (1966). *The Tacit Dimension*. New York: Doubleday.

Senge, P. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organisation,* Milsoms Point, NSW: Random House Australia.

Standards Australia. (1999). National knowledge management framework - Preliminary draft, Sydney: Standards Australia International Ltd.

Stephens, D. (2000). Knowledge management in the Australian Public Service: A stocktake and a prospectus. *IPAA Conference 'Five + years of reform'*, Canberra.

Strassman, P. (1995). *The Politics of Information Management: Policy Guidelines*, New Canaan, CT: The Information Economics Press.

Tuomi, I. (1999). Data is more than knowledge: Implications of the reversed knowledge hierarchy for knowledge management and organisational memory. *Journal of Management Information Systems, 16*(3), pp. 103-107.

von Krogh, G., Roos, J., & Kleine, M. (1998). *Knowing in Firms: Understanding, Managing and Measuring Knowledge,* London: Sage.

ENDNOTES

[1] Although this interest does seem relatively recent, philosophical discussions about knowledge and knowing engaged Plato and Aristotle and many scholars since. The potential of untapped knowledge within peoples minds was succinctly stated by Polanyi (1966) who said *"we know more than we can tell,"* thereby emphasizing the current challenge for business.

2 Another view is that the current popularity of KM is largely driven by the commercial imperatives of software vendors and consulting firms.

3 Further discussion about IM and KM framework development is the subject of another paper by Nelson and Middleton (2001) currently under development.

Chapter X

The Value of Trust in Knowledge Sharing

Ran Wang
University of Maryland–Baltimore County, USA

Bonnie Rubenstein-Montano
Georgetown University, USA

ABSTRACT

Knowledge sharing is currently at the forefront of research in the areas of organizational management and electronic business. Research has focused on aspects of knowledge sharing such as trust, quality of knowledge shared, and task complexity. This chapter builds on past inquiries of trust in knowledge sharing by examining how the benefits obtained from knowledge sharing change as trust levels change. A Repeated Measures ANOVA design is used to test the impact of trust on knowledge sharing. Task completion time, the dependent variable, measures the effect of knowledge sharing. Statistical analysis suggests that the benefit obtained from knowledge sharing increases as trust level increases.

INTRODUCTION

Knowledge is not a "thing" that can be "managed." It is a capacity of people and communities, continuously generated and renewed in their conversation, to meet new challenges and opportunities (Grant, 1995). Knowledge comes into being, is shared, given meaning, evaluated, developed, accessed, and applied best by groups of people. Knowledge is of limited value if it is not shared. The ability to integrate and apply the specialized knowledge of organizational members is fundamental to an organization's ability to create and sustain competitive advantage (Grant, 1995). Knowledge sharing involves the integration of explicit, formalized information existent in an organization with the tacit knowledge existent in the minds of individuals in an organization.

Trust is a basic feature of social situations that require cooperation and interdependence (Earley, 1986). It is a key to positive interpersonal relationships in various settings (Lewis, Weight, 1985) because it is central to how individuals interact with others. Thus, trust has a central role in knowledge sharing, which refers to all activities intended to establish, develop, and maintain the exchange of knowledge.

The most significant contributions to the conceptualization and measurement of the trust construct can be found in studies of inter-organizational relationships (Deutsch, 1958). However, because trust is considered so vital, it has been studied extensively in many research disciplines, such as economics (Anderson, Weitz, 1992), social psychology (Schlenker et al., 1973), and political sciences (Van-Lohuizen, 1986). Agreement concerning the positive effects of trust is rising (Kramer, Tyler 1996), and consensus has emerged on how interpersonal trust evolves (Lewicki, Bunker, 1995; Zand, 1972). However, the current literature does not address varying degrees of trust and how they may influence knowledge sharing.

The research reported in this chapter contributes to the knowledge sharing literature by addressing the issue of how changing trust levels impact knowledge sharing. We argue that as trust level increases, the benefits obtained from knowledge sharing increase. While preparing the experiment for this research, the issues of knowledge quality and task complexity were identified as relevant for knowledge sharing (Mayer, 1995). However, in an effort to isolate impacts of trust levels, knowledge quality and task complexity were held constant. The effects of knowledge quality and task complexity on sharing are left for future work. The next section discusses some of the underlying concepts relevant for knowledge sharing and formally presents the research hypotheses. Then, in Section 3 the research design and methodology are described. Section 4 presents our experimental results and findings, and Section 5 draws conclusions and makes suggestions for future research.

UNDERLYING CONCEPTS AND HYPOTHESES

Previous Research on Trust

Previous studies of trust view trust as an individual characteristic, as a characteristic of interpersonal transactions, or as an institutional phenomenon (Lewicki, Bunker, 1995). Each of these approaches has been associated with specific disciplines. Personal psychologists identify trust as an individual characteristic (Rotter, 1971). Social psychologists identify trust as an expectation about the behavior of another in transactions and focus on the contextual factors that enhance or inhibit the development and maintenance of trust (Lewicki, Bunker, 1995). Economists and sociologists have been interested in how institutions and incentives are created to reduce the anxiety and uncertainty, and thus increase trust associated with transactions among relative strangers (Goffman, 1971; Zucker, 1986).

The majority of discussion in the trust literature has focused on the positive influence of trust on organizational performance. Larsson et al. (1998) extend this discussion to the notion of learning by proposing that the commonly understood benefits of trust are particularly important in the creation and exchange of proprietary knowledge. It is trust that enables continuous economic relationships in the theoretical sense (Beamish, Banks, 1987). Kogut (1988) points out that trust reduces transaction costs associated with resources and knowledge exchange by reducing fears of partners' opportunistic behavior. In addition, trust in alliances provides an environment which helps ensure that information exchanged between partners is "accurate, timely and comprehensive" (Inkpen, 1997). Furthermore, by reducing uncertainty, trust can remove the fetters of hierarchical controls that may impede absorptive capacity and ultimately, adaptive capabilities (Aulakh et al., 1996; Gulati, Singh, 1998). The research in this chapter differs from previous work because previous work focused on the positive influence of inter-organizational trust among different organizations, whereas this chapter focuses on the positive influence of inter-personal trust.

Trust Definition

There are a number of definitions of trust in the literature. According to Sitkin and Roth (1993), trust is one party's "belief and expectation about the likelihood of having a desirable action performed by the trustee." Trust is also defined as "a set of expectations shared by all those in an exchange" (Zucker, 1986). Trust is an expectation that alleviates the fear that one's exchange partner will act opportunistically (Bradach, Eccles, 1989). Additionally, trust is a set of expectations that tasks will be reliably accomplished (Sitkin, Roth, 1993).

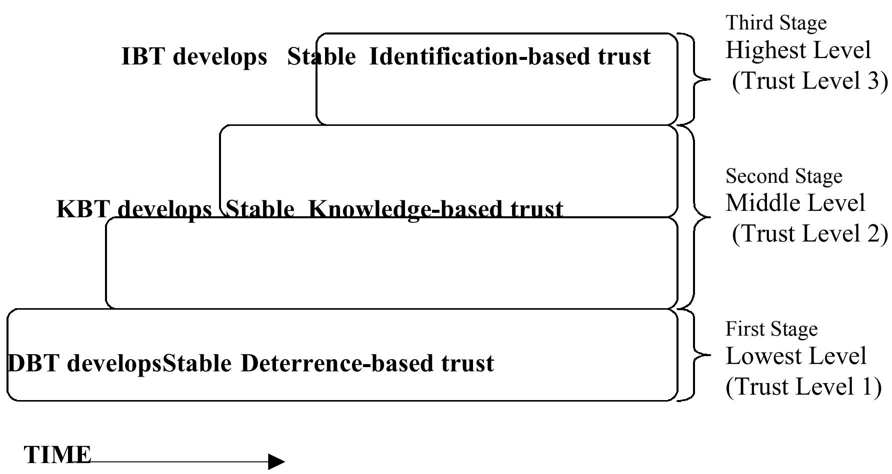
Trust is also defined as a willingness to rely on an exchange partner in whom one has confidence (Moorman et al., 1992). It is consistent with Deutsch's (1962) definition of trust as "actions that increase one's vulnerability to another," which Coleman (1990) suggests might include "voluntarily placing resources at the disposal of another or transferring control over resources to another." This view also suggests that uncertainty is critical to trust, because trust is unnecessary if the trustor can control an exchange partner's actions or has complete knowledge about those actions (Coleman, 1990; Deutsch, 1958).

Lewicki and Bunker (1995) integrated the various definitions of trust by defining trust as: "a state involving confident, positive expectations about another's motives regarding oneself in situations of risk." These expectations may be based on the rewards or punishments that guide behavior, the predictability of another's behavior, or a full internalization of another's intentions and desires. Thus, in integrating the theories, Lewicki and Bunker's categories depend on the source from which expectations arise. In this chapter, the trust definition of Lewicki and Bunker is adopted because it is widely accepted and used in the interpersonal transaction view of trust (Anderson, Weitz, 1992).

Trust Development

The development of trust was first theorized by Lewis and Weight (1985), followed a decade later by Lewicki and Bunker (1995), who present three bases to interpersonal professional trust: deterrence-based trust, knowledge-based trust, and identification-based trust. According to Lewicki and Bunker (1995), trust develops in stages over a period of time, with deterrence-based being the first, with the lowest level of trust, and identification-based as the last stage, with the highest level of trust (Lewicki, Bunker, 1995, 1996, 1998). Further, the development of trust is the same for all types of relationships whether, romantic, manager-employee, or among peers and trading partners engaged in electronic commerce.

Figure 1: Trust Model Developed by Lewicki and Bunker (1995)



The research presented in this chapter adopts the Lewicki and Bunker trust model (Figure 1) to test the influence of trust level on the benefit obtained from knowledge sharing because the model is widely accepted and used in the interpersonal transaction view of trust. According to Lewicki and Bunker (1998), there are three types of trust, where one form of trust leads to another form of trust. First, *deterrence-based trust* is where trading partners (suppliers) do what they say they will do because of a fear of punishment (cancellation of contracts) if they do not perform consistently. Second, *knowledge-based trust* is linked to knowledge of the other trading partner (that is the trustee), which allows the trustor to understand and predict the behavior of the trustee. The key factor at this level of trust is the information derived out of a relationship over time that allows one trading partner to predict the behavior of another trading partner. Third, *identification-based trust* is based on empathy and common values with the other trading partner's desires and intentions to the point that one trading partner is able to act on or as an agent for the other with the evolution of time. Identification-based trust tends to revolve around a common task rather than based on the individual cues from trading partners.

When relationships first occur they are based on deterrence-based trust. They may not move past this form, particularly if the relationship does not necessitate more than "arms-length" transactions, the interdependence is heavily bounded and regulated (e.g., through professional ethics), or violations have occurred that discourage a deepening of the relationship. Lewicki and Bunker (1996) identified the existence of this form of trust when people or trading partners do what they say they would do and trust is built because of consistency in their behaviors. Consistency is sustained by threat of punishment, for example, loss of a relationship that will occur if consistency is not maintained. With deterrence-based trust there is a cost involved when performance fails, such as loss of job, loss of respect and authority, or loss of relationship, and a reward when performance is achieved, such as a promotion, increased respect, or a closer relationship.

Deterrence-based trust works well for professional bodies and associations. Accountants, lawyers, engineers, doctors, etc., are bound by codes of conduct and ethical regulations in order to become and continue to be members of their professional bodies. Should they be found guilty of misconduct, the trust that their clients have in them is violated and their reputation is hurt, not only in the eyes of the clientele, but also in those of their friends and associates. The rules and procedures of the professional bodies determine the severity of the deterrence.

Over time, parties learn more about each other, which, in turn, lead to a new form of relationship termed a knowledge-based trust relationship. Lewicki and Bunker (1996) defined this trust as one where one party (the trustor) understands and predicts the behavior of the other party (the trustee) based on the knowledge about each other's behavior established over a period of time. It is based on a judgment of the probability of the other's likely choice of behavior. For knowledge-based trust to occur, information is needed by one party to understand and accurately predict the likely behavior of the other party. Knowledge-based trust needs predictability to enhance trust, i.e., repeated interactions in multi-dimensional relationships (e.g., wants, preferences, problem solving approaches). A good example of the occurrence of knowledge-based trust can be found in e-commerce interactions where product and service customization takes place to satisfy a customer's desires. The seller and buyer exchange information with each other, for example, to specify the size of a pair of jeans or the layout of a greeting card or a home design, until the buyer's specific wishes have been agreed upon.

More information may lead parties to identify with each other thereby creating identification-based trust. This stage may not be reached if parties lack the time or energy to invest beyond knowledge-based trust or don't have the desire for a closer relationship. Under this form of trust, trading partners establish common desires and intentions based on empathy and common values (Lewicki, Bunker, 1996). There is an emotional connection between them, and one can act as an agent for the other. Identification-based trust is linked with group membership, which results in a collective identity (joint name, logo, title), joint products and goals (a new product line or objective), and/or commonly shared values (Lewicki, Bunker, 1996).

Studies that followed Lewicki and Bunker's trust model later suggested that the first stage (deterrence-based trust) links willingness to trust to the belief that there is a credible threat of punishment for failure to cooperate. The second stage (knowledge-based trust) is when trading partners' dispositions are well known and their behavior can be reliably predicted. The third stage (identification-based trust) occurs when trading partners have taken on the needs and desires of other trading partners as their personal goals and acted in ways to consider joint gains.

Mention of groups is relevant when discussing trust, so they are discussed briefly here. It has been shown that groups work better together in an atmosphere of mutual trust based on mutual commitment and a stable long-term relationship (Anderson, Weitz, 1992; Bartlett, 1995). This type of committed, long-term relationship builds mutual trust, leading to increased communications and the eventual sharing of knowledge (Anderson, Weitz, 1992). Mutual trust is defined as the expectation shared by different groups that they would meet their commitments to each other (Bartlett, 1995). By alleviating the fear of the unexpected and facilitating interactions and involvement, trust encourages a climate conducive to the sharing of knowledge (Giffin, 1967). This chapter thus hypothesizes that trust is a determinant of knowledge sharing.

Trust Measurement

Previous trust research focused on general trust and trust as a social phenomenon (Lewis, Wiegert, 1985). Cook and Wall (1980) described three approaches to measure trust. The three approaches differ by the directness of the measurement. The most indirect approach is to infer trust from other behaviors. A second approach is to create situations where trust is critical for performance, and measure performance. The direct approach to measure trust is through measurement of affective response using self-reports.

Trust has been measured in 12 ways (Butler, 1991; Cook, Wall, 1980; Curral, Judge, 1995; Hart, Saunder, 1997; Gabbaro, 1978; Jennings, 1971; Larzerele, Huston, 1980; McAllister, 1995; Remple et al., 1985; Roberts, O'Riely, 1974; Rotter, 1971; Scott, 1980). The instrument developed by McAllister (1995) was adopted in this chapter together with the direct approach to measure trust because it enables one to identify varying levels of trust and their influence on task completion time and is easier to evaluate. McAllister (1995) developed a scale that measures levels of trust, specifically cognitive and emotional trust. This scale is based on the other measures of interpersonal trust (Cook, Wall, 1980; Remple et al., 1985; Rotter, 1971).

Knowledge Quality

Shared knowledge must be of high quality; otherwise, sharing activities will hinder the problem solving process (Weiss, 1980; Rubenstein-Montano, Wang 2003). Van-Louhuizen (1986) identifies two measures for assessing knowledge quality: validity and utility. For this chapter, the knowledge quality model developed by Rubenstein-Montano and Wang (2003) is adopted. In their model, knowledge quality is evaluated along the dimensions of validity and utility using a 7-point Likert-scale. The evaluations are made by individuals after receiving knowledge for task completion (Cook, Wall, 1980; Miller, 1956; Pemberton, 1933). The problem with this method is that quality measures averaged across all users of the knowledge may decrease the meaningfulness of the measure since distinction between the context within which the knowledge is used are not made. A number of knowledge management systems already evaluate knowledge quality in similar ways (O'Dell et al., 1998). In an effort to isolate the trust variable, only knowledge of high quality (7-point Likert value of 5-7) was used in knowledge sharing for this experiment.

Task Complexity

The concept of task complexity has been studied in a variety of literatures (e.g., information processing, decision making, task and job design) and from a variety of perspectives (e.g., psychological, person-task interaction, objective task characteristics). In this chapter, task complexity is defined in terms of objective task characteristics (Campbell, 1984; March, Simon, 1958). A task complexity model developed by Rubenstein-Montano and Wang (2003) is adopted in this chapter. In their model, there are three dimensions to make up task complexity: knowledge intensiveness, knowledge type, and knowledge location. In an effort to isolate the trust variable, only tasks of high complexity (7-point Likert value of 5-7) were used in knowledge sharing for this experiment.

Hypotheses

As mentioned in the Introduction, much research on knowledge sharing is present in the literature. However, the current literature does not adequately test the impact of different levels of trust on knowledge sharing. This chapter posits that the time and effort spent in knowledge sharing may not be warranted when there is a low level of trust. In such cases, the individual would spend as much or even more time completing the task alone than with the help of another, henceforth expert, because time must first be spent building trust. Additionally, the expert can use that time not spent sharing knowledge to complete other tasks. In contrast, for high level of trust, expert assistance has a greater effect on enhancing performance by decreasing the time required to complete the task. This leads to the hypothesis tested in this chapter, which is stated formally as follows:

A high level of trust between individuals involved in knowledge sharing is predicted to result in quicker task completion time than a moderate level of trust between individuals. A moderate level of trust between individuals is, in turn, predicted to result in quicker task completion time than a low level of trust. Thus, as the trust level increases, the value of knowledge sharing increases.

DESIGN AND METHODOLOGY

Overview

The design of our experiment is adapted from that of Leidner and Fuller (1997), and it seeks to examine the effects of trust levels on knowledge sharing. A similar experimental design has been used by Chaiken (1979).

The lead author of this chapter served as the expert in this experiment. Thus, she is the person to whom subjects in the experiment turned for knowledge when completing assigned tasks. The subjects were graduate students with whom the expert developed a relationship over a period of three months in a term project, and the expert was also a graduate student. Because both the expert and the subjects were all students in a class together, issues of power and location in the organization did not bias the experimental results.

Three separate tasks, each of equal levels of complexity, comprise the experiment. Each of the three tasks was completed at different points during the three month period, at the beginning of the project, at the middle of the project, and at the end of the project, as trust between the expert and the subjects developed from level 1, deterrence-based, through level 3, identification-based. A time limit for task completion was not placed on the subjects. It should be noted that complexity has been shown to impact knowledge sharing, with the completion of complex tasks benefiting from knowledge sharing more than simple tasks (Rubenstein-Montano, Wang, 2003). As mentioned previously, complexity of the tasks was high and held constant across all three tasks.

Design

The 3X2 experiment is a Repeated Measures design with six data points in each cell. Thirty-six data points were obtained from 12 subjects during the experiment. Three variables are involved in the experiment. The two dichotomous independent variables are levels of trust with three levels and treatment with two levels. Task completion time is the continuous dependent variable. Levels of trust are varied as low, moderate, and high. The two treatments are treatment A (no sharing) and treatment B (sharing of highly specific and relevant knowledge that can be directly applied for completing the task; high to very high quality). Task completion time, as the dependent variable, has become an important outcome measure (Hansen, 1999), and is thus an appropriate measure for this experimental study. The research hypothesis posited in this chapter is evaluated by comparing the impacts of three levels of trust on the value of knowledge sharing (i.e., given a level of trust, how much time is saved by knowledge sharing when completing a task).

While completing the tasks, subjects could ask questions, and the subject and expert discussed issues/questions until a sufficient level of understanding was achieved that the subject could integrate the new piece(s) of knowledge and move forward with the task. Questions were answered using pre-defined pieces of knowledge only. This ensures that sharing was consistent across subjects. For measuring completion time, subjects were instructed to complete the tasks as quickly as possible without sacrificing quality (Surinder, Cooper, 1999). Start time is defined as the moment when the subject actually begins working on the task. The time spent reading and understanding the task is not included in completion time. Completion time is defined as the moment when the solution to the task is found. Once complete, subjects briefly outlined the steps taken to complete the task. This way, their steps can be retraced to ensure correct outcomes of the tasks were achieved without penalizing completion time by forcing subjects to write down their steps as they worked through the tasks. Task completion time does, however, include time spent in knowledge sharing so the benefits and costs of such sharing are captured in the completion time.

In the Repeated Measures design, each subject contributes multiple data points, which allows for systematic variation across subjects to be removed from the error term and provides accurate results with less data points (Maxwell, Delaney, 1989). One possible disadvantage of the Repeated Measures design and analysis is the order effect. That is, subject performance may be influenced by previous treatment manipulations or by time (Hunton, Price, 1997). We control for order effect by assigning combinations of trust levels-treatments of knowledge sharing to subjects randomly.

In addition, pre-experiment and post-experiment surveys were used for each task to verify the experimental design and results (Kaplan, Duchon, 1988). A 6-point Likert-type scale was used for the pre-experiment survey to assess the subjects' relationship with the expert. The survey is based on that of Mayer et al. (1995). Likert values of 0-1 represent low trust (deterrence-based), values of 2-3 represent moderate trust (knowledge-based), and values of 4-5 represent high levels of trust (identification-based). On average subjects rated their trust levels as 0.89, 2.21, and 4.34 for task 1 through task 3 respectively.

A 7-point Likert-type scale was used for post-experiment survey responses. Subjects were queried regarding the difficulty of each task to ensure the three tasks were of equal levels of complexity. Responses were used in conjunction with completion time to verify that assignments of the tasks were valid. Furthermore, subjects answered questions about the usefulness and relevance of shared knowledge to verify it was of high quality.

Successful completion of the tasks was also dependent upon subjects' ability to successfully search the Internet, because each task involved an Internet search. Thus, the Internet search abilities of subjects was also captured in the post-experiment survey and used during our results' validation. The post-experiment survey revealed that the subjects rated their abilities consistently across tasks. The average, self-reported ability of subjects to successfully search the Internet is 5.23 with a standard deviation of 1.27. This value equates to an average search ability. Requiring each subject to complete each of the tasks also reduces search capability biases.

DATA ANALYSIS AND DISCUSSION

The experimental results were analyzed by two-way Repeated Measures ANOVA and Bonferroni tests. The descriptive statistics calculated are the mean completion times and standard deviations for each group of trust-treatment combinations (Table 1 and Chart 1). Both the ANOVA (Table 2) and the Bonferroni (Table 3) tests support the hypothesis.

Chart 1: Mean Completion Times for Each Group of Trust-Treatment Combination

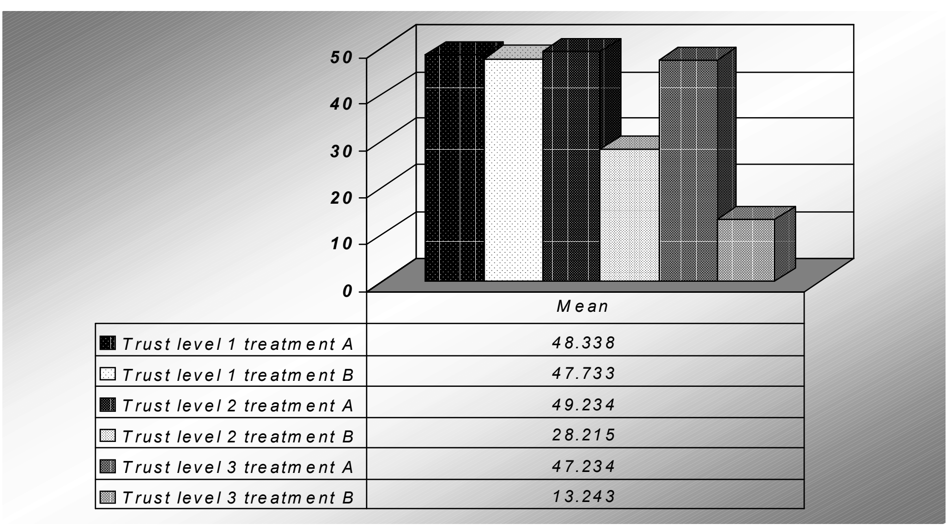


Table 1: Mean Task Completion Times (in minutes)

Trust-Knowledge Combination	Mean	Standard Deviation
Trust level 1 treatment A	48.338	5.421
Trust level 1 treatment B	47.733	5.125
Trust level 2 treatment A	49.234	6.021
Trust level 2 treatment B	28.215	4.584
Trust level 3 treatment A	47.234	5.017
Trust level 3 treatment B	13.243	4.287

Table 2: ANOVA (Test of Within-Subjects Effects)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Trust	10938.045	2	5469.023	30.529	.001
Error (Trust)	4299.386	24	179.141		
Treatment	7932.174	3	2644.05	16.742	.000
Error (Treatment)	5685.373	36	157.927		

Table 3: Comparison of Means (Bonferroni)

Knowledge Sharing (treatment B)	Mean Difference (MD)	Sig.
Trust level 1– trust level 2	15.000*	.012
Trust level 1– trust level 3	22.1111*	.000
Trust level 2– trust level 3	14.1111*	.015
No Knowledge Sharing (Treatment A)		
Trust level 1– trust level 2	9.1111	.795
Trust level 1– trust level 3	18.2222	.095
Trust level 2– trust level 3	9.1111	.795

* *The mean difference is significant at the .05 level.*

Table 2 provides the results of the ANOVA analysis for trust level. Trust level has a significant effect on task completion time ($F (3, 36) = 30.529$, $P = .001 < .05$). In tables 1 and 3, the means of the 6 groups and Bonferroni tests for difference in means are shown. A high level of trust between individuals involved in knowledge sharing is predicted to result in significantly quicker task completion time than a moderate level of trust between individuals (MD= 14.1111, P= .015). Moreover, a moderate level of trust between individuals is, in turn, predicted to result in significantly quicker task completion time than a low level of trust (MD= 15.000, P= .012). Therefore, the Hypothesis is supported.

Furthermore, for treatment A, no knowledge sharing, the mean task completion time for the 3 different tasks is almost the same (Tables 1 and 3), which further supports our claim that task complexity was held constant in the experiment.

CONCLUSIONS AND FUTURE DIRECTIONS

This experimental study shows that the level of trust between individuals involved in knowledge sharing will significantly impact whether such activities will be of value. The data analysis fully supports the hypothesis that as trust level increases, the value of knowledge sharing increases. However, there are now many more things to be considered.

A caveat of this research is that it involved student subjects. While the nature of their tasks can be generalized to other organizations, a next step in illustrating the role of trust level on knowledge sharing would be to experiment in a commercial organization. A primary reason for this is that the motivation for knowledge sharing will be different. In a commercial organization employees will participate in knowledge sharing to preserve their livelihood, whereas in a university setting students will participate in knowledge sharing to preserve their grades. The issue of which motivational factor is stronger, and the importance of motivation, are not within the scope of this study and are left for future research. Second, this study had an expert with knowledge readily available for sharing. The expert's personality and communication style may influence the impact of knowledge sharing on task performance. Finding both an appropriate expert and the necessary knowledge (Hansen, 1999) are additional factors that will impact the role of knowledge sharing on task completion, and thus task performance. Furthermore, it may not be sufficient to use a self-response method to measure trust level, since the self-evaluation standards may differ for different subjects. Finally, the issues of subjects' individual skills, personality, which motivational factor is stronger, and the importance of motivation, are not within the scope of this study and are left for future research.

REFERENCES

Anderson, E., & Weitz, B. (1992). The use of pledges to build and sustain commitment in distribution channels, *Journal of Marketing Research*, 29, 1, pp 18-35.

Aulakh, P.S., Kotabe, M., & Sahay, A. (1996). Trust and performance in cross-border marketing partnerships: A behavioral approach, *Journal of International Business Studies*, 27, 5, pp 1005-1032.

Bartlett, C. A., & Ghoshal, S. (1995, Fall). Rebuilding behavioral context: Turn process reengineering into people rejuvenation, *Sloan Management Review*, pp. 11-23.

Beamish, P.W., & Banks, J. (1987). Equity joint ventures and the theory of the multinational enterprise, *Journal of International Business,* 13, 2, pp. 1-16.

Bradach, J. L., & Eccles, R. G. (1989). Price, authority, and trust: From ideal types to plural forms, *Annual Review of Sociology*, 15, pp. 97-118.

Butler, J. K. Jr. (1991). Toward understanding and measuring conditions of trust: Evolution of a condition of trust inventory, *Journal of Management*, 17.

Campbell, D. J. (1984). The effects of goal-contingent payment on the performance of a complex task, *Personnel Psychology*, 37, pp. 23-40.

Chaiken, S. (1979). Communicator physical attractiveness and persuasion, *Journal of Personality and Social Psychology,* 37, 8, pp. 1387-1397.

Coleman, J. S. (1990). *Foundations of Social Theory*. Cambridge, MA: The Belknap Press.

Cook, J., & Wall, T. (1980). New York attitude measures of trust, organizational commitment, and personal need non-fulfillment, *Journal of Occupational Psychology,* 53, pp. 39-52.

Curral, S. C., & Judge, T. A. (1995). Measuring trust between organizational boundary role persons, *Organizational Behavior and Human Decision Processes*, 64, pp. 151-170.

Deutsch, M. (1958). Trust and suspicion, *Journal of Conflict Resolution,* 2, pp. 265-279.

Deutsch, M. (1962). Cooperation and trust: Some theoretical notes, in M. R. Jones, (Ed.), *Nebraska Symposium on Motivation.* Lincoln, NE: University of Nebraska Press.

Earley, P. C. (1986). Trust, perceived importance of praise and criticism, and work performance: An examination of feedback in the United States and England, *Journal of Management,* 12, pp. 457-473.

Gabarro, J. (1978). The development of trust, influence, and expectations, In A. G. Athos and J. J. Gabarro (Eds.), *Interpersonal Behavior: Communication and Understanding in Relationships,* pp. 290-303.

Giffin, K. (1967). The contribution of studies of source credibility to a theory of interpersonal trust in the communication process, *Psychological Bulletin,* 68, pp. 104-120.

Goffman, E. (1971). *Relations in Public*, New York: Basic Books.

Grant, R. M. (1995). Prospering in dynamically competitive environmental: Organizational capability as knowledge integration, *Organizational Science*, 7, 4, pp. 375-387.

Gulati, R., & Singh, H. (1998). The architecture of cooperation: Managing coordination costs and appropriation concerns in strategic alliances, *Administrative Science Quarterly*, 43, pp. 781-814.

Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organizational subunits, *Administrative Science Quarterly*, 44, pp. 82-111.

Hart, P., & Saunder, C. (1997). Power and trust: Critical factors in the adoption and the use of electronic data interchange, *Organizational Science*, 8, pp. 23-42.

Hunton, J.E., & Price, K. H. (1997). Effects of the user participation process and task meaningfulness on key information system outcomes, *Management Science*, 43, 6, pp. 797-812.

Inkpen, A. C. (1997). *An Examination of Knowledge Management in International Joint Ventures Cooperative Strategies: North American Perspectives*, San Francisco: New Lexington Press.

Jennings, E. E. (1971). *Routes to the Executive Suite*, New York: McGraw Hill.

Kaplan, B., & Duchon, D. (1988). Combining qualitative and quantitative methods in information systems research: A case study, *MIS Quarterly*, 12, 4, pp. 571-586.

Kogut, B. (1988). Joint ventures: Theoretical and empirical perspectives, *Strategic Management Journal*, 9, pp. 319-22.

Kramer, R. M., & Tyler, T. R. (1996). *Trust in Organizations: Frontiers of Theory and Research*, Thousand Oaks, CA: Sage Publications.

Larsson, R., & Lubatkin, M. (1998). Relative absorptive capacity and inter-organizational learning, *Strategic Management Journal*, 19, pp. 461-477.

Larzerele, L. E., & Huston, T. L. (1980). The dyadic trust scale: Toward understanding interpersonal trust in close relationships, *Marriage and the Family*, 42, pp. 595-604.

Leidner, D.E., & Fuller, M. (1997). Improving student learning of conceptual information: GSS supported collaborative learning vs. individual constructive learning, *Decision Support Systems*, 20, pp. 149-163.

Lewicki, R. J., & Bunker, B. B. (1995). Trust in relationships: A model of development and decline. In B. B. Bunker & J. Z. Rubin (Eds.), *Conflict, Cooperation and Justice*, San Francisco: Jossey-Bass.

Lewicki, R. J., & Bunker, B. B. (1996). Developing and maintaining trust in work relationships, In R. M. Kramer & T. R. Tyler (Eds.), *Trust in Organizations: Frontiers of Theory and Research*, Thousand Oaks, CA: Sage Publications.

Lewicki, R. J., & Bunker, B. B. (1998). Communication and trust in global virtual teams, *Journal of Computer-Mediated Communication*, 3, 4.

Lewis, J. D., & Weigert, A. J. (1985). Trust as a social reality, *Social Forces*, 63, 4, pp. 967-985.

March, J., & Simon, H. (1958). *Organizations*, New York, NY: Wiley.

Maxwell, S. E., & Delaney, H. D. (1989). *Designing Experiments and Analyzing Data*, California, CA: Brooks Publishing Company.

Mayer, R.C., Davis, J. H. & Schoorman, F. D. (1995). An integration model of organizational trust, *Academy of Management Review*, 20, 3, pp. 709-734.

McAllister, D. J. (1995). Affects and cognition based trust as foundations for interpersonal cooperation in organizations, *Academy of Management Journal*, 38, pp. 24-59.

Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information, *Psychological Review*, 63, pp. 81-97.

Moorman, C., Zaltman, G., & Deshpande, R. (1992). Relationships between providers and users of market research: The dynamics of trust within and between organizations, *Journal of Marketing Research*, 29, pp. 314-328.

O'Dell, C., Grayson, C. J., & Essaides, N. (1998). *If Only We Knew What We Know: The Transfer of Internal Knowledge and Best Practice*, New York, NY: The Free Press.

Pemberton, E.A. (1933). Technique for measuring the optimum rating scale for opinion measures, *Sociology and Social Research*, 17, pp. 470-472.

Remple, J. K., Holmes, J. K., & Zanna, M. P. (1985). Trust in close relationships, *Journal of Personality and Social Psychology*, 49, pp. 95-112.

Roberts, K. H., & O'Rielly, C. A., III (1976). Failures in upward communication in organizations: Three possible culprits, *Academy of Management Journal*, 17, pp. 205-215.

Rotter, J. (1971). General expectation for the interpersonal trust, *American Psychologist*, 26, pp. 443-452.

Rubenstein-Montano, B., & Wang, R. (2003). The Influence of Task Complexitiy on the Benefits Obtained from Knowledge Sharing (working paper). Georgetown University, McDonough School of Business, Washington, DC.

Schlenker, B. R., Hehn, B., & Tedeschi, J. T. (1973). The effects of personality and situational variables on behavioral trust, *Journal of Personality and Social Psychology*, 25, 3, pp. 419-27.

Scott, C. L. III. (1980). Interpersonal trust: A comparison of attitudinal and situational factors, *Human Relations*, 33, pp. 805-812.

Sitkin, S. B., & Roth, M. L. (1993). Explaining the limited effectiveness of legalistic 'remedies' for trust/distrust, *Organization Science*, 4, pp. 367-92.

Surinder, S. K., & Cooper, R. B. (1999). The effect of computer-mediated communication of agreement and acceptance, *Journal of Management Information Systems*, 16, 1, pp. 165-188.

Van-Lohuizen, C. W. W. (1986). Knowledge: Creation, diffusion, utilization, *Knowledge Management and Policy Making*, *8*(1).

Weiss, C. H. (1980). Knowledge creep and decision accretion, *Knowledge: Creation, Diffusion, Utilization*, *1*(3), pp. 381-404.

Zand, D. E. (1972). Trust and managerial problem solving, *Administration Science Quarterly*, 17, pp. 229-239.

Zucker, L. (1986). Production of trust: Institutional sources of economic structure. In B.M. Staw & L.L. Cummings (Eds.), *Research in Organizational Behavior*, 8, 53-11g, pp. 1840-1920.

Section III

Technical Challenges

Chapter XI

A Survey of Internet Support for Knowledge Management/ Organizational Memory Systems

Murray E. Jennex
San Diego State University, USA

ABSTRACT

Studies of organizational memory/ knowledge management, OM/KM, systems have found that using a common infrastructure to facilitate access to and utilization of knowledge and memory increases the usability and success of these systems. The solution to this is for organizations to have an integrated network. This paper discusses using the Internet as the integrated network. Several systems are described that use the Internet for the OM/KM infrastructure. Theoretical support from case study research for using the Internet as a common knowledge infrastructure is provided through DeLone and McLean's IS Success Model modified and analyzed for knowledge/memory based systems.

INTRODUCTION

Organizations are building and maintaining systems for managing organizational knowledge and memory. Users of these systems may not be at the same location. In many cases, they are distributed across large geographical distances and multiple offices. Key to this task is developing an infrastructure that facilitates distributed access and utilization of the retained knowledge and memory. Connectivity and easy-to-use interfaces are main concerns. Jennex (2000) found that using the Internet as a common communications platform (either as an Intranet or an Extranet) and web browsers as an interface is a viable, low cost solution. Newell et al. (1999) found that Intranets not only supported distributed knowledge processes, but also enhanced users' abilities to capture and control knowledge. Stenmark (2002) proposes that using a multiple perspective of the Internet—information, awareness, and communication—allows developers to build successful Internet-based Knowledge Management Systems, KMS. The purpose of this paper is to illustrate how the Internet can be effectively used as an infrastructure for Knowledge Management/Organizational Memory Systems, KMS/OMS. This is based on an intensive analysis of a KMS/OMS, an action research study of a KMS, and a literature review of KMS/OMS studies. For simplicity, this paper assumes that knowledge is a subset of Organizational Memory, OM, and the term OMS includes KMS, however, the term KMS will be used to generically refer to a KMS/OMS. This relationship will be illustrated later.

The paper begins by defining concepts used in the paper. This is followed by a discussion on the two types of KMS and the presentation of an assessment model based on DeLone and McLean's (1992) IS Success Model. The presented assessment model is used to assess the success of Internet-based KMS. This is followed by a discussion on enabling factors for a KMS and other tools and research for building an Internet-based KMS. This culminates in the presentation of examples of Internet-based KMS's followed by conclusions and limitations.

BACKGROUND

Organizational Learning

Organizational Learning, OL, is identified as a quantifiable improvement in activities, increased available knowledge for decision-making, or sustainable competitive advantage (Cavaleri, 1994; Dodgson, 1993; Easterby-Smith, 1997; Miller, 1996). Another definition refers to OL as the process of detection and correction of errors, Malhotra (1996). In this view, organizations learn through individuals acting as agents for them. Individual learning activities are seen as being facilitated or inhibited by an ecological system of factors that may be called an organizational learning system. Learning in this perspective is based on Kolb's (1984) model of experiential learning, where individuals learn by doing.

An organization can also learn if, through its processing of information, its potential behaviors are changed, Huber et al. (1998). This incorporates the concept of OM into OL (Huysman et al., 1994; Walsh, Ungson, 1991). In this view, OM is the process by which experience is used to modify current and future actions.

Organizational Memory and Knowledge

Organizational Memory is variously viewed as abstract or unstructured concepts and information that can be partially represented by concrete/physical memory aids, such as databases, and as concrete or structured concepts and information that can be exactly represented by computerized records and files. This paper views OM as a combination of abstract and concrete, where the concrete is the history and trend data collected in the memory and the abstract is the experience gained by the organizational member over time. Definitions by Stein and Zwass (1995) and Walsh and Ungson (1991) support this. Additionally, all agree that OM can include everything within the organization that is retrievable, including the set of documents and artifacts that forms the corporate record and the collection of shared and stored understandings and beliefs that forms the basis for organizational sense-making and social construction of reality.

OM has two principle goals: to integrate information across organizational boundaries and to control current activities and, thus, avoid past mistakes. OM functions are perception, acquisition, abstraction, recording, storage, retrieval, interpretation, and transmission of organizational knowledge (Stein, Zwass, 1995). OM retention facilities are individuals, transformations, structure, ecology, and culture (Walsh, Ungson, 1991).

Davenport and Prusak (1998) view knowledge as an evolving mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information. They found that in organizations knowledge often becomes embedded in documents or repositories and in the organizational routines, processes, practices, and norms. Nonaka (1995) expands this definition by stating that knowledge is about meaning in the sense that it is context-specific.

This paper considers OM and knowledge to be constructs and attributes of organizational learning. Also, knowledge is a subset of OM and the acquisition and use of OM includes the acquisition and use of knowledge.

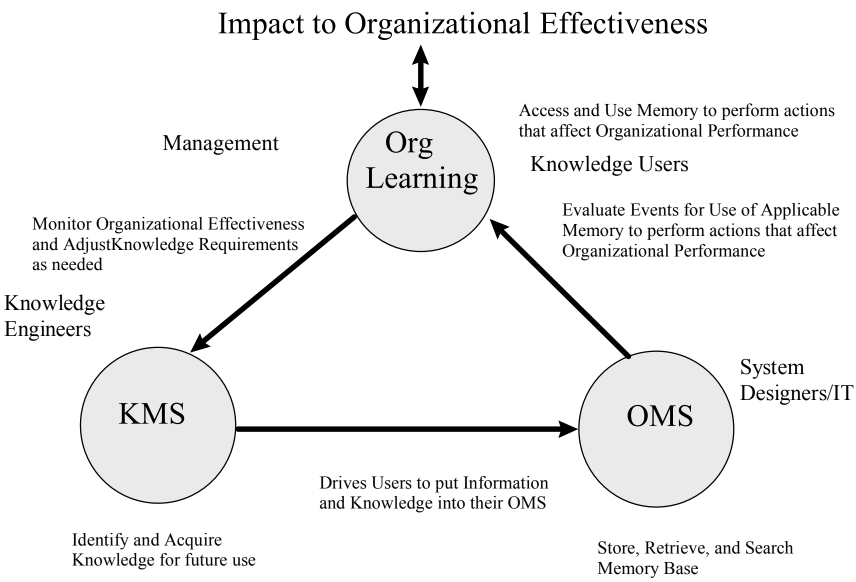
Knowledge Management

Knowledge Management, KM, as a discipline has not been clearly agreed upon. KM is defined as that process established to capture and use knowledge in an organization for the purpose of improving organizational performance (Malhotra, 1998). Organization refers to any acknowledged business group, from a small team to the total enterprise. Also, this process is not restricted to the IS/IT organization and is better done in the organizations that create and use the knowledge. Personnel performing these functions are referred to as Knowledge Workers.

Organizational Memory and Knowledge Management Systems

The OMS is the processes and IS components used to capture, store, search, retrieve, display, and manipulate OM. The KMS consists of the tools and processes used by knowledge workers to identify and transmit knowledge to the knowledge base contained in the OM. Knowledge is managed and used through a combination of the KMS and OMS. Jennex and Olfman (2002) presented the KMS-OMS model in Figure 1 as a model illustrating the relationships between OM, KM, and OL. As mentioned earlier, to simplify terms, the rest of the paper will refer to these combined systems as a KMS.

Figure 1: The KMS-OMS Model



Types of Knowledge Management Systems

There are two approaches to building a KMS as discussed by Hansen et al. (1999) and Stenmark (2002). These can be described as a project/process/task-based approach, henceforth referred to as the project-based approach, and an infrastructure/generic system based approach, henceforth referred to as the infrastructure-based approach. The project-based approach focuses on the use of OM by participants in a process, task or project in order to improve the effectiveness of that process, task or project. This approach identifies information and knowledge needs, where they are located, and who needs them. The KMS is designed to capture OM unobtrusively and to make OM available upon demand to whoever needs it. Many Y2K projects used project-based KMS.

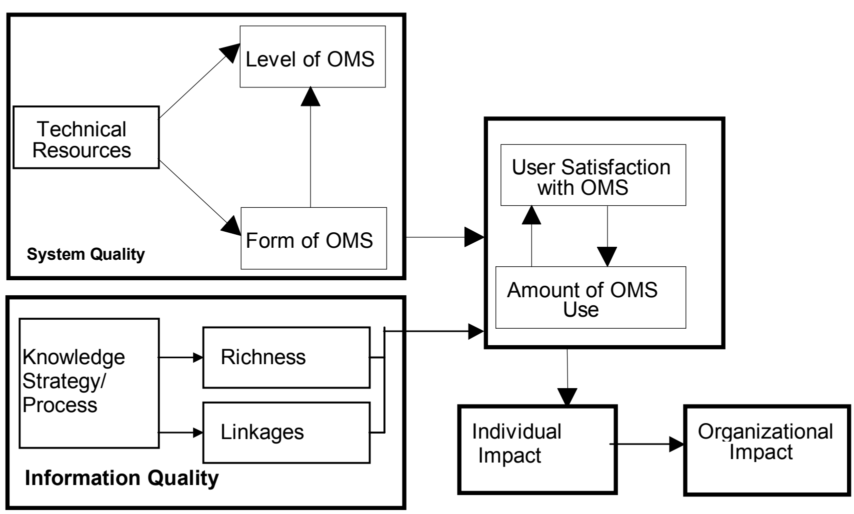
The infrastructure-based approach focuses on building a base system to capture and distribute OM for use throughout the organization. Concern is with the technical details needed to provide good mnemonic functions associated with the identification, retrieval, and use of OM. The approach focuses on network capacity, database structure and organization, and information and knowledge classification. Context is captured with the knowledge. The key difference is that the project-based approach has known users with a common context of understanding, while the infrastructure-based approach does not.

It is hypothesized that both approaches are necessary to create a complete organization-wide OM and KMS. Morrison and Weiser (1996) support the dual approach concept by suggesting that an organizational KMS be designed to combine an organization's various project/task/process-based KMSs into a single environment and integrated system.

Assessing KMS Success

Jennex and Olfman (2002) generalized assessment of KMS success by adapting DeLone and McLean's (1992) IS Success Model to a KMS. The DeLone and McLean model is based on a review and integration of 180 research studies that used some form of system success as a dependent variable. It identifies six system success constructs and shows how they are related. Figure 2 is the model adapted for KMS. The model is a block-recursive one that includes five blocks. Block descriptions are as follows:

Figure 2: The KMS Modified IS Success Model



System Quality – is defined by the technical characteristics of the KMS as described by three constructs: the technical resources of the organization, the form of the KMS, and the level of the KMS. Technical resources define the capability of an organization to develop and maintain a KMS. The form of KMS refers to the extent to which it is computerized and integrated, explicitly, how much of the accessible information/knowledge is on-line and available through a single interface. The level of the KMS refers to its ability to bring past information to bear upon current activities. Given the effectiveness of information technology to provide timely information, it is expected that a more fully computerized system utilizing network and data warehouse technologies will result in the highest levels of system quality.

Information Quality – Davenport and Prusak (1998) discuss two primary types of knowledge, links to experts who serve as sources of knowledge and rich, detailed knowledge. Jennex and Olfman (2002) found that KMS users new to an organization utilized knowledge linkages more than any other aspect of the KMS, while more experienced members of the organization relied on retrieving detailed, accurate, and timely information. The third construct, KM Strategy and Process, reflects that the knowledge needs of the KMS users change over time. KM Strategy is needed to determine what information/ knowledge should be in the knowledge base, where it is located, and how it is to be acquired. The KM Process ensures that knowledge requirements are reviewed on an ongoing basis.

Use - Information/knowledge use refers to the utilization of the outputs of the system. This construct is most applicable as a success measure when use is required. User satisfaction measures perceptions of the users. It is considered a good surrogate for measuring system use when use is voluntary. Jennex and Olfman (2002) used a perceived benefit model adapted from Thompson, Higgins, and Howell (1991) to measure user satisfaction and predict continued use of the KMS. This measure was found to work well and is included in the user satisfaction construct.

Individual and Organizational Impact – An individual's use of a system will produce an impact on that person's performance. DeLone and McLean (1992) note that an individual 'impact' could also be an indication that an information system has given the user a better understanding of the decision context, has improved his or her decision-making productivity, has produced a change in user activity, or has changed the decision maker's perception of the importance or usefulness of the information system. Each individual impact will, in turn, have an effect on the performance of the whole organization. Organizational impacts are typically not the summation of individual impacts, so the association between individual and organizational impacts is often difficult to draw.

Enabling Factors for KMS/OMS

Jennex and Olfman (2001) developed a set of design recommendations for enabling KM/OM in systems. The recommendations, Table 1, are based on the research previously discussed and on the blocks of the KM/OM modified IS Success

Model. It should again be noted that the model is recursive and that enhancing one factor enhances succeeding factors. System Quality recommendations call for use of a common infrastructure. The Internet is suggested for this due to its widespread availability, open architecture, and developed interfaces. This also assists in standardizing software across the organization through the use of browsers and web applications. Information Quality recommendations include one for security. This topic is not discussed in this paper due to length considerations, not lack of importance.

Table 1: KMS Enabling Recommendations

Factor	**Recommendation**
System Quality	Use a common network structure, such as the Internet.
	Add KM/OM skills to the tech support skill set.
	Use high end PCs and/or clients.
	Standardize hardware and software across the organization.
System and Information Quality	Incorporate the KMS into everyday processes and IS.
	Use an Enterprise wide data dictionary to design knowledge base.
	Allocate maintenance resources for KMS.
	Train users on use and content of the KMS.
Information Quality	Create and Implement a KM Strategy/Process for identifying/maintaining the knowledge base.
	Expand system models/life cycles to include the knowledge process.
	Assess system/process changes for impact to the KMS.
	Automate data capture.
	Design security into the knowledge base.
Use	Incorporate KM into personnel evaluation processes.
	Implement KMS use/satisfaction metrics.
	Identify organizational culture concerns that could inhibit KMS usage.

The Internet meets several of these recommendations. It provides a common network that is global. Use of common browsers aids in standardizing software. Ease of use of browsers and in building and maintaining Internet-based systems empowers users (Newell et al., 1999) and simplifies incorporating the KMS into everyday processes. Ease in handling unstructured data, as well as databases, simplifies knowledge representation, capture, and dissemination. Tools and research that expand the ability of the Internet to serve as the infrastructure for a KMS are discussed in the next section.

Other Tools/Research

Although there is strong support for using the Internet as a Knowledge infrastructure, there are concerns. Chief among these concerns is the difficulty in organizing and searching for knowledge. Ezingeard et al. (2000) points out that Ernst & Young UK in the beginning of 2000 had in excess of one million documents in its KMS. Another concern is the tendency to not use the system. Cross (2000) discusses this tendency, but comes to the conclusion that repositories are essential. Jennex and Olfman (2002) found that voluntary use is enhanced if the system provides near and long-term job benefits, is not too complex, and the organization's culture supports sharing and using knowledge and the system. Stenmark (2002) found that if the Internet is visualized as a system for increasing awareness of knowledge and the KMS as a system for retaining and sharing knowledge, and as a system for enhancing communication and collaboration between teams and knowledge experts and users, then it should be successful as a KMS.

Newman and Conrad (2000) propose a framework for characterizing KM methods, practices, and technologies. This framework looks at how tools can impact the flow of knowledge within an organization, its role in manipulating knowledge artifacts, and the organizational behavior most likely to be affected. The framework also looks at the part of the KM process the tool works in. The activity phase looks at the utilization, transfer, retention, and creation of Knowledge. This framework can be used to show that Internet and browser-based KMS tools are effective.

Gandon et al. (2000) propose using XML to encode memory and knowledge, and suggest using a multi-agent system that can exploit this technology. The proposed system would have improved search capabilities and would improve the disorganization and poor search capability normally associated with Internet systems. Chamberlin et al. (2001) and Robie et al. (1998) discuss using XML query language to search and retrieve XML encoded documents.

Dunlop (2000) proposes using clustering techniques to group people around critical knowledge links. As individual links go dead due to people leaving the organization, the clustered links will provide a linkage to people who are familiar with the knowledge of the departed employee. This technique would improve the reliability of the links to the knowledge called for in Figure 2. Lindgren (2002) proposes the use of Competence Visualizer to track skills and competencies of teams and organizations.

Te'eni and Feldman (2001) propose using task-adapted websites to facilitate searches. This approach requires the site be used specifically for a KMS. Research has shown that some tailored sites, such as ones dedicated to products or communities, have been highly effective. This approach is incorporated in the examples in this paper with the exception of the use of dynamic adaptation.

Eppler (2001), Smolnik and Nastansky (2002), and Abramowicz et al. (2002) discuss the use of knowledge maps to graphically display knowledge architecture. This technique uses an Intranet hypertext-clickable map to visually display the architecture of a knowledge domain. Knowledge maps are also known as Topic Maps and Skill Maps. Knowledge maps are useful, as they create an easy-to-use standard graphical interface for the Intranet users and an easily understandable directory to the knowledge.

The use of ontologies and taxonomies to classify and organize knowledge domains is growing. Zhou et al. (2002) propose the use of ROD, Rapid Ontology Development, as a means of developing an ontology for an undeveloped knowledge domain.

EXAMPLES OF INTERNET KMS

Jennex (2000) discussed an intranet-based KMS used to manage knowledge for a virtual Y2K project team. This KMS used two different site designs over the life of the project. The purpose of the initial site was to facilitate project formation by generating awareness and providing basic information on issues the project was designed to solve. The design of this site was based on Jennex and Olfman (2002), who suggested that a structure providing linkages to expertise and lessons learned was the knowledge needed by knowledge workers. This was accomplished by providing hot links to sites that contained Y2K knowledge, a project team roster that indicated the areas of expertise for each of the project team members and additional entries for individuals with expertise important to the project, and some basic answers to frequently asked questions. This site was accessed from the corporate Intranet site through the special projects section of the IT division page. This made the site hard to find for those who did not know where to look, forcing the project team leadership to provide direction to the site through e-mail directions. The site did not contain guidelines and accumulated knowledge as reflected in test plans, test results, inventories of assets referenced to the division who owned them, and general project knowledge, such as project performance data, meeting minutes and decisions, presentations, and other project documentation. This information had not been generated at the time the site was implemented. Once generated, this information was stored on network servers with shared access to acknowledged project team members. This was done due to a lack of resources allocated to the initial site. No dedicated personnel or special technologies were allocated for the design or maintenance of the site. This site was in effect from early 1998 through mid 1998.

As the project team formed and began to perform its tasks, the requirements for the Intranet site changed from generating awareness to supporting knowledge sharing. The site was redesigned and expanded to include detailed, frequently asked questions (FAQs), example documents, templates, meeting minutes, an asset database, guidelines for specific functions that included lessons learned, etc. The knowledge content of the site was distributed to the other components of the site and persons were identified as being responsible for the information and knowledge content of their responsible areas. Additionally, access to the site was enhanced by the addition of a hot link to the Y2K site placed and prominently displayed on the Corporate Intranet home page. The basic layout of the site provided for access to seven specific sub-sites: Major Initiatives, Contacts, Documents, What's New, Hot Links, Issues and Questions, and Y2K MIS.

Access to this site was granted to all the employees, however, several of the sub-sites were password protected for restricted use. Most of the knowledge contained on the site was contained in these protected sub-sites. The knowledge from the initial site was rolled over into the Hot Links and Contacts sub-sites. Additionally, information that had been previously stored on network servers was left on those sites, but access was provided through the Intranet site. The network structure was expanded to include more sub-structures for storing more documents, information, and knowledge.

The effectiveness of the two sites was considered good. The first site was successful in generating interest and starting the project. The second site succeeded in taking a project that was performing in the bottom third of all projects, to being a leading project within six months after its release. Effectiveness of the sites was established using the model in Figure 2 and by ensuring the Information Quality was high and the System Quality, especially the search, retrieval, and infrastructure, was good. Use of both sites was established by ensuring the sites met the needs of the project team and the company.

The second example is the Extranet site used by the utility industry for Y2K (Jennex, 2000). Its purpose was to facilitate information/knowledge sharing between industry members. It initially provided documents, procedures, and guidelines for getting projects started. It also provided an electronic forum for questions and answers. As projects progressed, more test data became available and this information was posted. Finally, this site provided links to other important sites and sources of information.

The effectiveness of the site was limited. A great deal of knowledge was stored on the site, but searching was difficult and time consuming, reducing system quality. The consensus of the Nuclear and Non-Nuclear Generation Y2K project personnel was that the site provided little benefit, as many companies did not post test results, thus reducing information quality. The Substation Controls Y2K project personnel also found it limited, except they did use the knowledge to put together a statistically valid test sample as requested by the North American Electric Reliability Council (NERC). Industry consensus was that the site had limited knowledge value. A redesign of the site with more emphasis on knowledge search and retrieval was not available until after most projects were complete. It was anticipated the new site would be available for the expected onslaught of lawsuits following the roll over to 2000 which, of course, did not happen. A further inhibitor to effectiveness was that the member companies did not categorize equipment and system information in the same format. This lack of a shared ontology contributed to the search and retrieval difficulties and made understanding the posted information and knowledge more difficult for users from other companies.

The third example, from Cross (2000), is an Intranet site built by Andersen Consulting. Consulting firms have had a long tradition of brokering their knowledge into business. In the early 1990s, Andersen Consulting began to produce global best practices CDs for distribution to project personnel. This evolved into the development of a Intranet site called KnowledgeSpace that provided consultants with various forms of knowledge, including methodologies and tools, best practices, reports from previous like engagements, and marketing presentations. Support was also provided for online communications for online communities of practice and virtual project teams. The site was effective for personnel with access to the Internet and adequate bandwidth. It should be noted that current modem technology and improved dial-in access, as well as the proliferation of cable modems and digital subscriber lines, DSL, have made sites such as this much more effective for field or remote personnel.

The last examples come from Eppler (2001). There are five types of knowledge maps: source, asset, structure, application, and development. A multimedia company Intranet site is used to illustrate a knowledge source map. This site provides graphical buttons representing individuals with specific expertise, color-coded to indicate the expert's office location. The Knowledge Asset map provides a visual balance sheet of an organization's capabilities of a skills directory or core competency tree. Colors are used to indicate knowledge domains, while the size of symbols indicates level of expertise. Knowledge Structure maps divides knowledge domains into logical blocks that are then broken into specific knowledge areas. The Knowledge Application map breaks an organization's value chain into its components parts and then indicates what knowledge, tools, or techniques are needed to implement the component part. The last example is a Knowledge Development map. This map is used to plot the activities needed to acquire the indicated knowledge competence. Clicking on the displayed competence displays the steps needed to develop the competence. Effectiveness of these maps has only been determined for the Knowledge Asset map. This map, developed for a telecommunications consultant firm, was found to be very useful for the planning of training activities and for identifying experts quickly when required during an emergency. It should be noted that knowledge maps enhance the linkage aspects of information quality.

CONCLUSIONS

The conclusion is that the Internet is an effective infrastructure for a KMS. However, there are issues associated with using the Internet that KMS designers need to be aware of. Chief among these are knowledge representation and search. Several tools, such as Knowledge Maps, XML, adaptive websites, clustering, and examples of effective Internet based KMSs, were discussed that addressed these issues. However, as knowledge bases grow, designers need to be aware of increasing search times, as well as a variety of knowledge artifacts. This is perhaps the most important area for future research. Developing ontologies and taxonomies to aid in classifying and structuring knowledge domains is critical.

Maintaining a site is critical. User, organizational, and/or project needs for knowledge change over time, requiring the KMS to change its knowledge content. Also, knowledge has a life cycle and eventually reaches a point where it is no longer useful. Organizations must allocate resources to update and maintain every KMS.

Securing the KMS is also critical, as knowledge is valuable. This paper did not address security issues or technologies, but KMS designers need to ensure the security of captured knowledge. This may be the greatest impediment to the development of Internet-based KMSs.

The final issue is the tendency of people not to use the computer portion of a KMS. Jennex and Olfman (2002) found that this is a tendency of new members and suggest that this is a matter of context. New members do not understand the context under which the knowledge was created and stored, so they don't know how to retrieve and use the knowledge. As these members gain experience, they gain context and rely more upon the computer and less upon their peers.

Browsers are not discussed in the paper, except that the mentioned sites were designed to work with Internet Explorer and Netscape. Use of a browser is mandatory for the Jennex (2000) examples with the inference that effectiveness of these sites supports the use of browsers. A potential issue for KMS designers is deciding which browsers to support. Knowledge representation can include rich context information and documents designed to store this information may not display or function properly on all browsers.

LIMITATIONS

The examples used in this paper are limited in number and scope. They may not be indicative of the actual effectiveness of the Internet when used to develop a KMS. Insufficient research has been performed to verify that the Internet is the best approach for a KMS infrastructure. However, sufficient evidence exists to suggest this may be the case. The external validity is limited and is left to the reader to determine if sufficient evidence exists to warrant the claims of this paper.

The examples have limitations as discussed in the references. In general, all used reliable methods to reach their conclusions.

REFERENCES

Abramowicz, W., Kowalkiewicz, M., & Zawadzki, P. (2002). Tell me what you know or I'll tell you what you know: Skill map ontology for information technology courseware. *Proceedings of the 2002 Information Resources Management Association International Conference.*

Cavaleri, S. (1994). Soft systems thinking: A pre-condition for organizational learning. *Human Systems Management, 13*(4), pp. 259-267.

Chamberlin, D., Clark, J., Florescu, D., Simon, J., Robie, J, & Stofancscu, M. (2001). Xquery 1.0: An XML query language. WSC Working Draft 2001. Retrieved from the World Wide Web at: www.w3.org/TR/xquery/.

Cross, R. (2000). Technology is not enough: Improving performance by building organizational memory. *Sloan Management Review, 41*(3).

Davenport, T. H., & Prusak, L. (1998). *Working Knowledge.* Harvard Business School Press.

DeLone, W. H., & McLean, E.R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research,* 3.

Dodgson, M. (1993). Organizational learning: A review of some literatures. *Organization Studies, 14*(3), pp. 375-394.

Dunlop, M. D. (2000). Development and evaluation of clustering techniques for finding people. *Proceedings of the Third International Conference on Practical Aspects of Knowledge Management,* PAKM2000.

Easterby-Smith, M. (1997). Disciplines of organizational learning: Contributions and critiques. *Human Relations, 50*(9), pp. 1085-1113.

Eppler, M. J. (2001). Making knowledge visible through intranet knowledge maps: Concepts, elements, cases. *Proceedings of the Thirty-fourth Hawaii International Conference on System Sciences,* IEEE Computer Society.

Ezingeard, J.-N., Leigh, S., & Chandler-Wilde, R. (2000). Knowledge management at Ernst & Young UK: Getting value through knowledge flows. *Teaching Case,* pp. 807-822.

Gandon, F., Dieng, R., Corby, O., & Giboin, A. (2000). A multi-agent system to support exploiting an XML-based corporate memory. *Proceedings of the Third International Conference on Practical Aspects of Knowledge Management,* PAKM2000.

Hansen, M. T., Nohria, N., & Tierney, T. (1999, March-April). What's your strategy for managing knowledge? *Harvard Business Review,* pp. 106-116.

Huber, G. P. (1991). Organizational learning: The contributing processes and the literatures. *Organization Science,* 2.

Huber, G. P., Davenport, T. H., & King, D. (1998). Some perspectives on organizational memory. Unpublished Working Paper for the Task Force on Organizational Memory, F. Burstein, G. Huber, M., Mandviwalla, J. Morrison, & L. Olfman, (Eds.) Presented at the *31st Annual Hawaii International Conference on System Sciences.*

Huysman, M. H., Fischer, S. J., & Heng, M. S. H. (1994). An organizational learning perspective on information systems planning. *Journal of Strategic Information Systems, 3*(3).

Jennex, M. E. (2000). Using an intranet to manage knowledge for a virtual project team. *Internet-Based Organizational Memory and Knowledge Management,* Hershey, PA: Idea Group Publishing.

Jennex, M. E., & Olfman, L. (2001). Development recommendations for knowledge management/ organizational memory systems. *Contemporary Trends in IS Development,* Kluwer.

Jennex, M. E., & Olfman, L. (2002). Organizational memory/knowledge effects on productivity; A longitudinal study. *Proceedings of the 35th Annual Hawaii International Conference on System Sciences,* IEEE Computer Society.

Jennex, M. E., Olfman, L., Pituma, P., & Yong-Tae, P. (1998). An organizational memory information systems success model: An extension of DeLone and McLean's I/S success model. *Proceedings of the 31st Annual Hawaii International Conference on System Sciences,* IEEE Computer Society.

Kolb, D. (1984). *Experimental Learning.* Prentice-Hall.

Lindgren, R. (2002). Competence visualizer: Generating competence patterns of organizational groups. *Proceedings of the 35th Annual Hawaii International Conference on System Sciences,* IEEE Computer Society.

Malhotra, Y. (1996). Organizational learning and learning organizations: An overview. Retrieved from the World Wide Web at: www.brint.com/papers/orglrng.htm.

Malhotra, Y. (1998). Knowledge management for the new world of business. Retrieved from the World Wide Web at: www.brint.com/km/whatis.htm.

Miller, D. (1996). A preliminary typology of organizational learning: Synthesizing the literature. *Journal of Management, 22*(3), pp. 485-505.

Morrison, J., & Weiser, M. (1996). A research framework for empirical studies in organizational memory. *Proceedings of the Twenty-Ninth Annual Hawaii International Conference on System Sciences,* IEEE Computer Society Press.

Newell, S., Scarbrough, H., Swan, J., & Hislop, D. (1999). Intranets and knowledge management: Complex processes and ironic outcomes. *Proceedings of the 32nd Annual Hawaii International Conference on System Sciences,* IEEE Computer Society.

Newman, B., & Conrad, K. (2000). A framework for characterizing knowledge management methods, practices, and technologies. *Proceedings of the Third International Conference on Practical Aspects of Knowledge Management,* PAKM2000.

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

Robie, J., Lapp, J., & Schach, D. (1998). XML query language (XQL). *WWW The Query Language Workshop (QL).*

Smolnik, S., & Nastansky, L. (2002). K-discovery: Using topic maps to identify distributed knowledge structures in groupware-based organizational memories. *Proceedings of the 35th Annual Hawaii International Conference on System Sciences,* IEEE Computer Society.

Stein, E. W., & Zwass, V. (1995). Actualizing organizational memory with information systems. *Information Systems Research*, *6*(2).

Stenmark, D. (2002). Information vs. knowledge: The role of intranets in knowledge management. *Proceedings of the 35th Annual Hawaii International Conference on System Sciences,* IEEE Computer Society.

Te'eni, D., & Feldman, R. (2001). Performance and satisfaction in adaptive websites: An experiment on searches within a task-adapted website. *Journal of the Association for Information Systems, 2*(3).

Thompson, R. L., Higgins, C. A., & Howell, J. M. (1991, March). Personal computing: Toward a conceptual model of utilization. *MIS Quarterly*.

Walsh, J.P., & Ungson, G.R. (1991). Organizational memory. *Academy of Management Review, 16*(1).

Zhou, L., Booker, Q.E., & Zhang, D. (2002). ROD – Toward rapid ontology development for underdeveloped domains. *Proceedings of the 35th Annual Hawaii International Conference on System Sciences,* IEEE Computer Society.

Chapter XII

On the Design of Knowledge Management System for R&D Organization:

Integration of Process Management and Contents Management

Yongtae Park, Yeongho Kim, and Intae Kang
Seoul National University, Korea

ABSTRACT

This chapter proposes a framework for designing knowledge management system (KMS) for R&D organization. Broadly, KMS comprises two principal modules: a process management module to administer knowledge activities to generate and utilize knowledge, and a contents management module to deal with knowledge contents, input and output of knowledge activities. The two modules are then materialized through two operational systems: workflow *management system (WFMS) for R&D process and R&D knowledge management system (RKMS) for R&D contents. As a building block to integrate the two systems, workflow-based knowledge map is suggested. The authors admit that the research is an exploratory proposal that suggests merely a conceptual scheme. Therefore, it is required to elaborate detailed procedure and materialize real system.*

INTRODUCTION

Recently, knowledge management (KM) has attracted increasing recognition from academicians and practitioners alike. In a corporate setting, the functional spectrum of KM is so ample, ranging from procurement of raw material to the marketing of end products. Amongst others, R&D organization serves as the primary actor of knowledge management (KM), since it is the major source of knowledge generation and dissemination. Furthermore, R&D organization may be a challenging test bed for KM in that it needs to coordinate collaborative work among knowledge workers and ill-defined workflows across knowledge nodes. Despite the importance, however, little attention has been paid to development and implementation of KM for R&D organization. In this regard, the main purpose of this chapter is to propose a framework for designing KM system (KMS) of R&D organization.

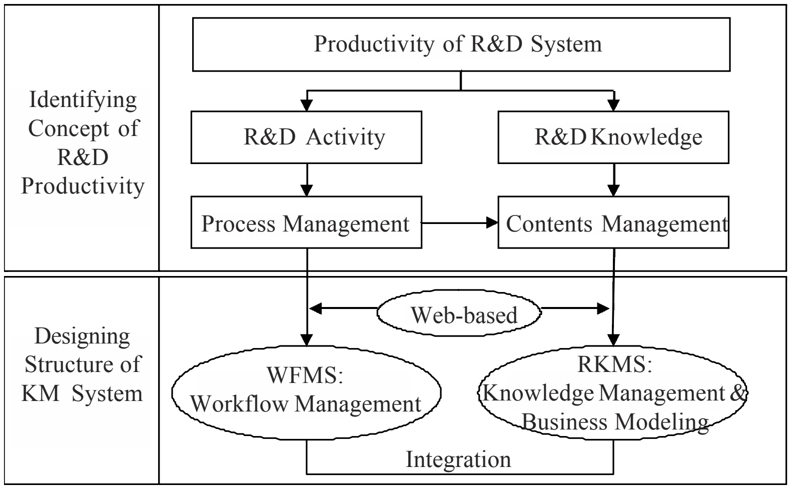
Broadly, KMS is composed of a process management module to administer knowledge activities to generate and utilize knowledge and a contents management module to deal with knowledge contents, input and output of knowledge activities. Accordingly, the framework is composed of two major pillars, process management for R&D activity and contents management for R&D knowledge. Then, we propose two operational systems: a workflow management system (WFMS) for R&D process and an R&D knowledge management system (RKMS) for R&D contents. The overall architectures of WFMS and RKMS are briefly described and the procedure to integrate RKMS and WFMS is explained. The proposed system is web-based in that it is designed and developed on the web environment.

OVERALL FRAMEWORK

Matching WFMS and RKMS

As explained before, KMS for R&D organization comprises two major components, R&D activities and knowledge contents. R&D activities are associated with processes to generate and utilize knowledge, and knowledge contents are related with input and output of knowledge activities. Therefore, the overall framework of KMS is constructed by matching process management to administer knowledge activities and contents management to deal with knowledge contents, as portrayed in Figure 1.

Figure 1: Overall Framework of KMS to Integrate WFMS and RKMS



Matching R&D Organization Types and KMS Domains

KMS of R&D organization encompasses heterogeneous and multi-disciplinary knowledge that is hard to formalize and R&D activities comprise complicated and unstable processes that are hard to standardize (Polanyi, 1966; Saren, 1984; Cooper, 1983; Clark, 1985). In particular, the notion of a sectoral pattern of innovation highlights differences across industrial sectors in terms of knowledge management (Pavitt, 1984). Therefore, it is impossible to propose a general structure of KMS that is applicable to all the forms of R&D organizations. The design of KMS, thus, needs to be customized by matching characteristics of individual R&D units and characteristics of KMS domains. To this end, it is necessary to classify R&D units into several types and to identify the best-practice form of KMS for each type of R&D units. The conceptual scheme of customization is depicted in Figure 2.

Figure 2: Matching of R&D Organization and KMS Domain

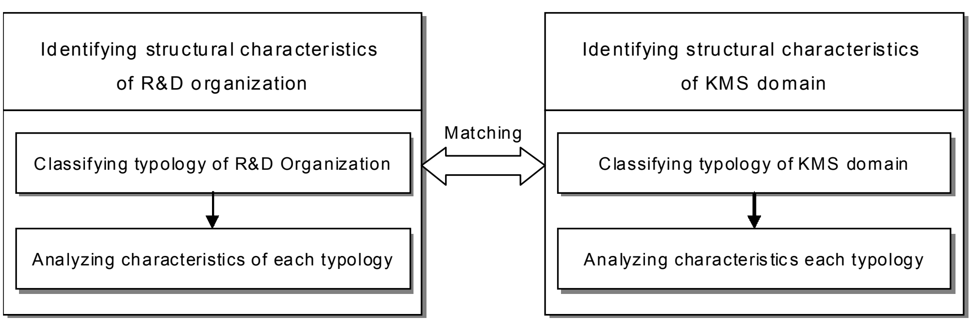


Table 1: Typology of R&D Organizations

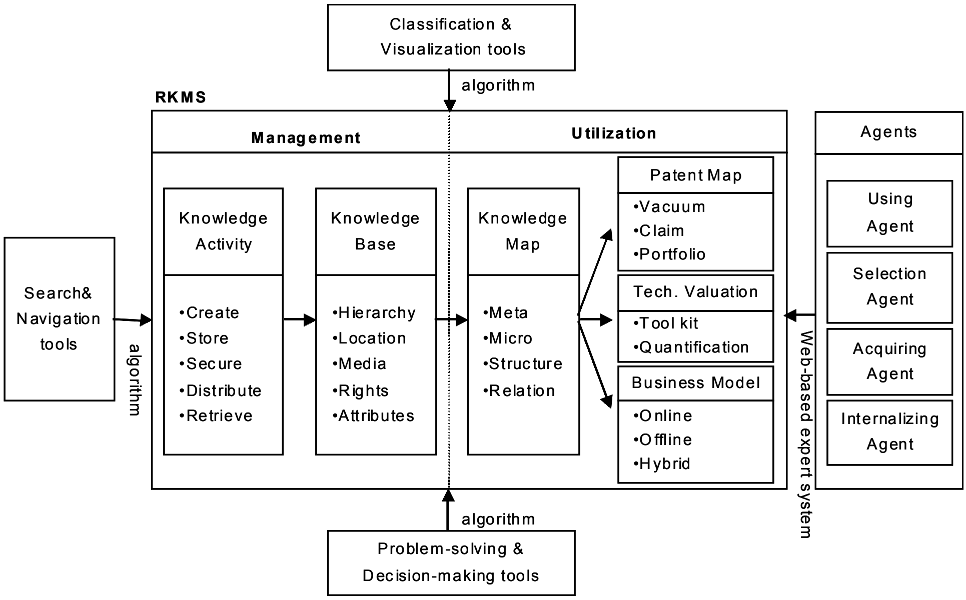
Typology of R&D organizations	Description
Product-oriented Organization	- R&D organization comprise separate units each takes charge of development of individual product
Process-oriented Organization	- R&D organization comprise separate units each is related to different process of research and/or manufacturing
Technology-oriented Organization	- R&D organization comprise separate units each takes charge of development of component technology
Function-oriented Organization	- R&D organization comprise separate units each takes charge of management of different function
Matrix(hybrid) Organization	- R&D organization comprise separate units, each is a hybrid combination of multiple features

To illustrate, as presented in Table 1, it may be possible to classify R&D units into five types and develop customized KMS domains according to the characteristics of each type (Park, 2001).

DESIGN OF RKMS

Once the correspondence between R&D organization type and KMS domain is established, the blueprint of RKMS is developed. In this chapter, we suggest a comprehensive system that covers the whole cycle of R&D activities, from initial research to ultimate commercialization. To this end, RKMS is composed of a main system and several supporting tools. The main system includes a management module to create, store, secure, distribute and retrieve knowledge and a utilization module to structure knowledge map, evaluate knowledge asset and commercialize knowledge to business model. To support the main system, several supportive tools such as classification, visualization, agent, navigation and decision-making criteria are also included in the framework. Figure 3 describes the overall architecture of RKMS.

Figure 3: Overall Architecture of RKMS

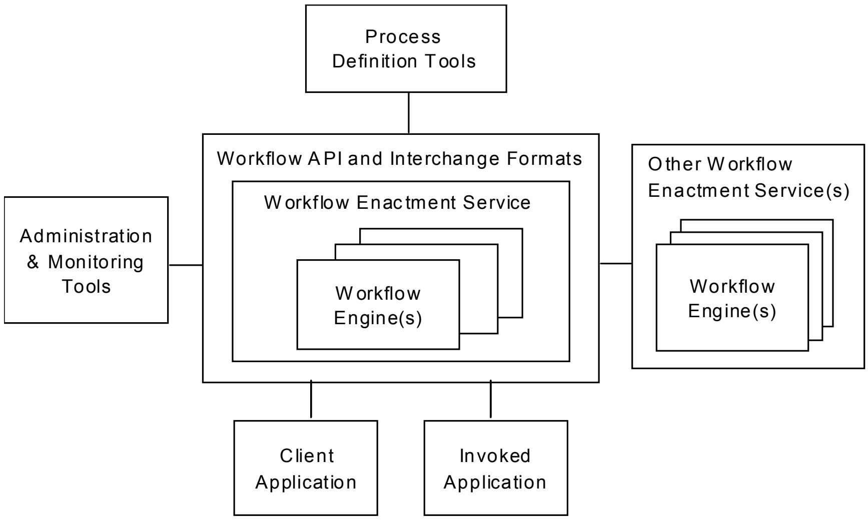


DESIGN OF WFMS

Broadly, workflow is a tool to define and administer business processes automatically and, in turn, becomes the core engine of WFMS that electronically operates and controls the R&D process. The usefulness of WFMS is highlighted as the amount of knowledge becomes intractably large, the business units are geographically decentralized but more closely networked and the importance of collaboration among individual workers is emphasized (WFMC, 2001; Kumar, Zhao, 1999; Kim et al., 2000).

In this chapter, WFMS is composed of two main modules: a definition module to identify and design R&D processes and an execution module to monitor the progress of processes, control and carry out tasks and manage application programs. These modules are basically developed and implemented on the workflow engine. The overall architecture of WFMS is exhibited in Figure 4.

Figure 4: Overall Architecture of WFMS

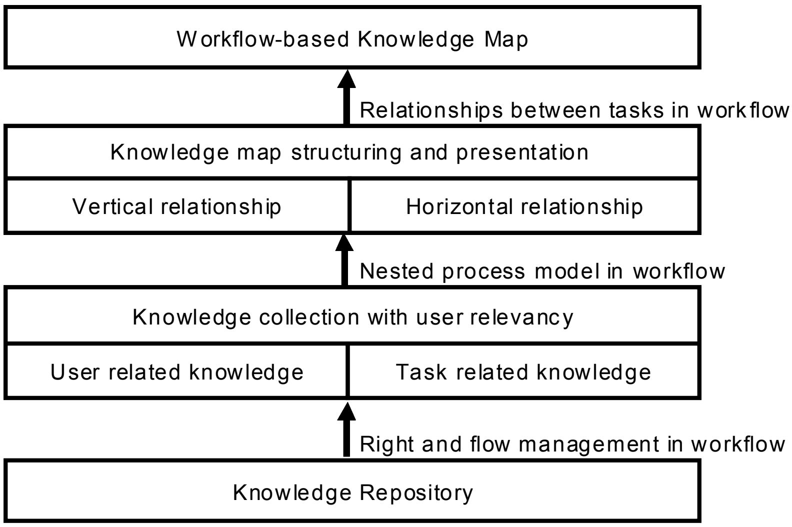


INTEGRATION OF WFMS AND RKMS

Finally, RKMS and WFMS need to be integrated. The integration of RKMS and WFMS is accomplished by developing a workflow-based knowledge map. The notion of knowledge map, defined as a visual architecture of knowledge domain, may be developed in diverse forms (Eppler, 1999), but a workflow-based map is suggested here. Since workflow is the backbone of process management and the knowledge map is the building block of contents management, the integration represents an exploratory effort to combine process management and contents management. Basically, the construction of a knowledge map of RKMS consists of two steps: knowledge collection and knowledge structuring. As depicted in Figure 5 and as explained below, these two steps of RKMS necessitate information from WFMS.

First, in the knowledge collection step, knowledge in the knowledge repository is filtered in accordance with knowledge users and related tasks. In building a knowledge map, it is critical to provide the right knowledge to the right user. For the relevancy in terms of knowledge contents and knowledge users, we need information on user and task attributes. This information is obtained from the process definition in WFMS. By doing so, the knowledge collection takes the relationship of user-task and task-knowledge into account.

Figure 5: Integration of WFMS and RKMS



In the second step, the filtered knowledge is structured and presented based on the vertical relationship and horizontal relationship of knowledge. The term vertical relationship means the hierarchical linkage of knowledge artifacts, whereas horizontal relationship indicates the input-output relationship of knowledge artifacts. The information on the vertical and horizontal relationship among knowledge artifacts is also obtained the workflow definition of WFMS. The proposed system is web-based in that it is designed and developed on the web environment.

CONCLUSIONS AND FUTURE WORK

In this chapter, we proposed a framework for designing workflow-based KMS of R&D organization. The framework consists of two major components: WFMS for process management and RKMS for contents management, whereby RKMS derives necessary information from WFMS. In doing that, it was emphasized that the design of KMS needs to be customized by matching characteristics of R&D units and KMS domains.

This research in nature is an exploratory proposal that suggests merely a conceptual scheme. Therefore, it is required to elaborate detailed procedure and materialize real system. Specifically, the notion of workflow-based knowledge map needs to be put in a definite shape. The definition module of WFMS is another source of difficulty, since the workflow of the R&D process is hard to generalize. Finally, the identification and determination of the relationship among knowledge necessitates that more practical efforts should be made from the perspective of the knowledge user, rather than the system developer.

REFERENCES

Clark, K. (1985). The Interaction of design hierarchies and market concepts in technological innovation. *Research Policy,* 14, pp. 235-251.

Cooper, R. (1983). The new product process: An empirically-based classification scheme. *R&D Management, 13*(1), pp. 1-13.

Eppler, M. (2001). Making knowledge visible through intranet knowledge maps: Concepts, elements, cases. *Proceedings of 34th Hawaii International Conference on System Sciences,* IEEE, pp. 1530-1539.

Kim, Y., Kang, S., & Kim, D. (2000). WW-FLOW: Web-based workflow management with runtime encapsulation. *IEEE Internet Computing, 4*(3), pp. 55-64.

Kumar, A., & Zhao, J. (1999). Dynamic routing and operational controls in workflow management systems. *Management Science, 45*(2), pp. 253-272.

Park, Y. (2001). A framework for designing technological knowledge management systems: A sector-specific approach. *Intangibles in Competition and Cooperation.* Banerjee, P. & Richter, F. (Eds). New York: Palgrave.

Pavitt, K. (1984). Sectoral patterns of technical change: Towards a taxonomy and a theory. *Research Policy,* 13, pp. 343-373.

Polanyi, M. (1966). *The Tacit Dimensions.* New York: Doubleday.

Saren, M. (1984). A classification and review of models of the intra-firm innovation process. *R&D Management, 14*(1), pp. 11-24.

WfMC (2001). The workflow coalition specification – Interface 1: Process definition interchange process model. Retrieved from the World Wide Web: http://www.wfms.org.

Section IV

Case Studies of Knowledge Management in Practice

Chapter XIII

Developing Business Aligned Knowledge Management Strategy

El-Sayed Abou-Zeid
Concordia University, Canada

ABSTRACT

With the growing awareness of the crucial role that knowledge can play in gaining competitive advantage, several issues with regard to knowledge management (KM) initiatives have challenged executives. The articulation of the relationship between an organization's competitive strategy and its knowledge strategy is the most eminent. This chapter addresses the issue of how to align knowledge strategy with enterprise business strategy. Based on the premise that the realization of business value from KM investments requires alignment between business and knowledge strategies, the issue is addressed by developing a strategic alignment model for KM. This model, which is based on the Henderson-Venkatraman strategic alignment model, includes the external domains (opportunities/threat) and internal domains (capabilities/arrangements) of both business (B-) and knowledge (K-) strategies and the relationships between them. Furthermore, it provides alternative strategic choices. The model is used to study a KM initiative at Buckman Laboratories.

INTRODUCTION

The role of knowledge as a crucial asset for an enterprise's survival and advancement has been recognized by several researchers (e.g., Von Krogh, Ichijo, Nonaka, 2000). Moreover, by having knowledge (intellectual resources), an organization can understand how to exploit and develop its traditional resources better than its competitors can, even if some or all of those traditional resources are not unique (Zack, 1999a).

However, realizing the importance of organizational knowledge and its management in creating value and in gaining competitive advantage is only the first and the easiest step in any knowledge management (KM) initiative. The second, and almost as important, step is to answer how and where to begin questioning (Earl, 2001). In fact "many executives are struggling to articulate the relationship between their organization's competitive strategy and its intellectual resources and capabilities (knowledge)" (Zack, 1999a). As Zack (1999a) argued, they need a pragmatic, yet theoretically sound, model. The required model has to meet at least two criteria. First, it must explicitly include the external domains (opportunities/threat) and internal domains (capabilities/arrangements) of both business (B-) and knowledge (K-) strategies and the relationships between them. Second, it must provide alternative strategic choices.

This chapter stems from the premise that the realization of business value gained from KM investment requires alignment between the business (B-) and knowledge (K-) strategies of the firm. Therefore, it addresses the aforementioned issues by developing a "strategic alignment model (SAM)" for KM initiatives. It is based on the Henderson-Venkatraman SAM for IT (Henderson & Venkatraman, 1993).

The remainder of this chapter is organized as follows: The Henderson-Venkatraman SAM for IT (ITSAM) is first presented. Next, the KM Strategic Alignment Model (KMSAM) is developed and used to study the KM initiative at Buckman Laboratories. The paper then concludes by discussing the implications of the proposed metamodel and future research.

OVERVIEW OF THE HENDERSON-VENKARTAMAN STRATEGIC ALIGNMENT MODEL

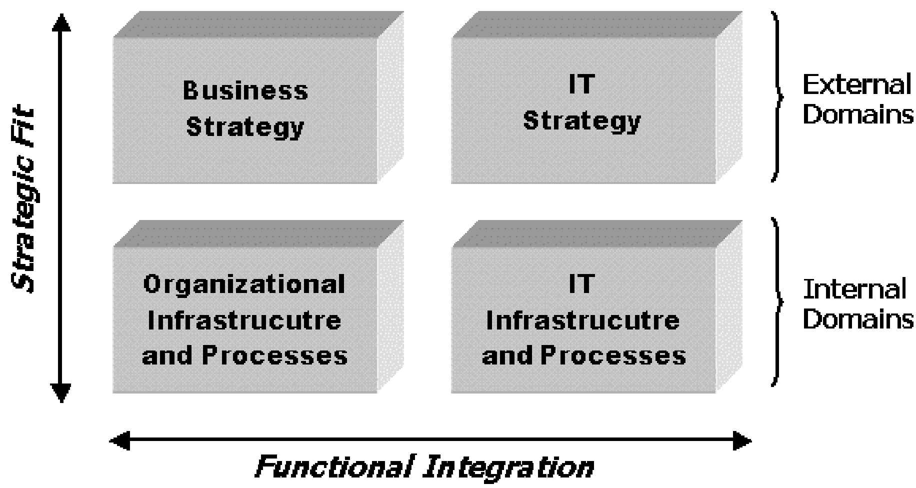
The strategic alignment model (SAM), the framework for this study, is based on the theoretical construct developed by Henderson and Venkatraman (1993). In this model, business success is viewed as the result of the synergy between four domains. The first two, the external domains, are business strategy and information technology (IT) strategy. The strategy domains are described in terms of (business/technology) scope, (distinctive business/IT systemic) competencies and (business/

IT) governance. The second two, the internal domains, are organizational infrastructure and processes and IT infrastructure and processes. Both internal domains are described in terms of (administrative/IT) infrastructure, (business/IT) processes and (business/IT) skills. This synergy is achieved through two types of relationship:

- *Strategic fit* emphasizes the need for consistency between strategy (external domain) and its implementation (internal domain).
- *Functional integration*, which has two modes, extends the strategic fit across functional domains. The first mode, *strategic integration*, deals with the capability of IT functionality both to shape and to support business strategy. The second mode, operation integration, focuses on the criticality of ensuring internal coherence between organizational infrastructure and processes and IT infrastructure and processes.

Figure (1) shows the elements of the IT Strategic Alignment Model (ITSAM).

Figure 1: IT Strategic Alignment Model (Henderson & Venkatraman, 1993)



KM Strategic Alignment Model

Whereas the premise of the original ITSAM is that, "the effective and efficient utilization of IT requires the alignment of IT strategies with business strategies" (Henderson & Venkatraman, 1993), the premise of knowledge management SAM (KMSAM), in which knowledge strategy replaces IT strategy, is that, "the effective and efficient use of organizational knowledge requires the alignment of knowledge strategies with business strategies." Since strategy, whether business (B)-strategy or knowledge (K)-strategy, can be seen as a balancing act between the *external domain* (opportunities/threats) and the *internal domain* (capabilities/arrangements) of the firm (strengths and weaknesses) (Henderson & Venkatraman, 1993; Zack, 1999a), the external and internal domains of K-strategy first have to be defined.

K-Strategy External Domain

In the case of K-strategy, the *external domain* involves three dimensions: *K-Scope* (what the firm must know), *K-Systemic Competencies* (what are the critical characteristics of the required knowledge) and *K-Governance* (how to obtain the required K-competencies). The first dimension, K-Scope, deals with the specific domains of knowledge that are critical to the firm's survival and advancement strategies. Survival strategies aim at securing current enterprise profitability, while advancement strategies aim for future profitability (Von Krogh et al., 2000).

In order to identify the required knowledge, two concepts are introduced. First, is the concept of the enterprise's cognitive domain, which is composed of all relevant things, together with the set of possible relationships between them, toward which thought or action is directed or is communicated by the members of the enterprise, i.e., business (B-) things. Examples of B-things include: business outcomes, business processes, resources, business rules (Davenport, Sbort, 1990; Eriksson, Penker, 2000; McDavid, 1999), consumer, supplier, competitors, and partners (e.g., distributors, vendors, banks, …).

Second, is the concept of knowledge (K-) thing. A K-thing describes the knowledge about the knowledge associated with a B-thing, i.e., the meta-knowledge. Each B-thing in the enterprise's cognitive domain is associated with certain knowledge that is needed to deal with it or to act upon it (Grant, Baden-Fuller, 1995). For example, STEP (The Standard for the Exchange of Product Model Data) data architecture recognized three categories of knowledge to be associated with a product, i.e., classification, marketing and technical (Fowler, Boyle, 1997). Classification knowledge is concerned with how the product is classified or categorized. Marketing knowledge is concerned with how the product is presented to the market. Finally, technical knowledge is the technical description of the product for the purpose of design, engineering, manufacturing, operations, maintenance, etc. This knowledge is characterized in terms of one or more knowledge thing (K-thing). Such a distinction between B-things and K-things is important, since the knowledge associated with a B-thing is in constant change and is context-dependent. For example, the knowledge required to manufacture certain product may change because of the introduction of new technology or the emergence of new marketing demands. Table (1) shows examples of a K-thing's attributes that characterize the knowledge associated with a B-thing.

Table 1: Examples of the Attributes of a K-Thing

Attribute	**Description**
Actualization	The list of products, services, or processes in which the available or the required knowledge is/will be used.
Convertibility	The ability and the feasibility of converting knowledge from one form to another.
Compositionality	The amenability of knowledge to be synthesized from existing knowledge.
Currency	The recentness of knowledge.
Form	The form of the available/required knowledge: tacit, explicit.
Mode of Generation	The way by which the new knowledge is generated, i.e., acquisition, externalization, discovery, synthesis, creation.
Mode of Mobilization	The way in which the organizational knowledge, whether explicit or tacit, is distributed or shared.
Mode of Preservation	The way in which the organizational knowledge, whether explicit or tacit, is preserved.
Ownership	The bearers or the sources of available or required knowledge.
Value	The business value of actualized knowledge.
Visibility	The list of individuals and collectives who can access the knowledge.

Based on the concepts of B-thing and K-thing, determining the K-scope can be achieved by constructing a B-things/K-things matrix that documents the current and required state of organizational knowledge concerning some or all of the constituents of the enterprise cognitive domain. The first group of elements that constitute this matrix includes the list of B-things in the enterprise cognitive domain. The second group of elements includes the K-things that describe the current state of knowledge associated with each of the relevant B-things. To relate this knowledge to enterprise business strategies, K-things are further classified according to the roles they play in such strategies. Von Krogh et al. (2000) have suggested that there are two types of strategies: survival and advancement. Survival strategies aim at securing current enterprise profitability, while advancement strategies aim for future profitability. Therefore, organizational knowledge, and consequently K-things, are classified into two categories: survival (K_S) and advancement (K_A). Figure (2) shows the generic form of this matrix.

Figure 2: The Generic Form of B-Things/K-Things Matrix (Abou-Zeid, 2002)

	Survival Knowledge			**Advancement Knowledge**		
B_1	K_{S11} (Current/Required States)	….	K_{S1n} (Current/Required States)	K_{A11} (Current/Required States)	….	K_{A1m} (Current/Required States)
B_2	K_{S21} (Current/Required States)	….	K_{S2k} (Current/Required States)	K_{A21} (Current/Required States)	….	K_{A2l} (Current/Required States)
….	….	….	….	….	….	….
B_N	K_{SN1} (Current/Required States)	….	K_{SNk} (Current/Required States)	K_{AN1} (Current/Required States)	….	K_{ANl} (Current/Required States)

The second dimension of the K-strategy external domain is K-systemic competencies. The focus of this dimension is the set of utilization-oriented characteristics of knowledge that could contribute positively to the creation of new business strategy or to better support of existing business strategy. This set includes characteristics such as:

- *Accessibility*, the extent to which organizational knowledge is made available to its members, regardless of time or location (Buckman, 1998);
- *Transferability*, the extent to which the newly acquired knowledge can be applied in other contexts, e.g., organizational, cultural (Grant, 1996);
- *Appropriability*, the extent to which knowledge can be imitated. Things are said to have "strong" appropriability if they are difficult to reproduce by another organization. The converse is "weak" appropriability. A related concept is that of "sticky/slippery", i.e., sticky knowledge is such an integral part of a regime that it cannot be extracted in a meaningful whole (Grant, 1996; Narasimha, 2000);
- *Depth and breadth* (Narasimha, 2000);
- *Compositionality*, the amenability of knowledge to be synthesized from existing knowledge; and
- *Integrateability*, the extent to which the newly acquired knowledge can be integrated with existing knowledge.

Finally, the K-governance dimension deals with the selection and use of mechanisms for obtaining the required K-competencies. The following are examples of some "acquisition mechanisms" (Probst, Raub, Romhardt, 2000):

- Bringing experts to the firm by recruiting specialists as full-time or temporary staff. Temporary hiring is becoming an increasingly interesting alternative.
- Tapping knowledge held by other firms through different inter-organizational co-operation forms, such as joint ventures or strategic alliances.
- Utilizing the knowledge of stakeholders, e.g., customers, suppliers, employees and owners. For example, involving customers early in the product-development process could generate valuable information about their needs.
- Acquiring knowledge products, such as software, patents, and CD-ROMs.

K-Strategy Internal Domain

In the case of *K-strategy,* the internal domain involves three dimensions: *Knowledge (K)-infrastructures, Knowledge (K)-processes* and *Knowledge (K)-skills*. Organizational knowledge processes are socially interaction-intensive. They involve social interactions and direct communication and contact among individuals and among members of "communities of practice." Therefore, they require the presence of social capital. Social capital is "the sum of actual and potential resources embedded within, available through, and derived from the network of relationships possessed by a social unit" (Nahapier, Ghoshal, 1998). Recognizing the importance of social capital, Gold et al. (2001) have identified three key K-infrastructures, i.e., technical, structural and cultural, that enable social capital. The *K-technical infrastructure* includes IT-enabled technologies that support KM activities, such as business intelligence, collaboration and distributed learning, K-discovery, K-mapping, opportunity generation and security. The *K-structural infrastructure* refers to the presence of enabling formal organization structures and the organization's system of rewards and incentives. Finally, the *K-cultural infrastructure* involves elements, such as corporate vision and the organization's system of values (Gold et al., 2001).

The second dimension of the K-strategy internal domain, Knowledge (K)-processes, deals with the processes that change the states of K-things. While things in the cognitive domains of the enterprise (B-things) are relatively stable, the associated K-things are in a state of continual change. For example, during its life cycle K-things can exist in different states that correspond to the states of the knowledge associated with B-things. The life cycle of a K-thing starts with the "Being identified" state. This state occurs whenever the necessity of having certain knowledge relevant to a B-thing becomes obvious, and the form of the required knowledge, together with its owner/bearer, is identified. After being identified the K-thing may have many states, such as "Being created," "Being acquired," "Being discovered," "Being synthesized," "Being externalized," "Being preserved," "Being actualized," "Being justified," "Being updated," "To be evaluated," "Being evaluated," "Being mobilized," and "Being visible." Some of these states are composite; for example, the state "Being justified" contains nested states such as "Being conceptually justified" and "Being commercially justified" (Abou-Zeid, 2002). The state transitions of a K-thing are caused by performing one or more K-manipulating processes. Based on the literature review (e.g., Firestone, 1999; Nissen, Kamel, Sengupta, 2000; Nonaka, 1994; Probst et al., 2000; Zack, 1999b) and on analysis of several KM initiatives (e.g., Davenport, 1998; Elliott, 1997, 1998), K-manipulation processes can be classified into three main categories, i.e., K-generation, K-mobilization and K-application.

K-Generation Processes

The knowledge generation process includes all activities by which new knowledge is generated within the organization. There are several types of knowledge generation, namely:

- *Acquisition*, where the new knowledge is acquired from external sources;
- *Externalization*, where the convertible tacit knowledge of the members of the organization is conceptualized and articulated;
- *Discovery*, where the knowledge hidden in the data sources of the organization (e.g., databases, data warehouses) is discovered (O'Leary, 1998);

- *Synthesis*, where the new knowledge is generated either by integrating the newly generated and validated knowledge with the existing knowledge or by combing the existing knowledge;
- *Production (creation)*, where the new knowledge is produced by interacting with the things in the cognitive domains of the enterprise (Cook, Brown, 1999).

K-Mobilization Processes

Knowledge mobilization means increasing the visibility of knowledge by sharing it or transferring it from one bearer (the knowledge provider, owner or source) to another (the knowledge seeker or target) through space or time. The knowledge bearer could be an artifact, such as technical documents or best practice databases, or human, such as experts in a certain domain. Based on the nature of the provider/source and seeker/target, four K-mobilization types can be distinguished, i.e., human-human, human-artifact, artifact-human and artifact-artifact.

- *Human-human:* Mobilizing knowledge among individuals depends on its form. In the case of tacit knowledge, this mode can be realized through activities such as *socialization*, which results in the creation of common perspectives and shared experience (Nonaka, 1994) or *informal and semi-formal learning*, e.g., mentorship and apprenticeship. In the case of explicit knowledge, it can be realized through activities such as *formal learning*, i.e., professional training. Moreover, through these activities individual knowledge will be preserved by extending its ownership range.
- *Human-artifact:* Two processes are needed in order to transfer the explicit knowledge and store it in physical media, i.e., knowledge (K-) refinement and knowledge (K-) preservation processes. *K-refinement process* consists of all the knowledge activities intended to refine existing or newly generated explicit knowledge, e.g., testing, labeling, indexing, abstracting, restructuring, and to maintain (update) the existing explicit knowledge (Zack, 1999b). The refined knowledge is then preserved. The *K-preservation process* includes activities, such as formalizing, codifying, organizing, and storing in different media.
- *Artifact-human:* This type of K-mobilization includes the processes that aim at increasing the visibility of the preserved explicit knowledge that is stored in physical media, i.e., K-delivery and K-presentation. An example of such processes is *K-delivery process,* which includes activities such as pushing/pulling, searching/retrieving. However, as knowledge and knowledge use are context-dependent, whether this context is related to the individual user or to the business process in which it will be used, the effective use/re-use of knowledge depends upon the degree to which the presented knowledge matches its context-of-use. From this perspective, the *K-presentation process* aims to develop the capabilities for presenting explicit knowledge "with sufficient flexibility to render it meaningful and applicable across multiple contexts of use" (Zack, 1999b).

- *Artifact-artifact:* The main purpose of the processes of this type of K-mobilization is to develop and implement machine-processable representations of the semantics of the preserved knowledge. For example, the Resource Description Framework (RDF) specifications provide a lightweight ontology system to support the exchange of knowledge on the Web. It provides interoperability between applications that exchange machine-understandable information on the Web (Harmelen, Fensel, 1999; W3C, 1999).

K-Application Processes

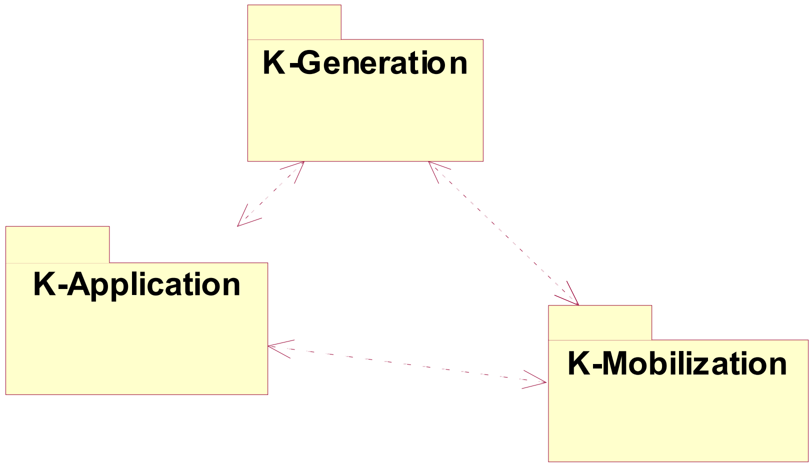
During K-application processes, knowledge is embodied in various forms. Knowledge can be used to develop new product/service/business processes or to improve existing ones. Associated with the processes of K-application are the processes of *K-evaluation,* which includes all the activities that aim at justifying and measuring the business value of the knowledge. Von Krogh et al. (2000) have identified three types of knowledge justification. The first type, strategic justification, includes justifying the newly generated knowledge against the advancement and survival strategies of the company. The second type, stakeholders' justification, focuses on evaluating the stakeholders' attitudes towards the newly generated knowledge. The final type, emotional justification, concerns the aesthetic value of the newly generated knowledge (Von Krogh et al., 2000). The K-evaluation process may initiate a *K-identification process,* which includes all the activities that develop the awareness of the need to create new K-things or to update existing ones. It also includes activities that determine the form, the convertibility, and the owner(s) of the required knowledge. The following are examples of such activities:

- Determining the knowledge gap by comparing knowledge needs with the existing knowledge.
- Identifying the form and convertibility of the required knowledge.
- Identifying the possible internal and external sources of the required knowledge.

Figure (3) shows the cyclical nature of K-manipulating processes.

However, knowledge processes are characterized by their dual nature. On the one hand, there are K-manipulating processes, i.e., processes such as acquiring knowledge, converting it into a useful form, applying it, and protecting it. On the other hand, it has been identified that cultural and organizational issues are crucial in the successful deployment of KMS (Alavi, Leider, 1999; Von Krogh et al., 2000). Therefore, each K-manipulating process should be associated with one or more K-enabling process. The following are examples of K-enabling processes (Von Krogh et al., 2000):

Figure 3: K-Manipulating Processes



Managing Conversation

This process includes setting the guiding principles for holding fruitful conversations with respect to encouraging active participation, establishing conversational etiquette, editing, and fostering innovative language.

Mobilizing Knowledge Activists

The principal activities of this process consist of triggering K-manipulating activities throughout the different parts of an enterprise, coordinating them, and providing overall directions for them. These activities are performed by the "knowledge activist," which could be an individual, group or function.

Creating the Right Context

As K-manipulating activities are crucially dependent on social interactions among the organizational members, this process aims at setting "shared spaces" - physical, cyber, and mental - that enhance existing interactions and foster new ones. This involves creating the organizational structures that foster solid and effective collaboration.

Globalizing Local Knowledge

This process aims at supporting the creative approach to knowledge mobilization. Since knowledge is context-sensitive, it cannot be treated as a "commodity" that can be packaged and shipped to another location, within or outside the organization, to be readily re-used. Rather, to be effective, it must be reshaped by local experience and expectations, and justified by local values. In other words, it must be re-created.

Table 2: K-Manipulating Processes and the Associated K-Enabling Processes

K-Manipulating Processes	K-Enabling Processes: Instilling K-Vision	Managing Conversation	Mobilizing Knowledge Activists	Creating the Right Context	Globalizing Local Knowledge
K-Generation					
K-Acquisition	✓				
K-Externalization	✓	✓✓	✓	✓	
K-Discovery	✓				
K-Synthesis	✓	✓✓	✓	✓	
K-Production (creation)	✓	✓✓	✓	✓	
K-Mobilization					
K-Human-human		✓✓	✓	✓✓	
K-Preservation (K-Human-artifact Mobilization)	✓			✓	
K-Presentation (K-Artifact-human Mobilization)	✓	✓		✓	
K-Artifact-artifact Mobilization	N/A	N/A	N/A	N/A	N/A
K-Application					
K-Utilization				✓	✓✓
K-Evaluation	✓✓	✓✓	✓		
K-Identification	✓✓				

Table (2) is an extension of the von Krogh et al. (2000) knowledge enabling grid. It shows the links between K-manipulating processes and K-enabling processes, and to what degree each K-enabling process affects the related K-manipulating process.

The last dimension of the K-strategy internal domain is K-skills. KM processes are by their very nature multifaceted. They involve many dimensions, such as technical, organizational and human. This characteristic of KM processes reflects on the nature of skills required to perform them. For example, Malhotra (1997) defines a senior Knowledge Executive, such as a Chief Knowledge Officer (CKO) or an Organizational Knowledge Architect, as the person who should have the combined capabilities of a business strategist, technology analyst, and a human resource professional. The ability to facilitate the ongoing process of knowledge sharing and knowledge renewal, the ability to develop the human and cultural infrastructure that facilitates information sharing, and the ability to utilize the available technologies for serving the creation, sharing and documentation of knowledge are some examples of the required skills.

The Dynamics of KMSAM

Affecting a change in any single domain requires the use of three out of the four domains to assure that both strategic fit and functional integration are properly addressed. Therefore, applying KMSAM requires the identification of three domains: pivot, anchor and impacted (Luftman, 1996). The pivot domain is the weakest and offers the greatest opportunity for improvement. The anchor domain is the strongest and will be the driver of change. Finally, the impacted domain is the area affected by a change to the pivot domain. Figure (4) shows the dynamics of the strategic alignment process. Based on this distinction, 12 perspectives of strategic alignment can be identified (see Table (3)). Among the 12 perspectives, the last four are fusion perspectives that result from fusing two of the eight single-path perspectives. In the fusion perspectives, the pivot domain is not directly adjacent to the anchor domain (Luftman, 1996).

Figure 4: The Dynamics of the Strategic Alignment Process

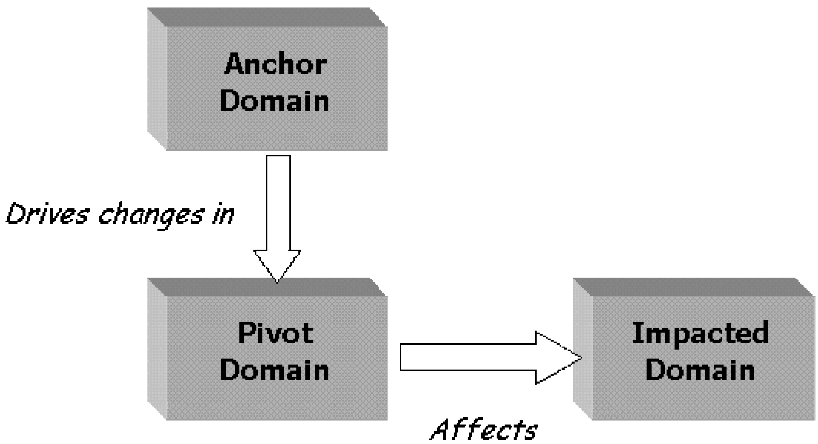


Table 3: KM Strategic Alignment Perspectives

	Strategic Perspective \ Domain	Anchor Domain	Pivot Domain	Impacted Domain
1	**Strategy Execution**	Business Strategy	Organizational Infrastructure	K-Infrastructure
2	**Technology Potential**	Business Strategy	K Strategy	K-Infrastructure
3	**Competitive Potential**	K-Strategy	Business Strategy	Organizational Infrastructure
4	**Service Level**	K-Strategy	K-Infrastructure	Organizational Infrastructure
5	**K-/Organizational Infrastructure**	K-Infrastructure	Organizational Infrastructure	Business Strategy
6	**K-Infrastructure/ K-Strategy**	K-Infrastructure	K-Strategy	Business Strategy
7	**Organizational/ K-Infrastructure**	Organizational Infrastructure	K-Infrastructure	K-Strategy
8	**Organizational Infrastructure/ Business Strategy**	Organizational Infrastructure	Business Strategy	K-Strategy
9	**K-Infrastructure Fusion** (Perspectives 1 + 2)	Business Strategy	▪ Organizational Infrastructure ▪ K- Strategy	K-Infrastructure
10	**Organizational Infrastructure Fusion** (Perspectives 3+ 4)	K-Strategy	▪ Business Strategy ▪ K-Infrastructure	Organizational Infrastructure
11	**Business Strategy Fusion** (Perspectives 5+ 6)	K-Infrastructure	▪ Organizational Infrastructure ▪ K- Strategy	Business Strategy
12	**K-Strategy Fusion** (Perspectives 7+ 8)	Organizational Infrastructure	▪ Business Strategy ▪ K-Infrastructure	K-Strategy

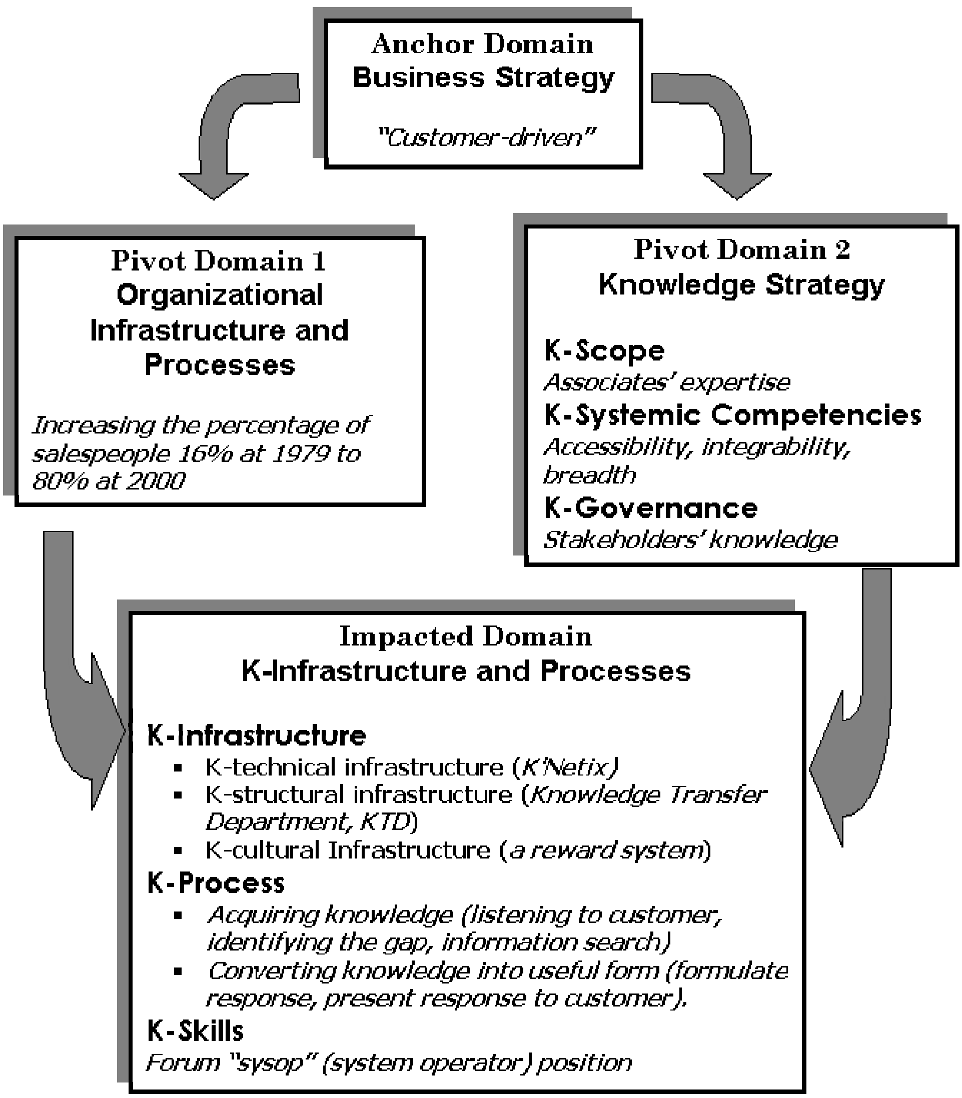
KMSAM AT BUCKMAN LABORATORIES

In order to illustrate its interpretive power, KMSAM it will be used to study one of the KM initiatives at Buckman Laboratories (Buckman, 1998; Fulmer, 1999; Pan, Scarbrough, 1999; Rifkin, 1996). The first KM initiative, global knowledge sharing, was introduced when Robert Buckman, who became the new chairman and CEO in 1978, was convinced that the company was too "product driven" and not sufficiently "customer driven." This shift reflected Buckman's belief that "cash flow is generated on the front line with customers, by associates…who have built relationships of continuity and trust, face-to-face with the customer" (Fulmer, 1999). To realize such a strategic shift, the percentage of salespeople, i.e., those employees "effectively engaged with the customer," was increased from 16% in 1979 to 80% by 2000 (Rifkin, 1996). Moreover, salespeople must provide fast and correct answers to customers by deploying the company's tacit knowledge, carried in the heads of the company's associates, at the points of sale. The new K-strategy that emerged from this strategic business shift was characterized by its emphasis on associates' expertise (K-scope), accessibility, integrateability and breadth of knowledge - "replace the depth of knowledge offered in a multi-tiered hierarchy with the breadth of knowledge that is the sum of the collective experience of employees" (Fulmer, 1999) - (K-systemic competencies) and "utilizing stakeholders' knowledge" as the main mechanism for acquiring knowledge (K-governance).

The implementation of this new K-strategy was accomplished by developing K-infrastructures, K-processes and K-skills. The first component of K-infrastructures, K-technical infrastructure, is K'Netix, a global corporate intranet consisting of e-mail, seven forums, files of company knowledge and databases of 'fluid' knowledge. K'Netix's forums are "open spaces" where anyone can post a message, question, and/or request for help. The second component, K-structural infrastructure, is the Knowledge Transfer Department (KTD) which is formed by merging three departments: IS, Telecommunication and Technical Information Center. The last component, K-cultural Infrastructure, includes a reward system, "the most powerful people are those who become a source of knowledge by sharing what they know" (Rifkin, 1996) and Buckman's Code of Ethics that "provides the basis for the respect and trust that are necessary in a knowledge sharing environment" (Fulmer, 1999). As both Buckman's B-strategy and K-strategy are customer driven, the K-sharing flow includes processes such as K-acquisition (listening to customer), K-externalization (formulating response), and K-presentation (presenting response to customer). Finally, the K-skills at Buckman Laboratories are exemplified by the forum "sysop" (system operator) position, which has been established to facilitate discussion, promote usage, track requests and make sure that they were fulfilled and to assist users.

From the previous discussion, one can identify the "K-infrastructure fusion" strategic alignment perspective adopted by Buckman Laboratories. In this perspective, B-strategy is the anchor domain that drives the change, K-strategy and organizational infrastructure are pivot domains and K-infrastructure and processes are the impacted domain. Figure (5) shows the "K-infrastructure fusion" perspective at Buckman Laboratories.

Figure 5: "K-Infrastructure Fusion" Perspective at Buckman Laboratories



CONCLUSION

Based on the premise that the realization of business value from KM investments requires alignment between the business and knowledge strategies and on the IT strategic alignment model (SAM) developed by Henderson and Venkatraman (1993), a KM strategic alignment model (KMSAM) is developed. The interpretive power of KMSAM is illustrated by studying the KM initiative at Buckman Laboratories. Moreover, it provides executives with a logical framework for analyzing and assessing alternative strategic choices with regard to aligning K-strategy and B-strategy.

Extension of this work would move in two directions. The first would be to use KMSAM in a cross-sectional study of KM initiatives in order to identify the dominant patterns of K-strategy and B-strategy alignment. As "strategic alignment is not an event, but a process of continuous adaptation and change" (Henderson, Venkatraman, 1993), the second direction would be a longitudinal study of each enterprise cycle around the alignment perspectives and how the adopted perspective is related to the degree of maturity of the KM initiative.

REFERENCES

Abou-Zeid, E. (2002). A knowledge management reference model. *Journal of Knowledge Management, 6*(5), 486-499 (forthcoming).

Alavi, M., & Leider, D. (1999). Knowledge management systems: Issues, challenges, and benefits. *Communication of the AIS, 1*(7).

Buckman, R. (1998). Lions, tigers and bears: Following the road from command and control to knowledge sharing. *White Paper*, Retrieved from the World Wide Web at: http://www.knowledge-nurture.com/.

Cook, S., & Brown, J. (1999). Bridging epistemologies: The generative dance between organizational knowledge and organizational learning. *Organization Science, 10*(4), pp. 381-400.

Davenport, T. H. (1998). Teltech: The business of knowledge management case study. Retrieved from the World Wide Web at: http://www.bus.utexas.edu/kman/telcase.htm.

Davenprot, T., & Sbort, J. (1990, *Summer*). The new industrial engineering: Information technology and business process redesign. *Sloan Management Review*, pp. 11-27.

Earl, M. (2001). Knowledge management strategies: Toward a taxonomy. *Journal of Management Information Systems, 18*(1), pp. 215-233.

Elliott, S. (1997). Case corporation's pilot effort proves value of knowledge management. *Knowledge Management in Practice* (10).

Elliott, S. (1998). Broderbund builds stong 'case' for internal, external knowledge sharing. *Knowledge Management in Practice* (14).

Eriksson, H., & Penker, M. (2000). *Business Modeling with UML*. John Wiley.

Firestone, J. (1999). Enterprise knowledge management modeling and distributed knowledge management systems. Retrieved from the World Wide Web at: http://www.dkms.com/EKMDKMS.html.

Fowler, J., & Boyle, A. (1997). From Product to Product Knowledge Modelling in STEP. Retrieved from the World Wide Web at: http://www.pdtsolutions.co.uk/standard/papers/pdtag/paper.htm.

Fulmer, W. (1999). *Harvard Business School Case Study on Knowledge Sharing at Buckman Laboratories* (N9-899-175).

Gold, A., Malhotra, A., & Segars, A. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems, 18*(1), pp. 185-214.

Grant, R. (1996, Winter Special Issue). Toward a knowledge-based theory of the firm. *Strategic Management Journal,* 17, pp. 109-112.

Grant, R., & Baden-Fuller, C. (1995). A knowledge-based theory of inter-firm collaboration. *Academy of Management Journal, Best Papers Proceedings*, pp. 17-21.

Harmelen, F., & Fensel, D. (1999). *Practical Knowledge Representation for the Web*. Paper presented at the IJCAI-99 Workshop on Intelligent Information Integration, Held on July 31, 1999 in conjunction with the Sixteenth International Joint Conference on Artificial Intelligence, Stockholm, Sweden. Retrieved from the World Wide Web at http://citeseer.nj.nec.com/202021.html.

Henderson, J., & Venkatraman, N. (1993). Strategic alignment: Leveraging information technology for transforming organizations. *IBM Systems Journal, 32*(1), pp. 4-16.

Luftman, J. (1996). Applying the strategic alignment model. In J. Luftman (Ed.), *Competing in the Information Age*, Oxford University Press, pp. 43-69.

Malhotra, Y. (1997). Profile of the ideal knowledge manager/architect. Retrieved from the World Wide Web at:http://www.brint.com/wwwboard/messages/273.html.

McDavid, D. (1999). A standard for business architecture description. *IBM Systems Journal, 38*(1), pp. 12-31.

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

Narasimha, S. (2000). Organizational knowledge, human resource management and sustained competitive advantage: Toward a framework. *CR, 10*(1), pp. 123-135.

Nissen, M., Kamel, M., & Sengupta, K. (2000). Integrated analysis and design of knowledge systems and processes. In Y. Malhotra (Ed.), *Knowledge Management and Virtual Organizations*. Hershey, PA: Idea Group Publishing, pp. 214-244.

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

O'Leary, D. (1998). Knowledge management systems: Converting and connecting. *IEEE Intelligent Systems, 13*(3), pp. 30-33.

Pan, S., & Scarbrough, H. (1999). Knowledge management in practice: An exploratory case study. *Technology Analysis & Strategic Management, 11*(3), pp. 359-374.

Probst, G., Raub, S., & Romhardt, K. (2000). *Managing Knowledge: Building Block for Success*: John Wiley.

Rifkin, G. (1996). Buckman Labs Is nothing but net. *FC*(3), p. 118.

Von Krogh, G., Ichijo, K., & Nonaka, I. (2000). *Enabling Knowledge Creation*: Oxford University Press.

W3C. (1999). Resource description framework (RDF) model and syntax specification. Retrieved from the World Wide Web at: http://www.w3.org/TR/1999/REC-rdf-syntax-19990222/#intro.

Zack, M. H. (1999a). Developing knowledge strategy. *California Management Review, 41*(3), pp. 125-145.

Zack, M. H. (1999b). Managing codified knowledge. *Sloan Management Review, 40*(4), pp. 45-58.

Chapter XIV

Some Implementation Challenges of Knowledge Management Systems: A CRM Case Study

Bendik Bygstad
The Norwegian School of Information Technology, Norway

ABSTRACT

The promise of knowledge management systems is challenged by implementation problems. This CRM case illustrates that technology-driven approaches are not likely to succeed. It also indicates some limitations of top-down managerial interventions, arguing that we need a deeper understanding of learning processes to be able to implement KM systems successfully. A more experimental implementation strategy is suggested.

INTRODUCTION

The great expectations for knowledge management systems illustrate a phenomenon long acknowledged by IS research: A strong socio-economic trend (the growth of knowledge workers) fuses with a technological trend (knowledge supporting technologies like Lotus Notes and World Wide Web). In a global economy, knowledge may be the greatest competitive advantage for a company

(Davenport, Prusak, 1998), with the support of KM technology to structure the knowledge and make it available in the company's learning process.

On the other hand there are continuing reports of disappointments, due to poor alignment between business and technology (Applegate et al., 1999) or the mismatches between the socio-technical potential and the old management practices (Ciborra, 1996). Implementing information systems has proved to be difficult (Markus, Benjamin, 1997), and the main challenge with KM systems also seems to be implementation (Ericsson, Avdic, 2002).

Implementation is mostly seen as an acceptance challenge (Kwon, Zmud, 1987). This view is probably valid also in the area of KM systems (Ericsson, Avdic, 2002), but there are two aspects which may deserve a closer examination. First, Leonard-Barton observed (1988) that company adoption does not necessarily imply user adaptation. The spread of the knowledge-based, less hierarchical organizations with both more powerful and knowledgable users (Nambisan et al., 1999) has accelerated this development: The knowledge user decides whether he or she will use the system, and in what way.

Secondly, the use of knowledge systems is quite different from the use of transaction systems. Since KM systems usually are set up to support organizational learning, they constitute part of a much more complex process. Argyris and Schön (1996) defines organizational learning in these terms:

> *Organizational learning occurs when individuals within an organization experience a problematic situation and inquire into it on the organization's behalf (..) In order to become organizational, the learning that results from the organizational enquiry must become embedded in the images of the organization held in its members' minds and/or in the epistemological artefacts (the maps, memories, and programs) embedded in the organizational environment (p. 16).*

This process is coined *organizational learning II* or double-loop learning, in contrast to single-loop learning, i.e., problem-solving. Organizational learning concerns changing the *theory-in-use,* the underlying assumptions of how things are working, which heavily influence the patterns of actions. Argyris and Schön observe that there often is a mismatch between the official *espoused theory* and the theory-in-use. An important implication from this is that only real double-loop learning can change the theory-in-use.

Thus, the question posed in this chapter is the following: How should we implement KM systems in a way that supports organizational learning? To illustrate this we shall tell a story of a six-year CRM project - an important goal being knowledge synergies - trying to describe in some detail how a knowledge-based organization addressed the challenge.

The chapter is structured as follows: first, the chapter describes the case methodology. There is followed with a brief outline of the promise of CRM systems. Next, the chapter discusses two process perspectives on implementation are presented, and the case is described in some detail, focusing on the implementation process and actor behavior, told by the practitioner. The chapter then discusses solutions and recommendations, focusing on the interaction between learning and management. Finally, it briefly outlines future trends and finishes with a summary of the conclusions.

METHODOLOGY: A CASE STUDY

This chapter tells the story of a Norwegian knowledge-based organization, the Oslo-based National Institute of Technology (TI) that started implementing a CRM system in 1993. The focus is on the implementation process that lasted six years. The author was the IT manager at the institute during this period.

Using a qualitative and interpretive approach (Miles, Huberman, 1994), the study focuses on *behavior* as a practitioner experienced the project, using only very simple theoretical concepts. These concepts are part of the narrative, illustrating what we conceived was our methodological options at the time. The empirical evidence also includes company and project documents and user satisfaction surveys.

Being a single case study, there is no claim of validity for the KM systems field in general. Rather, the aim is to ask relevant questions, and discuss them in the light of existing theories.

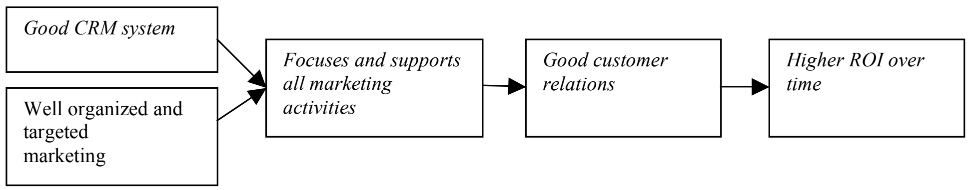
THE PROMISE OF CRM SYSTEMS

Theories on relationship marketing were developed at the end of the 1980s, under the motto "from transaction to relation." Researchers showed that companies have both economic and social relations: In addition to economic transactions there is, usually, a development of trust. These relations may give benefits to both sides and among them are a higher degree of customer loyalty, lower marketing costs, mutual learning and other forms of strategic cooperation. Developing long-term customer relations is a part of the company's strategy development, and should involve every level of the company (Hakansson, 1995).

Since relationship marketing is heavily dependent on rich customer information, and also dependent on frequent communications with the customers, the pioneers were early aware of the IT potential. Today, CRM systems represent a large and growing part of the software industry (Tafti, 2002).

Ciborra and Failla describe CRM as an information infrastructure, consisting of processes, people and technology (Ciborra, Failla, 2000). CRM is linked to the BPR thinking, in the way that CRM is also process oriented and focused on dramatic and fundamental change. CRM structures and supports all activities that support a business transaction, from the first lead to fulfillment.

Figure 1: The Basic Assumption of the Effect of CRM Systems



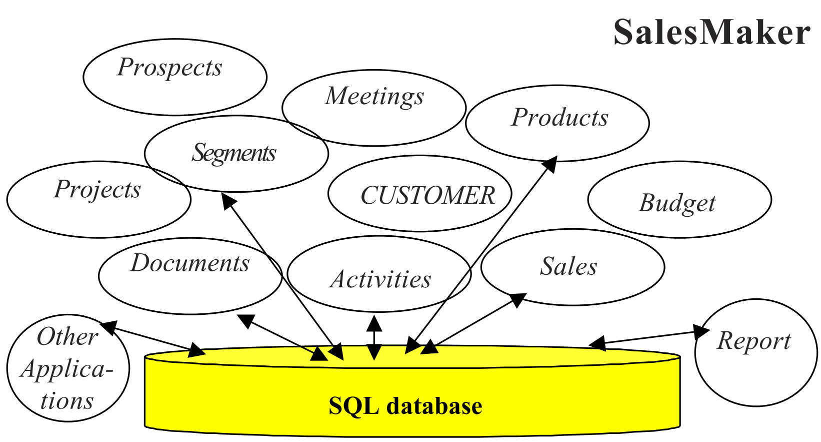
Assumptions about the effect of CRM system are simplified in Figure 1.

As Figure 1 illustrates, CRM is a long-term business strategy, where the CRM system is an important component. The reason for the high expectations is that the CRM systems seem to connect the two central resources of the modern, "flat" and decentralized company: The core competence of the knowledge workers, and the company's relations with its most important customers (Kay, 1993).

CRM systems have three promises:

- It gives each worker a tool to manage her personal contacts, activities, documents, etc. As Drucker has stated, "managing oneself" has become the management challenge for the knowledge worker (Drucker, 1999).
- It provides a tool for dialogue marketing, making the company able to individualize the marketing activities: The customer gets only the information he wants and needs (Hakansson, 1995).
- It represents a synergic potential for the company: If all this information could be utilized in analysis and concept development, it might be a basis for new products and markets, transcending the barriers of business functions and locations.

Figure 2: Features of Norwegian CRM System SalesMaker



This is not trivial. If successfully implemented, this implies that the CRM systems could be an important technology for the non-hierarchical, knowledge-based organization of the 21st century.

Figure 2 shows the rich functionality of a medium-sized Norwegian CRM system, SalesMaker, used in the TI case.

THE CASE: COULD A FORMER GOVERNMENTAL INSTITUTE BECOME A FLEXIBLE AND MARKET-DRIVEN COMPANY WITH THE HELP OF CRM?

The National Institute of Technology (TI) was made a private foundation in 1989. The main market was the small and medium-sized companies in Norway (being 95% of all the Norwegian companies) that are too small to do their own technology development and transfer. The services provided were technical consulting, practical courses in disciplines like welding, testing and calibration, and also ISO certification. There were branch offices in other cities in Norway, and an international component, the Norwegian Technology Attachés.

As a private organization TI had to earn its own income, and the governmental support was gradually reduced during the 1990s from 50% to 25%, while the total income increased from 125 mill NOK to 185 mill NOK.

The 260 employees were not used to marketing and selling services. After privatization all the managers were recruited from the private sector, while the technical consultants survived from the old organization. They were largely technically inclined, and regarded marketing as a, maybe necessary, but unwanted activity. The culture in the technical departments was practical and rather practical. The manager of the furniture department, with a lifelong experience with electrical sawing tools was proud to say about job applicants: "Well, it's OK that he has a Ph.D., but then at least he shouldn't have more than nine fingers left!"

TI's only real competitive advantage was the 8,000 small and medium sized customer companies, and thousands of personal contacts. Could this asset be capitalized and thus develop TI into a modern and market-driven company? And could CRM play an important role in this transformation? The director thought so, and in 1992 she commissioned a major project called, The Customer Project. The objectives were:

1994: Better financial control of the consulting projects (about 4,000 each year).
1995: More effective and efficient marketing by systematic dialogue marketing.
1996: Develop long-term relations with the most important customers.

It was easier said than done. In 1992 the institute did not even have a LAN, and the workforce was unfamiliar to the concept of CRM. How was this to be accomplished?

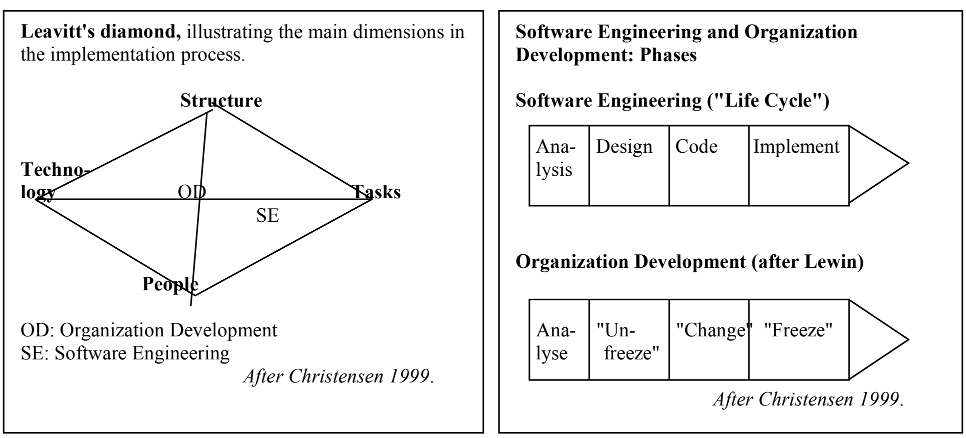
Methodology: Software Engineering — or Organization Development?

Around 1990 IS projects were usually analyzed in terms of success factors (Kwon, Zmud, 1987). The critical success factors (CSF) for the Customer System were assumed to be strategic alignment, cross-functional synergies (BPR inspired), workforce participation (Scandinavian school), technically competent implementers and a sound technical solution. This was rather by the books, and also the teaching of the TI staff.

The CSFs, however, do not give much guidance on *how* IS should be implemented. In practice there was a choice of two models, the Software Engineering model or the Organization Development model. The SE approach takes as a point of departure that an information system is developed and implemented into an organization (Sommerville, 2001). The mainstream of the IT industry - like Microsoft - has traditionally focused on the functional attributes of the system (advanced, user friendly, etc.). The Scandinavian school has focused more on the user participation and acceptance. For both schools, however, the starting point is the technology and the emphasis is on structure and rationality.

The Organization Development model comes from the behavioral sciences, and the point of departure is that organizations are stable organisms that change slowly and reluctantly (Argyris, Schön, 1996). To succeed, the organization should *prepare* for the change, then change slowly, and lastly institutionalize the changes ("freeze"). The OD discipline has traditionally not been very interested in IS, and has focused on the irrational aspects of change processes, and that a normal outcome is a gap between intentions and results. The reason for this is resistance to change.

Figure 3: Two Non-Congruent Frameworks: The Organization Development Model and the Software Engineering Model



Both traditions, the SE and the OD, should ideally be combined. Christensen (1999) makes an interesting attempt, where Leavitt's diamond is used to illustrate how the two perspectives could be integrated.

Figure 3 illustrates both the elegance and the problem in Christensen's synthesis (Christensen, 1999). Leavitt's diamond illustrates the need for an integrated approach, because the 4 variables are very integrated. The phases, however, show how incongruent these schools are. The main problem is not to gain acceptance for the integrated approach, but to implement it in real projects. The practitioner communities, being the IT consultants on one hand and the OD consultants on the other, represent different cultures, with different tools and terms, for different contexts.

At TI we chose the software engineering approach, following the recommendations of the vendor of the CRM system. This did not imply that the Customer Project was seen as a purely technical project. On the contrary, great effort was made to ensure user participation and organizational alignment. One of several measures was to merge the IT and marketing departments into one unit, with the responsibility for the CRM implementation.

The First Attempt in 1993/94: Crises

Chronology

Autumn 1991.

IT strategy, concluding with the Customer Project, is approved.

Winter 1992.

A projects group and a steering group are established. Requirements document is made after interviewing all departments.

Spring 1992.

Agreement with Software Innovation purchasing SalesMaker (first customer)
Analysis and design: A consultant firm produces a business model in DFD and E/R-diagrams. Central users participate.

Rest of 1992.

Database is implemented and prototyping in a 4GL is done in close coop-eration with different user groups. Installation of LAN, WAN and servers.

Autumn 1992.

User training with in-house instructors. Managers were sent to take courses to learn to use the report facilities.

January 1, 1993.

System set into production.

Spring 1993.

System in production, but technical problems in client/server technology.

Autumn 1993.

Data quality problems.

Spring 1994.

Data quality problems attacked, but not solved. Confidence in system declining.

The Customer System was based on SalesMaker from the small Norwegian company Software Innovation, extended with a module developed in-house. The system was, at the time, very modern: Windows based, integrated with both the financial system and with office software like MS Word. For an organization not used to CRM systems, it appeared complex, with many screens and a new terminology including words like "contacts," "relations" and "campaigns." All users were trained, concentrating on screens and terms.

The first problem was technical: The client/server technology at this time was not stable, and created a continuous demand for support. Also, the quality of the in-house developed module was not satisfying, and demanded more support.

A larger problem was the fact that the core of the system, the customer information, had quality problems. The reason was trivial: When registering a new customer, the user should check if the company was already registered. If you don't, the result may be a double or a triple registration of the customer (spelled a little bit differently), which in short time creates chaos in the system.

This was the origin of a vicious circle: The existence of double and triple customers very quickly threatened the confidence in the system: "One cannot trust the new system - it is useless" became a common comment. The positive users became reserved in their use, and the negative ones had lots of arguments in the company canteen.

The result of these problems was that the system was not used as intended. In spite of several activities to increase the quality of information, parts of the organization lost faith in the concept. The system did not give the expected benefits because of incorrect information and lack of trust. It also became evident that the user participation strategy had produced little effect: One reason why the data quality problem persisted was that the system was not considered *important* enough to spend the necessary time to learn properly. It was not integrated in the day-to-day working routines.

The investment was still financially sound, because the dialogue marketing, as a tool for the marketing department, was beginning to work. But the implementation had failed on important points, and we were looking for another way of doing it.

The Second Attempt from 1995-98: Elephants and Giraffes

Chronology

Autumn 1994.

The "Elephant Method" was developed: A step-by-step method to use the Customer System in dialogue marketing: Define your market, find the potential customers in the system, produce the brochure, mail it to the potentials, follow-up by telephone, register the response, correct any wrong information, summarize the learning. Easy, when assisted by marketing staff.

1995.

The Elephant Method was a success in most departments.

1996-98.

The Giraffe Project: Aimed at changing organization and culture:

- Marketing teams established.
- Each team had a marketing plan, with clear objectives.
- All customers segmented into groups, according to profitability.

Main responsibility for each customer is assigned.

- Marketing activities are focused on "A" customers, aiming at creating partnerships.
- A number of motivating and learning activities are initiated by the IT/ Marketing depts.

1998.

Project is evaluated partly successful, but local (department) culture is stronger than central push.

In the autumn of 1994 the steering group initiated a task force to help a troubled department perform their marketing activities more systematically. This attempt was gradually developed into the "Elephant Method" (after the how-to-eat-an-elephant joke), which was a step-wise method for market segmentation and Direct Marketing.

This method was gradually implemented in most departments during 1995, and led to more sales of TI's course portfolio, while the volume of DM was cut by half. Together this was the first visible success of the system, and this was also acknowledged.

The experience showed us two things: Firstly, the departments needed hands-on guidance in using the CRM system in a way that gave a commercial effect. Secondly, it showed that only very specific results could change the attitudes in the departments. Traditional user training and general information had very little effect.

In 1996 the perspective was broadened. Under the motto "stretching a little further," the Giraffe project was started. The aim was to concentrate the marketing activities on the most important customers ("A" customers) to increase the profitability of the institute, that is, to make it less dependent on government money.

All managers, secretaries and key consultants were taken to kick-offs and follow-ups, listening to national "relationship gurus" and discussing the concept. All departments were organized into marketing teams, and systematic reporting to the top management group every month was instigated.

For the following two years the Giraffe-1 and Giraffe-2 were run continuously, with a focus on changing the culture from focusing on technical disciplines to focusing on the customer. The whole bag of OD tricks was used, like image and brand building, team building, leadership development, skills development, parties and prizes.

The results were on the positive side, but progress was slow. Some departments worked very systematically, and achieved good results. Others were more half-hearted, and gave priority to other activities. A few were ignoring the whole project, and worked with other concepts. The attitude of the manager and the most senior consultants seemed to determine the culture. Also important was the fact that the CRM system did not support all kinds of products, and that two departments lacked loyal customers altogether, and were working in a spot market.

Summing up, in 1998 the CRM strategy had worked for five years. While having a partial success, the process was not self-sustained. It was still dominated by central staff pushing reluctant technicians into the market. The local cultures were stronger than the central push, and only when the commercial perspective was very short, there was a real commitment to the project. Thus, while the DM activities continued to be rather successful, the more long-term approach of using the customer relations more strategically was much harder to achieve. The Giraffe ambition of changing the culture was, therefore, mainly a failure.

We scratched our heads again, now wondering if the whole concept was wrong, not only the implementation. Our concept was built on releasing the potential synergies in cross-functional coordination. Did such a potential really exist - or is it, at the end of the day, only within the individual *projects* there are synergies? Is the modern knowledge organization too culturally complex, and immune to this kind of standardization? Should the focus be changed to satisfy the more immediate needs of the knowledge worker?

Third Attempt 1998-99 and Summing-up the Case

A new version of the Customer System was introduced at the start of 1999. The emphasis was now changed to the consultant users, and focused on calendar, document support and personal contacts. This was well received, but also signified a lower ambition on the organizational level.

Of the three original goals of the system, the first two goals, financial control of projects, and more efficient direct marketing, were achieved. The DM activities were concentrated in a new unit, and the "A customers" concept was implemented in the whole organization.

The third and most important goal, to establish partnerships with the "A customers," in a cross-functional cooperation, and to use this partnership systematically in changing the organization, had mainly failed. This goal was more or less abandoned, and the departments were left to develop their customer relationships individually.

The planned three-year implementation became a six-year continuing effort. Is there something to learn from the story?

SOLUTIONS AND RECOMMENDATIONS

Interpreting the case, it is obvious that the system was a success regarding the management goals (cost control, Direct Marketing), and a failure in the area of knowledge management.

The implementation of KM is directly affected by what Argyris has termed the "learning paradox" (Argyris, 1991). Studying professionals, he found (as expected) that they were good at single-loop learning, but surprisingly bad at double-loop learning. The explanation: These knowledge specialists seldom experienced failure, and, therefore, are not used to learning from failure. Thus, instead of double-loop learning, the response is defensive, often including blaming something or somebody else.

Returning to the initial question, how should we implement KM systems in a way that supports organizational learning, we may conclude with two perspectives: What is not working, and what may - in some cases - work?

What Does Not Work

The case illustrates that a technology-driven approach is not working. Implementing CRM is hard, and successful implementation requires a different strategy than systems development. This is a problem, because many CRM vendors still use a systems development implementation framework. Also Davenport and Prusak warn against the unrealistic expectations towards KM software: "Unfortunately, it is usually much harder to get organizational consensus for behaviour change and new roles than it is for technology - and if you start with the technology, the other necessary factors may never materialize" (p. 166).

More controversial, perhaps, is our view that traditional organization development may work well in the logistics and marketing area (for example within Direct Marketing), but not in knowledge management. Why not? One answer may be that the first type of project had support in pre-existing capability in the organization's formative context - the institutional arrangements and cognitive frames (Argyris, 1996), while the Giraffe project was a foreign and abstract concept in the language of management. The system and the concepts - *espoused theory*, in Argyris' terms- could not be translated into a departmental culture which had a very practical problem-solving way of working. The technical teams at TI were small and tightly knit, and the members preferred, vastly, projects to formal cross-functional coordination meetings. The most important learning was in the projects, and it was shared with the other members by the irregular coffee break. Such teams have, seen from within, no need for a CRM system.

Their response to the CRM challenge was defensive, and indeed not beneficial for a learning process. Moreover, the "management push," insisting on espoused theory, prohibited a more creative approach.

What May — In Some Cases — Work?

These are some elements in an alternative implementation strategy.

Could the teams at TI convert to double-loop learning, where they really attempted to achieve the cross-departmental synergies, and use the CRM system as a vehicle of support? Argyris and Schön (1996) suggest a strategy where members of the organization try to "learn strategically," where designers and implementers develop more open and non-determined communication, using failures as input to change their mind-sets. They also advocate developing managers with more "artistic sense" (p. 259).

Evidently this is not easy- and what does it mean to the actual case? We think it means to stage a more innovative process, to experiment with the following:

- Be honest about implementation problems. (This is harder than you may think, because the project has usually been "sold" with glossy promises.)
- Use the problem as a source of innovation. For example, if the system is used in a "wrong" way - explore if there is a potential in this direction.
- Bring in new people, especially critical ones.
- Reorganize teams which are not productive or creative.
- Do not play political games. Focus on business issues.
- Accept that technical problems are not always "trivial," and that systems in one sense are actors. They should be dealt with, not blamed.

We also think one should accept that implementation is inherently context sensitive. What works in one company, or one department, may not work in another. This seems a paradox, because the synergy expectation of KM systems usually implicates that knowledge should be standardized. We agree that this is an important aspect of KM, but that great care is necessary to distinguish between infrastructure information (like names, addresses) and specific domain knowledge. An infrastructure is clearly important, and should be developed early. On the other hand, standardizing domain knowledge is very challenging, and one may run the risk of jeopardizing the whole KM project if this is done insensitively.

CONCLUSION

This CRM case has been used to illustrate some challenges in KM implementation, and to suggest some possible solutions.

The main challenge is that top-down organization development, focusing on control and change management, is not necessarily a successful implementation strategy for knowledge management systems. Often this will appear as an uphill struggle, against defensive knowledge workers.

The solutions do not come easy. They involve staging a learning process, in which the KM system becomes an integrated part. The hardest part may be to leave the glossy image of KM systems behind, replacing it with promises of hard work.

Solutions may also require a partial loss of management control, because what is recommended is more of an innovation process. Managing such processes is rather different from goal-oriented change management, and should allow for more experimentation, and in particular for learning from failures.

REFERENCES

Applegate, L., McFarlan, F. W., & McKenney, J. (1999). *Corporate Information Systems Management*. Boston: Irwin McGraw-Hill.

Argyris, C. (1991, *May-June*). Teaching smart people how to learn. *Harvard Business Review,* pp. 99-109.

Argyris, C., & Schön, D. A. (1996). *Organizational Learning II*. Reading, MA: Addison-Wesley.

Christensen, G., Grønland, S. E., & Methlie, L. B. (1999). *Informasjonsteknologi*. Oslo: Cappelen.

Ciborra, C. (1996). *Groupware and Teamwork*. Chichester, UK: Wiley.

Ciborra, C., & Failla, A. (2000). Infrastructure as a process: The case of CRM at IBM. *From Control to Drift*. Oxford: Oxford University Press.

Drucker, P. (1999, March/April). Managing oneself. *Harvard Business Review*.

Ericsson, F., & Avdic, A. (2002). *Framework of Knowledge Management Systems Acceptance.* Paper presented at the IRMA 2002, Seattle.

Hakansson, H., & Snehota, I. (1995). *Developing Relationships in Business Networks.* London: Routledge.

Kay, J. (1993). *The Foundation of Corporate Success*. Oxford: Oxford University Press.

Kwon, T. H., & Zmud, W. (1987). Unifying the fragmented models of information systems implementation. *Critical Issues in Information Systems Research.* J. R. B. R. Hirscheim. Chichester, UK: Wiley, pp. 227-251.

Leonard-Barton, D. (1988). Implementation characteristics of organizational innovation. *Journal of Communication Research,* (*15)*5.

Marble, R. P. (2000). Operationalising the implementation puzzle: An argument for eclecticism in research and practice. *European Journal of Information Systems* 9, pp. 132-147.

Markus, M. L., & Benjamin, R. (1997, Winter). The magic bullet of IT-enabled transformation. *Sloan Management Review,* pp. 55-68.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis*. Thousand Oaks: Sage Publications.

Sommerville, I. (2001). *Software Engineering.* Harlow: Pearson Education.

Tafti, M. H. A. (2002). *Analysis of Factors Affecting Implementation of Customer Relationship Management Systems.* IRMA. Seattle. Hershey, PA: Idea Group Publishing.

Authors Note: Sources from National Institute of Technology, Annual Reports 1989-98, Project documents from the Customer Project, User satisfaction evaluations

Chapter XV

Strategic Knowledge Sharing for Improved Public Service Delivery: Managing an Innovative Culture for Effective Partnerships

Gillian Wright
Liverpool John Moores University, United Kingdom

Andrew Taylor
University of Bradford, United Kingdom

ABSTRACT

This chapter considers inter-organizational knowledge sharing in the delivery of public services. While public services represent a significant economic sector in most countries, there is little published research of its implementation of knowledge sharing to improve service performance. The chapter highlights potential barriers to effective knowledge sharing in public service partnerships and introduces a second-order regression model to guide managers in their development of an effective knowledge sharing environment. Based on research incorporating participant observation, document analysis, 30 interviews and a survey (n=132), the chapter identifies six antecedent factors to effective knowledge sharing, the most significant of which is an innovative culture.

INTRODUCTION

As with many other managerial innovations, Knowledge Management appears to have been adopted firstly by manufacturing firms and is only now beginning to permeate the service sector, predominantly in professional services, such as consulting (Hansen et al., 1999; Sarvary, 1999). Public services, traditionally slower to embrace innovative management practices, have not yet recognized the importance of Knowledge Management and there is little published research of its implementation in this context. Public sector services are a major economic activity, for example, spending £350bn in the UK and representing 40% of GDP (Office of National Statistics, 2001). Public services management is thus a moral imperative, a challenge for effective management and an opportunity for research that can make a significant impact.

Partnership working in public services provides an interesting context for discussion of strategy and knowledge sharing for a number of reasons. Firstly, it represents a formal departure from the traditional compartmentalized approach to public service delivery. The emphasis on partnership comes directly from the ideas of joined-up-thinking, espoused by national policy as a vehicle to improve the experience of service users (DETR, 2001). Secondly, it challenges existing hierarchies, forcing the partner organizations to work together at all levels of strategy, service planning and service delivery. Thirdly, partnership working is one management concept that public services are addressing as innovators, or certainly as early adopters.

This chapter examines public services in the context of the mandate to improve the delivery of healthcare services, through an inter-organizational partnership. In particular, the chapter explores the relationship of knowledge sharing with innovation and change, and with information quality, clarity of responsibility, strategy formulation and deployment, and accountability. In the sections that follow, we firstly review the literature on knowledge sharing to develop themes for our investigation. We then outline the context of the study and the research methods employed. Results of our survey are presented, together with a second-order regression model of factors that influence effective knowledge sharing. Our results suggest that an innovative culture and information quality are the two most significant predictors of the dependent variable. Finally, we discuss the significance of the results for the specific public service partnerships we studied, and their potential relevance for management more generally.

Inter-Organizational Knowledge Management

It was Drucker (1995) who observed that the greatest change in the way that business is being conducted is the accelerating growth of relationships, based not on ownership, but on partnership. Inkpen and Dinur (1998) studied private sector joint ventures to understand how firms transfer knowledge across organizational boundaries. They focused on alliance forms that combined resources from more than one organization to create a new organizational entity ("the child") distinct from its "parents." Moreover, they conceptualized the joint venture as a stimulus for learning, because it "may force changes in the mental maps of the organization." The strength of a firm's learning intent will determine the organizational resources committed to learning, and hence to knowledge transfer (Hamel, 1991).

Nonaka (1994) also recognized the potential for knowledge transfer between organizations in his discussion of the interactions between tacit and explicit knowledge and their subsequent spiralling through different organizational levels, beginning with individuals and ending (sometimes) with inter-organizational knowledge transfer. While Nonaka's research has not placed much emphasis on the latter, his SECI model has become very influential. However, less recognition has been given to the importance Nonaka placed upon information in this process: "information is a necessary medium for initiating and formalizing knowledge … in short, information is a flow of messages, while knowledge is created and organised by the very flow of information, anchored on the commitment and beliefs of its holders."

Blumentritt and Johnston (1999) underscored the importance of information to any knowledge management initiative. They discussed the interplay between information and knowledge, arguing that information is not only a necessary antecedent to knowledge creation and use, but it is also the medium by which knowledge is transferred. "The transmission or sharing of knowledge requires that it be translated into information and transferred. Successful transfer will usually lead to a re-translation into knowledge." McDermott (1999) echoed the same theme, commenting that while the knowledge revolution is inspired by new information systems, it is ironic that it takes people to make knowledge management happen. In McDermott's terms, this is not because people are reluctant to use IT, but rather because knowledge involves thinking with information. To leverage knowledge we need to enhance both thinking and information. The most natural way to do this is to build communities that cross teams, disciplines, time, space and business units. It is this co-dependence on the contribution of people and the enabling role of information resources that makes knowledge management so challenging as a management activity and intriguing as a research theme.

Information as an essential organizational resource is not a new phenomenon (Synott, Gruber, 1981; Horton, Marchand, 1982; Marchand, Horton, 1986). Information Resource Management has evolved gradually over the past 15 years (Caudle, 1989; Marchand et al., 2001). While now established as a formal management discipline in many sectors, it continues to evolve as companies recognize the strategic significance of information and knowledge, even though "the way knowledge is used by people and combined with information sources is not well understood" (Davenport, 1997, p. 18). It is our contention that the ability to manage information (and, hence, knowledge) effectively, remains one of the most important, but still least understood, activities in modern organizations.

Much of the foregoing discussion has alluded to the importance of information and knowledge as a strategic resource, implicitly to improve performance and competitiveness. Yet, as Marchand et al. (2001) observed, there is still a lack of evidence that effective information use is causally linked to improved performance.

Understanding Effective Knowledge Management Practices

Studies of knowledge management practices have been predominantly of two types to date: (a) surveys, often sponsored by consulting groups, with limited reporting of the underpinning methodologies, and (b) case studies in individual firms. There is much about KM implementation that we can draw on from these studies to guide complementary research in the public sector.

For example, Ernst and Young (1998) concluded from a survey of 431 private organizations that the main barriers to implementing knowledge management were all people related, i.e., a culture that inhibited knowledge sharing, a lack of top management leadership, and poor understanding of what KM involved. Similar studies by KPMG (1998) of 100 UK companies and by The Conference Board (Hackett, 2000) of 200 companies, broadly confirmed these findings. The surveys did highlight some differences. For example, lack of time and lack of perceived benefits were cited in the KPMG survey as the most significant barriers to KM. Further, the Conference Board survey added that there was little observed integration between firms' activities in Knowledge Management and the promotion of Organizational Learning. Indeed, Leidner (2000, p. 100) underlines the same point:

> *Although a well-established tradition of organizational learning research could be considered an adumbration, if not a forerunner of organizational KM, KM as a research discipline has drawn less from organizational learning as from strategy research.*

In summary, implementation of knowledge management places a renewed focus on the importance of information, and on organizational factors such as learning capability, culture and leadership. Knowledge Management is largely a private sector innovation at the present time, although gradually moving towards the public service sector. Moreover, the role of knowledge in the formation of effective inter-organizational partnerships is viewed as a key determinant of successful achievement of alliance strategies.

It was against this background that we selected health and social care as an area of public service in which organizations responsible for the commissioning and all aspects of delivering care are increasingly expected to do so without fragmentation of access to the user.

Management of the provision of high quality public services continues to be a major social and political issue. This research was conducted in the context of national policies for performance management (DETR, 2001), partnership working (joined-up-thinking) (DETR, 2000, 2001a; Fordham, 1998), the reduction of health inequalities (DoH, 1998,1999) and overall improvements in service quality (DOH, 1998a, 2000).

Figure 1: The Healthcare Partnership Performance Management Process

Our research question focused on the issue of making public service partnerships work effectively to achieve strategic objectives. In particular, the research questions related to assessing the readiness of the partners to work together, and to share knowledge that each possessed about their part in the overall service delivery process.

We conceptualized the partnership process in terms of two core aspects, viz;

- The effective vertical deployment of organizational strategy in terms of communication, and development of meaningful performance measures, with information managed to support these, see Figure 1.
- The wider organizational context in which deployment takes place, i.e., the effectiveness of the culture of the organization to support attitudes conducive to new ways of working.

Thus, we regarded the key to partnership as being concerned with the creation of a more explicit understanding of what needs to be done to meet the strategic objectives – in effect, the creation of a “knowing organization” (Choo, 1998).

RESEARCH METHOD

Fundamentally, national care policy mandates improved service quality as a strategic outcome. To achieve this, the instruments and initiatives change frequently, making it difficult to evaluate and attribute the impact of individual interventions. Our research design overcomes this problem by focusing on the core issues of information, knowledge, change management, performance and user focus, while at the same time incorporating reactions to, and implementation of, specific performance improvement initiatives. This chapter focuses primarily on the aspects of the study that concern the management of information and knowledge.

The research approach was a questionnaire survey, validated for content analysis through: participant observation, key informant interviews, an in-depth service study and document analysis.

Participant observation was facilitated by the researchers being members of strategic evaluation teams for specific initiatives to promote partnership. Working with the project co-ordinators to set objectives and performance indicators for the partnerships gave background and insight into the themes that concerned members.

Key informant interviews were held with 10 managers associated with the strategic development and leadership of partnership working.

The service study focused on four key areas of public service that rely on effective partnership working for successful, user-focused outcomes. These were services for the elderly, for children with severe disabilities, food initiatives and community policing. For each of these services, interviews were conducted at strategic, service planning and service delivery levels. Individual in-depth interviews with 20 healthcare managers represented over 50 hours of discussion, identifying current challenges in managing care services in the UK, specifically in the context of partnership working and service improvement.

Document analysis covered national, local and project-based policies and plans. This is on-going to ensure that all contemporary issues are included in each stage of the study.

The best ***practice management survey*** covered health and social care managers responsible for service provision and commissioning. The survey instrument was developed from the themes identified in the key informant interviews, from the extensive literature review, and from the document analysis that set the base-line management agenda. The service study provided the basis for the content of the items regarding vocabulary and context. The questionnaire was pilot tested for content validity. Questionnaires were delivered to health and social care managers for self-completion as part of a longitudinal research study that will be administered at two-yearly intervals in order to evaluate the efficacy of public services management initiatives.

Analysis Procedures

Key themes that emerged from the interviews were summarized as quality/performance management and customer satisfaction, organizational culture, strategic leadership and information management. Discussion about partnership working suggested that two important and related concerns of respondents were the strategic process, and information/knowledge-related issues.

The 22 independent variables associated with strategic knowledge management were examined to establish their underlying themes using factor analysis. The relationship of the factors with effective knowledge sharing was explored using regression analysis. The details of these analyses are provided in the appendices to this chapter, together with the detail of the results regarding data parameters and statistical significance.

Respondent Profiles

A total of 132 responses were received from the 500 questionnaires distributed in this first survey, representing a response rate of 26%. As a preliminary survey, we consider this response rate to be acceptable. Respondents described their primary roles as strategic (30%), service planning (15%) and service delivery (36%). Many respondents' responsibilities covered more than one of these role categories, with those who took responsibility as part of their remit were: strategic (49%), planning (48%) and service delivery (54%). Most worked for service delivery (provider) organizations (51%) within the partnership, with a smaller percentage working within service commissioning (purchasing) organizations (12%), while 17% worked in an organization with dual roles.

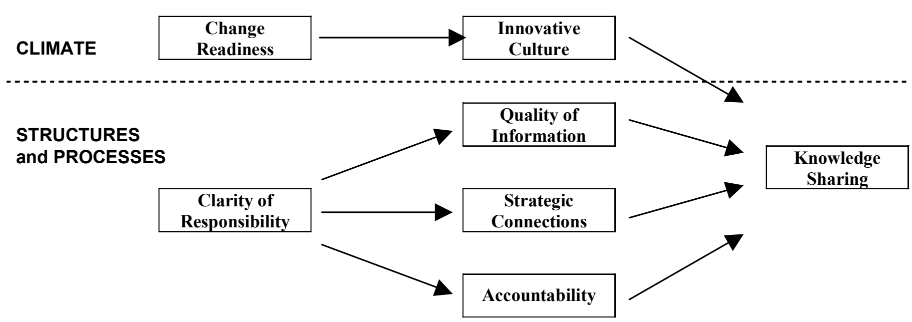
RESULTS

The analysis of results led to the development of a model of knowledge sharing represented in Figure 2. The six factors were identified through factor analysis and the relationships between them with multiple regression.

This section presents four aspects of analysis:

(a) The results of factor analysis highlighting six composite constructs that are inherent in the data set.
(b) The descriptive statistics of the respondents' answers to each of the items within the constructs.
(c) Regression analysis of these six composite factors showing the strength of their relationships with the dependent variable, knowledge sharing.
(d) More detailed exploration of the theme of an innovative culture. This was the strongest construct in the factor analysis and also the one that has most impact on knowledge sharing, according to the regression analysis.

Figure 2: The Predictors of Knowledge Sharing in Synchronistic Partnerships



Tables 1 and 2 present the six latent factors in the data set, together with the responses to each item and the composite response profile for each factor. Full details of the factor analysis are contained in Appendix A. Tables 1 and 2 contain the statements as they were presented in the questionnaire; statements that were reversed for the analysis are indicated 'R'. By presenting the full statements with their original valence, the tables incorporate a feel for some of the issues and vocabulary that emerged from the qualitative research.

Organizational Climate and Structure in a Knowledge Sharing Partnership

Table 1 contains the two strongest factors, an innovative culture and change readiness, accounting for 46% of the variance in the data set. These two factors represent elements of the climate within the organization. Table 2 contains the remaining four factors, quality of information, clarity of responsibility, strategic connections and accountability. These four factors are more focused on the way things are done – structures, processes and practices. Thus, Table 1 is about the way it feels to work in an organization and Table 2 is about organizational activities and behaviors.

Factor 1: Innovative Culture

An innovative culture is one where people are receptive, rather than resistant, to new ideas, and where they are motivated to embrace and develop these ideas and shape them into improved working practices. It is a culture that provides people with time to reflect on past performance and practice, to learn from what has worked and, equally importantly, on what hasn't worked well. It is also a culture that reinforces reflective learning by providing supporting systems to facilitate reflection and capture lessons learned. Finally, a culture of innovation has a focus on the end user or customer, whereby people actively search for new ways of improving service delivery.

Table 1 shows that the majority of respondents felt that their organizations could not be described as having such an environment, with only 20% believing that their organizations had a strong innovative culture. The most striking implication of these responses is that while the strongest agreement is that people are encouraged to suggest new things (33%), this is not corroborated by beliefs about feeling enabled or having an appropriate infrastructure.

Although over half of the respondents felt that they reflected on what works well, less felt that they reflected on what doesn't work, with only 8% strongly agreeing that they reflected on lessons learned from things that don't work. Although there was some evidence of encouragement and motivation to suggest new things and develop new ideas, these were not seen as supported by systems to facilitate learning from experience. Similarly, this encouragement and motivation was not underpinned by an environment that was receptive to new ideas.

Table 1: Latent Themes in Knowledge Sharing: Organization Climate

Factors and variables	Strongly agree	Slightly agree	No opinion	Slightly disagree	Strongly disagree	Mean	S.D.
Factor 1 Innovative culture							
Composite response profile	**20%**	**35%**	**7%**	**23%**	**15%**	**2.78**	**1.39**
New ideas are generally accepted by people in my organization	20%	36%	9%	17%	18%	2.77	1.42
We are motivated to develop new ideas	27%	35%	9%	18%	11%	2.50	1.35
We regularly make time to reflect on what works well	14%	37%	6%	24%	19%	3.00	1.40
We are encouraged to suggest new things	33%	35%	7%	11%	14%	2.36	1.40
We are always on the lookout for things we can do differently that will make a difference to our user	23%	32%	10%	20%	15%	2.73	1.14
We regularly make time to reflect on what doesn't work	8%	32%	4%	33%	23%	3.32	1.34
Our organization is good at learning from what we do because we have the systems in place to make that happen	11%	33%	11%	18%	27%	3.18	1.42
Factor 2 Change readiness							
Composite response profile	**15%**	**24%**	**24%**	**19%**	**18%**	**3.02**	**1.34**
We are sometimes asked what we think, but it's usually ignored R	20%	26%	12%	26%	16%	2.94	1.41
When you are always covering your back, how can you admit to wanting to do things better? R	23%	27%	18%	15%	17%	2.76	1.40
We just collect the statistics and then carry on doing things the way we know works best R	12%	38%	12%	15%	23%	2.98	1.39
Partnership working will only mean more bureaucracy R	12%	37%	14%	26%	11%	2.86	1.24
R denotes variables with reversed valence in the factor analysis							

Factor 2: Change Readiness

Change and innovation are closely linked. If an organization has an innovative culture that generates new ideas, it also needs to be able to implement the consequent changes to working practices and behaviors. This requires people to have a forward-looking and positive attitude toward doing things differently, rather than maintaining the status quo. To bring about successful change, managers must carry the rest of the people along with them, by proactively seeking their opinions and listening to their views. They must also engender an atmosphere where people are not afraid to express their opinions for fear of punishment, rather than have people feeling the need to 'cover their backs' to protect themselves from criticism and retribution. When people sense that their opinions are not welcomed, or they are not empowered to challenge current practice, they will be unlikely to make innovative suggestions. Consequently, their level of involvement and commitment will decline and the organization's innovative potential will be diminished.

Being ready to change implies a concomitant sensing of the need to change. Managers need to confront current performance gaps by not only collecting performance statistics, but also disseminating them widely and translating their implications into meaningful messages for their staff. In other words, managers need to communicate the problem that is behind the need to change. If people feel that managers pay little attention to performance statistics, they, too, will ignore them and continue working in ways that maintain the status quo. Thus, managers need to ensure that they neither ignore the views of their staff, nor the signals from performance statistics. Finally, people need to understand the nature of the change and the benefits that it will bring. If they perceive change as having negative or undesirable consequences, they will logically not be willing to embrace it wholeheartedly. So, for example, in the context of this chapter, if people perceive partnership working as merely the introduction of more bureaucracy and paperwork, they will be disinclined to commit to it. Managers need to communicate the benefits, as well as the problems.

In our interviews, change was a recurring theme. There was a feeling of pervading weariness with the dis-equilibrium this repeatedly brought to the organization. If we try to develop partnerships and share knowledge within them, we are *de facto* setting up a change-inducing scenario. From the composite responses for this factor, over 60% did not see themselves as being open to change, with only 15% strongly agreeing that their organizations were change ready.

The results suggest that managers need to remove the need to cover their backs, and to actively seek people's views in a climate of openness and realism. As one respondent said, "Turkeys don't vote for Christmas." We now consider the remaining four factor constructs, represented in Table 2.

Table 2: Latent Themes in Knowledge Sharing: Structures and Processes

Factors and variables	Strongly agree	Slightly agree	No opinion	Slightly disagree	Strongly disagree	Mean	S.D.
Factor 3 Information quality							
Composite response profile	**6%**	**21%**	**3%**	**38%**	**32%**	**3.68**	**1.29**
We have very good information that is helpfully presented	7%	27%	6%	34%	26%	3.42	1.34
Our information systems give me all the information I need to do my job	3%	17%	4%	35%	41%	3.94	1.19
Generally, we are very clear about how to measure performance	6%	29%	9%	35%	21%	3.36	1.27
Factor 4 Clarity of responsibility							
Composite response profile	**6%**	**18%**	**9%**	**49%**	**18%**	**3.58**	**1.13**
Partnership working means it is difficult to know who is responsible at the end of the day R	11%	41%	9%	27%	12%	2.89	1.27
We develop some great strategies, but we never know if they are working R	17%	40%	21%	17%	5%	2.52	1.11
We have to collect statistics, but a lot are not useful for how to manage our services R	33%	40%	12%	10%	5%	2.14	1.14
Factor 5 Strategic connections							
Composite response profile	**10%**	**32%**	**9%**	**38%**	**11%**	**3.06**	**1.25**
Strategy is decided by a few people behind closed doors R	30%	35%	15%	15%	5%	2.29	1.19
We have a lot of strategic plans, but they don't mean much to those who work with users R	29%	35%	20%	10%	6%	2.30	1.18
Partnership working will mean better relationships with our service users	59%	26%	3%	7%	5%	1.73	1.13
Factor 6 Accountability							
Composite response profile	**17%**	**18%**	**24%**	**24%**	**17%**	**3.08**	**1.33**
Partnership working makes measurement of individual department's effectiveness impossible R	12%	23%	12%	29%	23%	3.28	1.37
Partnership working means that accountability for service management is problematic R	23%	36%	12%	23%	6%	2.53	1.24
R denotes variables with reversed valence in the factor analysis							

Factor 3: Quality of Information

We have already highlighted from the literature the importance of information to effective knowledge sharing. Good quality information facilitates performance review, and reflection on service delivery. It supports people in their work tasks and it provides a medium for the capture and dissemination of lessons learned. If timely and meaningful information is not provided, people will find it difficult to know how well they are performing, and they will spend extra time searching for the information they really need. This extra search time makes it even more problematic for them to spend time on reflection, or to think about new ideas.

The majority of respondents were negative about the quality of information in their organizations. Overall, only 27% viewed their information quality positively. Perhaps most significant of all were the respondents' perceptions of their information support services. Some 60% disagreed that they had very good information that was helpfully presented, while over three-quarters (76%) believed that their information systems did not give them the information they needed to do their jobs. Only 6% strongly agreed that they were very clear about how to measure performance. Unless there is clarity about the basis of performance measurement, information systems will not be perceived as providing appropriate support.

Clarity of responsibility is an antecedent to the perception of information quality. Such understanding of responsibilities would mean that people could see how information relates to them and their part in the service delivery process.

Factor 4: Clarity of Responsibility

In any organization, it is important for people to understand their specific roles and responsibilities and to know whom to contact elsewhere in the service value chain. We argue that these roles and responsibilities devolve from the design of the value chain, which in turn is determined (or should be) from the organization's strategies and objectives. In other words, people need to see clearly how their job fits into the bigger picture. In developing this line of reasoning, it seems to follow that people also need to have their responsibilities delineated clearly in relation to the organizational strategy, and to be able to see how their role contributes to its achievement. Thus, clarity of responsibility is concerned with the effectiveness of strategy delivery. Managers must ensure that people can grasp the significance of strategy in relation to their own responsibilities, and that the performance measures that derive from the strategic process (see Figure 1) are useable for managing service delivery. In this partnership-working context, it is possible to diffuse the clarity of responsibilities if the partner organizations:

(a) do not develop a joint strategy
(b) do not redefine the service value chain
(c) do not re-examine people's roles and responsibilities within the value chain
(d) do not develop inter-departmental and inter-organizational performance measures

(e) do not ensure that the new performance measures derive logically and explicitly from the joint strategy

Our results suggest that there were substantial concerns (67%) about clarity of roles and responsibilities for service delivery in this partnership. Respondents seemed to feel that much of what was being measured was not useful for service management (73%), and was not being used to influence and improve the service delivery process. Some 57% agreed that they never knew if strategies were working or not. From the interviews, it was clear that staff believed that external government requirements for statistical reporting of performance were largely irrelevant, and were, in fact, an obstacle to meaningful performance improvement.

Factor 5: Strategic Connections

This factor is concerned with the strategy formulation and deployment process. Specifically, it is about the communication of strategy and the communication connections between (i) those formulating strategy and those implementing it, and (ii) those delivering strategic plans and the relationships with service users. It is essentially about communication gaps in strategy development and deployment. Firstly, this factor suggests that managers must ensure that people feel involved in the strategy formulation process. They should check that people do not feel that strategy is handed down from 'on high'. Staff need to understand the meaning of strategy in their own situations. Strategic plans need to be living documents, owned by all, rather than uninspiring rhetoric that gathers dust on a shelf in a strategist's office. Where the strategy involves partnership working, it must be communicated in terms of improved relationships and outcomes for service users, rather than a structural end in itself.

From Table 2, we can see that there is a widespread concern about respondents' involvement in strategy formulation, and the communication of strategy, with only 5% strongly disagreeing with the view that strategy was decided by a few people behind closed doors. This lack of involvement is supported by the related statement in factor 2 (change readiness) that they were sometimes asked to express their views, but usually they were ignored.

This top-down development of strategy was also shown to be weak in two ways. First, only 6% strongly disagreed with the view that the developed strategies had little operational meaning, i.e., the strategies were not being translated into actionable intent at the user or customer interface. Secondly, performance-related variables in factor 4 (clarity of responsibility) indicate there was little subsequent feedback to employees about strategy effectiveness, with only 5% strongly disagreeing with the statement that they never knew whether or not the strategies were working. Curiously, 85% of respondents agreed that partnership working would lead to better relationships with service users. Their views about previous strategic initiatives do not support this level of optimism, and it could be that they were simply hoping that something more positive would emerge from the partnership. Given the poor levels of information quality and the lack of relevance of performance information, it is difficult to see how they would know if partnership working achieved its promise or not.

Factor 6: Accountability

The final factor is concerned with accountability within partnerships. Generally people need to know 'where the buck stops'. In an integrated service delivery chain that crosses organizational boundaries, managers must address the accountability issue. If partner organizations share a joint strategy, then it must be made clear who is ultimately accountable for performance. In public services, budgets follow performance, so that with partnership working, there must be a redefinition of the budget allocation process. Shared budgets may be a partial solution, but it is also important that each constituent department's performance can still be assessed relative to the overall service value chain. Poor redefinition of accountability is symptomatic of, and consistent with, top-down imposition of strategy with little staff involvement, and poor deployment of strategies into meaningful processes and activities.

Our results show considerable concern about accountability being problematic in partnership working, with only 6% strongly disagreeing. Similarly, only half disagreed that partnership arrangements would make measurement of individual department's performance impossible. This links to the earlier concerns about reduced clarity of roles and responsibilities highlighted in factor 5.

Explaining Knowledge Sharing

This section reports the regression analysis that shows the strength of the relationship of each factor with knowledge sharing (see Table 3). The factors are listed in order of their predictive capability.

Table 3: The Influence of the Antecedents of Knowledge Sharing

	Factor	Sig
F1	Innovative culture	Yes
F3	Information quality	Yes
F6	Accountability	Yes
F5	Strategic connections	Yes
F2	Change readiness	No
F4	Clarity of responsibility	No
Amount of knowledge sharing explained: 69%	Predictive value of factors: significant	

Full details of the regression model are contained in Appendix B. From this analysis, an innovative culture, information quality, accountability and strategic connections all make a direct and significant contribution to knowledge sharing. The remaining two factors, change readiness and clarity of responsibility do not have a significant influence on knowledge sharing, relative to the other four factors. This does not mean that they are not important. It only shows that relative to the other four factors, their contribution is less significant.

Based on connections made in the content of the interviews, we then remodelled these two factors, hypothesizing that a second-order model might be more meaningful. We hypothesized that change readiness may be an antecedent to an innovative culture, and clarity of responsibly may be an antecedent to accountability, strategic connections and information quality. This second order model is represented by Figure 2. Further regression modelling confirmed our hypotheses (see Table 4).

Table 4: Second Order Regression Analysis

The influence of change readiness on an innovative culture	
Factor items	**Sig**
We are sometimes asked what we think, but it's usually ignored	Yes
When you are always covering your back, how can you admit to wanting to do things better?	Yes
Partnership working will only mean more bureaucracy	No
We just collect the statistics and then carry on doing things the way we know works best	No
Amount of knowledge sharing explained: 60%	Predictive value of items: significant
The influence of clarity of responsibility on accountability	
Factor items	**Sig**
Partnership working means it is difficult to know who is responsible at the end of the day	Yes
We have to collect a lot of statistics, but a lot are not useful for how to manage our services	Yes
We develop some great strategies, but we never know if they are working	No
Amount of knowledge sharing explained: 49%	Predictive value of items: significant
The influence of clarity of responsibility on strategic connections	
Factor items	**Sig**
We develop some great strategies, but we never know if they are working	Yes
We have to collect a lot of statistics, but a lot are not useful for how to manage our services	Yes
Partnership working means it is difficult to know who is responsible at the end of the day R	Yes*
Amount of knowledge sharing explained: 52%	Predictive value of items: significant
	*** at 10% significance**
The influence of clarity of responsibility on strategic connections	
Factor items	**Sig**
We develop some great strategies, but we never know if they are working	Yes
Partnership working means it is difficult to know who is responsible at the end of the day	Yes
We have to collect a lot of statistics, but a lot are not useful for how to manage our services	No
Amount of knowledge sharing explained: 36%	Predictive value of items: significant

In Table 4, we can see that change readiness explained 60% of the variance in an innovative culture, while clarity of responsibility accounted for 49% of the variance in accountability, 52% of the variance in strategic connections, and 36% of the variance in information quality. The most important issues in change readiness were people believing that their opinions would be listened to, and the perceived need of individuals to cover their back. This reflects the content of the interviews, in which a blame culture was mentioned frequently.

Innovative Culture and Knowledge Sharing

From our initial regression analysis, the strongest factor in explaining knowledge sharing was that of an innovative culture, which accounted for 37% of the variance in the dependent variable. We then regressed the seven components of the innovative culture construct to explore the relative effect of each item on this factor (see Table 5).

Table 5: The Influence of Component Variables on Innovative Culture

Table 5: The influence of component variables on innovative culture	
Variable	**Sig**
New ideas are generally accepted by people in my organization	Yes
We regularly make time to reflect on what doesn't work	Yes
We are motivated to develop new ideas	Yes
We regularly make time to reflect on what works well	Yes
We are encouraged to suggest new things	Yes
Our organization is good at learning from what we do because we have the systems in place to make that happen	Yes
We are always on the lookout for things we can do differently that will make a difference to our users	No
Amount of knowledge sharing explained: 95%	Predictive value of variables: significant

Acceptance of new ideas was the strongest variable in this factor, supported by reflection on both what works and what doesn't, as well as motivation to develop new ideas. The organisation needs to be considered by staff as one that learns from experience, otherwise individual input into an innovative outlook will be felt to be ineffective.

DISCUSSION OF RESULTS

In general the results suggest five things:

(i) That the six composite factors are all important antecedents to the development of an effective knowledge sharing process and can give guidance to managers about where they should focus their efforts.

(ii) An innovative culture is the source of new ideas, but this must be underpinned by a readiness to embrace the changes embodied in these ideas and a willingness to depart from the status quo. Though the factors are strong themes in the data set, the organisations are often perceived as weak in terms of their practices.

(iii) Processes and practices that provide good quality information must also support knowledge sharing, with performance information being aligned to the organization's strategy and providing meaningful feedback on service outcomes.

(iv) To achieve effective knowledge sharing, particularly in partnership working, people need to have clarity of their roles in the process and a belief that accountability is transparent.

(v) These partnerships are unlikely to be able to achieve effective knowledge sharing, judging from respondent's answers.

The results have identified six latent constructs that explain 69% of the overall variance in the data set. We have reviewed the respondents' answers in relation to the six constructs, and concluded that these partnerships must concentrate on these six antecedents in order to develop an effective knowledge sharing process. Using regression analysis, we have produced a second-order model showing how each construct influences the effectiveness of knowledge sharing. Finally, we have explored the most significant construct, an innovative culture, to see how each of its constituent items relates to the dependent variable. We will now discuss what implications these results may have for the development of knowledge sharing within the context of strategic partnerships in the public sector.

The qualitative phase of the study implied that there were important organizational climate themes representing attitudes to reflective learning and corporate culture. In the factor analysis, the groupings of the attitude statements suggested that these issues were best represented by the labels of an innovative culture and change readiness. An innovative culture was the strongest factor in explaining the success of knowledge sharing in this partnership. Innovation, itself, depends on change readiness and together these two organizational climate factors appear to be more important than processes and systems. Embracing knowledge sharing implies that reflection on current activity leads to behaviors that result in continuous improvement – doing things differently. Implicit in this is the concept of continuous change. The change implications of knowledge management were very important in the interviews and this has translated into a strong factor that is complementary and antecedent to the main factor of an innovative culture. Both innovative culture and change readiness are well established as key strategic management challenges, and so these findings quite clearly identify knowledge sharing as a key strategic issue, rather than an IT-centred initiative, as it is often portrayed.

Public services are in an environment that is, by the nature of governmental control, characterized by continuous and often dramatic change. All too often, government-imposed changes address structural issues, e.g., new management structures, partnership policies or performance measurement initiatives. Our results suggest that this may inadvertently be misguided and that the key to improved service delivery lies in changes to the underlying culture, particularly with regard to an innovative orientation and change readiness. Applying structural solutions to behavioral problems is not recommended. What, therefore, should public sector managers do to improve service delivery through knowledge sharing?

Managing an Innovative Culture

Our results suggest that as well as management exhortations to innovate, there must also be a climate where acceptance of new ideas and the motivation to innovate are equally strong. Further, there must be appropriate systems in place to facilitate learning and reflection. The responses to the variables that comprise an innovative culture were detailed in Table 1. It is not the norm to reflect on what works well and, even less so, on what doesn't work well. From the associated interviews, this was mainly because respondents did not see the need to do so – if the statistics provided for government kept the latter "off their backs," they were content to continue with current practices.

The implications of government's policy of "seamless government" can be equated with the philosophy behind Business Process Re-engineering, i.e., that there is a need for a greater focus on the horizontal service delivery processes that begin with customer requirements and end with satisfied customers receiving the services that they expected. To this end, the current fragmentation in healthcare service delivery needs to change. In particular, intra-organizational departments need not only to understand their specific roles in delivering strategic objectives, but they also need to understand their wider contributions to the service value chain. In addition, where several healthcare organizations have a combined role in service delivery, they must also develop practices and performance measures that are more closely integrated.

In such a partnership context, this in turn implies a greater need for information sharing, and the development of information systems that support this integrated process. Moreover, to generate a shared understanding of best practices and a sharing of knowledge about lessons learned, staff in such partnerships need to be given time and opportunities to engage in socialization processes that facilitate learning. It appears from the data presented here, that McDermott's notion of "thinking with information" is unlikely to take place, given the weaknesses of current information systems and the lack of reflection on what did and what did not work well. These responses suggest that the organizations' brain is being under-utilized and starved of the lifeblood of information. More notice should be taken of Garvin's (1993) assertion that while much knowledge can be generated from reflection on success, there is even more to be gained from reflection on failure.

Taken together, these data suggest considerable evidence of a top-down culture, not very receptive to new ideas, where the lack of connection to users' experiences of service delivery was stifling staff motivation and diffusing the focus on improving the right things.

CONCLUSIONS

While there may be no recipe for an effective partnership, it seems clear from the literature and from the data presented here that some ingredients are either missing or of poor quality. We have already alluded to the need for changes in the areas of inter-organization socialization processes, reflection and learning from past practices, information system support and the development of shared performance measures. Most of these changes will require, to echo Inkpen and Dinur's observation, alterations to peoples' mental maps of what is important. These requirements point very forcibly to the organizational culture and the role of top management, underscoring the findings from the Ernst and Young survey reported earlier in the chapter.

Closer inspection of our data points to the need for further change in culture and in the strategy process. Firstly, while staff reported that they were encouraged to develop new ways of working, they were not highly motivated to do so. They also believed that an innovative culture was being stifled with a need to cover their backs. The reasons for this are unclear, but it may be associated with the heavily top-down nature of strategy development that:

- did not gather much feedback from the customer interface
- did not communicate to staff about strategic effectiveness
- had not translated strategic objectives into meaningful performance measures at operational levels
- was too focussed on measuring individual departmental performance.

There was also a hint that government requirements for performance reporting had little relevance for informing staff about what needed to be improved. This lack of focus on customers' needs and expectations is a lesson that has already been learned to significant effect in the private sector.

The concept of partnership working in public services should remove conflict and lead to better coordination of the service value chain. We see a new type of strategic alliance developing. Rather than the 'economies of scale' alliances that give access to new markets, or the complementarity of "link" alliances (Dussauge et al., 2000), that combine complementary capabilities, these 'synchronistic' alliances are about co-operation in learning and sharing of knowledge to deliver responsive services. The intangibility of such services means that public service managers rely very much on knowledge – insight, understanding and empathy, although they have yet to realize its importance.

While care organizations can be regarded as knowledge-intensive, they need to move beyond reliance on the possession of professional and clinical knowledge, and concentrate more on the delivery of this knowledge through improved processes and more involved staff. As laggards in the adoption of management approaches, public services tend to be relegated to the second division of management research. They are, however, a major component of most developed economies. Management in these organizations should no longer be subordinated to clinical excellence or government intervention. It is mainstream to the effective performance and accountability of public services, and ultimately to the achievement of healthier and happier populations.

While we recognize that our results only relate to knowledge sharing in one organizational partnership, we believe that they are generally consistent with the literature. However, the prominence of organizational change-readiness has not previously been reported in knowledge sharing research. In addition, knowledge sharing in public services contexts is relatively under-researched and we hope that these findings stimulate others to add to the debate.

REFERENCES

Blumentritt, R., & Johnston, R. (1999). Towards a knowledge management strategy. *Technology Analysis and Strategic Management, 11*(3), pp. 287-300.

Caudle, S. L. (1989). *A National Study of State Government Information Resources Management*. Syracuse, NY: School of Information Studies, Syracuse University.

Choo, C. W. (1998). *The Knowing Organisation*. New York: Oxford University Press.

Davenport, T. (1997). *Information Ecology: Mastering the Information and Knowledge Environment*. New York: Oxford University Press.

DETR. (2000). *Local Government Act*. London: The Stationary Office.

DETR. (2001). *Local Strategic Partnerships: Government Guidance*. London: The Stationary Office.

DETR. (2001a). *Best Value and Audit Commission Indicators for 2001/2002: Consultation*. London: The Stationary Office.

DoH. (1998). *Independent Inquiry into Inequalities in Health report (the Acheson Report)*. London: The Stationary Office.

DoH. (1998a). *The New NHS Modern and Dependable*. London: The Stationary Office.

DoH. (1999). *Reducing Health Inequalities: An Action Report*. London: The Stationary Office.

DoH. (2000). *NHS Plan: A Plan for Investment, a Plan for Reform* (Cm 4818). London: The Stationary Office.

Drucker, P. (1995). The new society of organizations. *Harvard Business Review, 70*(5).

Dussauge, P., Garrette, B., & Mitchell, W. (2000). Learning from competing partners: Outcomes and durations of scale and link alliances in Europe, North America and Asia. *Strategic Management Journal,* 21, pp. 99-126.

Ernst & Young. (1998). *Twenty Questions on Knowledge in the Organization*. London: Ernst & Young.

Fordham, G. (1998). *Building Partnerships in the English Regions: A Guide to Good Practice*: DETR.

Garvin, D. A. (1993, *July-August*). Building a learning organization. *Harvard Business Review,* (Reprint 93402).

Hackett, B. (2000). *Beyond Knowledge Management: New Ways to Work and Learn*. New York: The Conference Board.

Hamel, G. (1991). Competition for competence and inter-partner learning within international strategic alliances. *Strategic Management Journal,* 12, pp. 83-104.

Hansen, M. T., Nohria, N., & Tierney, T. (1999, *March- April*). What's your strategy for managing knowledge? *Harvard Business Review,* pp. 106-116.

Horton, F. W., & Marchand, D. A. (1982). *Information Management in Public Administration*. Arlington VA: Information Resources Press.

Inkpen, A. C., & Dinur, A. (1998). Knowledge management processes and international joint ventures. *Organization Science, 9*(4), pp. 454-468.

KPMG. (1998). *Knowledge Management Research Report*. London: KPMG Consulting.

Leidner, D. (2000). Editorial. *Journal of Strategic Information Systems, 9*, pp. 100-105.

Marchand, D. A., & Horton, F. W. (1986). *Infotrends: Profiting from Your Information Resources*. New York: John Wiley and Sons.

Marchand, D. A., Kettinger, W. J., & Rollins, J. D. (2001). *Information Orientation: The Link to Business Performance*. NY: Oxford University Press.

McDermott, R. (1999). Why information technology inspired but cannot deliver Knowledge Management. *California Management Review, 41*(4), pp. 103-117.

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

Office of National Statistics. (2001). *Quarterly National Accounts*. London: The Stationary Office.

Sarvary, M. (1999). Knowledge management and competition in the consulting industry California management review. *41*(2), pp. 95-107.

Synott, W. R., & Gruber, W. H. (1981). *Information Resource Management: Opportunities and Strategies for the 1980s*. New York: John Wiley and Sons.

APPENDIX A

Factor Analysis Procedures

The 22 independent variables were subjected to exploratory factor analysis using Principal Components Analysis as the extraction method and Varimax rotation with Kaiser normalization. All factors with eigenvalues greater than 1.0 were extracted. A cut-off loading of 0.5 was used to screen out variables that were weak indicators of the constructs.

All variables loaded satisfactorily onto the latent factors. The composite reliabilities of five of the six constructs met Nunnally's (1978) recommended standard of a Cronbach alpha >=0.7 for early stage research. The reliability of the remaining construct fell mildly short of this standard (0.627), but culling of the variables did not improve this situation. The MKO measuring of sampling adequacy was .789 and Bartlett's test for sphericity was significant.

To enable scrutiny of performance on each of the themes, responses to each of the factors were calculated, taking a summated variable approach, in which the average score of each component variable was used. This method was adopted so that the factor scores can be used comparatively with data from other studies, which use the same variables as items to measure factor performance. If factor scores had been used, this would not be possible as factor loadings are not replicable across data sets. The problem inherent in this is the categorization of the resultant scores on a 5-point scale. Though this is problematic, we have presented the results, which at the very least give an indication of the spread of opinion across the factors.

Table A1 shows the latent themes in this set of variables, indicating the factor loadings and communality associated with each variable. It also presents the Cronbach alpha for each factor to indicate the reliability of the variables in representing a discrete theme.

APPENDIX A (CONTINUED)

Table A1: Latent Themes in Knowlede Sharing

Factors and variables (communality)	Factor loadings					
Factor 1 Innovative culture alpha =.9153						
New ideas are generally accepted by people in my organization (.739)	.826					
We are motivated to develop new ideas (.745)	.821					
We regularly make time to reflect on what works well (.705)	.752					
We are encouraged to suggest new things (.786)	.744					
We are always on the lookout for things we can do differently that will make a difference to our users (.770)	.700					
We regularly make time to reflect on what doesn't work (.700)	.677					
Our organization is good at learning from what we do because we have the systems in place to make that happen (.704)	.586					
Factor 2 Change readiness alpha =.8110						
We are sometimes asked what we think, but it's usually ignored (.683)	.551	.533				
When you are always covering your back, how can you admit to wanting to do things better? (.716)		.839				
We just collect the statistics and then carry on doing things the way we know works best (.676)		.714				
Partnership working will only mean more bureaucracy (.743)		.676				
Factor 3 Information quality alpha =.7604						
We have very good information that is helpfully presented (.808)			.847			
Our information systems give me all the information I need to do my job (.841)			.844			
Generally, we are very clear about how to measure performance (.493)			.523			
Factor 4 Clarity of responsibility alpha =.7204						
Partnership working means it is difficult to know who is responsible at the end of the day (.777)				.815		
We develop some great strategies but we never know if they are working R (.588)				.539		
We have to collect statistics, but a lot are not useful for how to manage our services (.728)				.519		
Factor 5 Strategic connections alpha =.7185						
Strategy is decided by a few people behind closed doors (.736)					.803	
We have a lot of strategic plans but they don't mean much to those who work with users (.817)					.777	
Partnership working will mean better relationships with our service users (.660)					.624	
Factor 6 Accountability alpha =.6271						
Partnership working makes measurement of individual department's effectiveness impossible (.815)						.868
Partnership working means that accountability for service management is problematic (.661)				.552		.552
Eigenvalues	8.112	2.036	1.728	1.545	1.425	1.047
% of variance explained	36.9	9.3	7.85	7.0	6.5	4.8
Cumulative %	36.9	46.1	54.0	61.0	67.5	72.2
R denotes variables with reversed valence in the analysis						

APPENDIX B

Regression Analysis

We used multiple regression with the six composite independent variables, expressed as factor scores condensed from the item responses, regressed against the dependent variable of effective knowledge sharing. Stepwise regression analysis provided the amount of variance explained by the individual factors. Table B1 shows the results for all six independent variables.

Further regression analysis was used to model the second-order pathways of relationships between the independent variables leading to prediction and, thus, management of the dependent variable (see Tables B2-B5).

The final step in regression analysis was to calculate the regression of the individual variables that contribute to an innovative culture, Table B6.

Table B1: Regression Analysis: The Influence of Factors on Knowledge Sharing

Dependent variable: effectiveness of knowledge sharing					
Factor		**R**	**Beta**	**t**	**Sig**
Innovative culture		.598	.598	9.210	0.000
Information quality		.649	.251	3.860	0.000
Accountability		.667	.156	2.404	0.018
Strategic connections		.680	.132	2.040	0.043
Change readiness			.100	1.535	0.127
Clarity of responsibility			.010	0.147	0.884

Model Summary	**R**	**R^2**	**Adjusted R^2**	**Std error of estimate**
	0.688	0.473	0.447	1.01

Analysis of Variance (ANOVA)					
	Sum of squares	df	Mean Square	F	Significance
Regression	115.115	6	19.186	18.673	0.000
Residual	128.430	125	1.027		
Total	243.545	131			

Table B2: Regression: The Influence of Change Readiness on an Innovative Culture

Variable	**R**	**Beta**	**t**	**Sig**
We are sometimes asked what we think, but it's usually ignored R	.545	.690	7.329	.000
When you are always covering your back, how can you admit to wanting to do things better? R	.595	.257	.2986	.003
Partnership working will only mean more bureaucracy R		.117	1.116	.267
We just collect the statistics and then carry on doing things the way we know works best R		.081	.858	.393

Model Summary	**R**	**R^2**	**Adjusted R^2**	**Std error of estimate**
	.601	.361	.341	.811

Analysis of Variance (ANOVA)					
	Sum of squares	Df	Mean Square	F	Significance
Regression	46.401	4	11.600	17.652	.000
Residual	82.145	125	.657		
Total	128.546	129			

Table B3: Regression: The Influence of Clarity of Responsibility on Accountability

Variable	R	Beta	t	Sig
Partnership working means it is difficult to know who is responsible at the end of the day R	.478	.441	4.906	.000
We have to collect a lot of statistics, but a lot are not useful for how to manage our services R	.297	.426	4.893	.000
We develop some great strategies but we never know if they are working R		.102	1.136	.258

Model Summary	**R**	**R^2**	**Adjusted R^2**	**Std error of estimate**
	.486	.237	.218	.878

Analysis of Variance (ANOVA)					
	Sum of squares	Df	Mean Square	F	Significance
Regression	30.120	3	10.040	13.012	.000
Residual	97.218	126	.772		
Total	127.338	129			

Table B4: Regression: The Influence of Clarity of Responsibility on Strategic Connections

Variable	R	Beta	T	Sig
We develop some great strategies, but we never know if they are working R	.390	.572	6.481	.000
We have to collect a lot of statistics, but a lot are not useful for how to manage our services R	.498	.297	3.472	.001
Partnership working means it is difficult to know who is responsible at the end of the day R		.153	1.734	.085

Model Summary	**R**	**R^2**	**Adjusted R^2**	**Std error of estimate**
	.515	.265	.248	.863

Analysis of Variance (ANOVA)					
	Sum of squares	Df	Mean Square	F	Significance
Regression	33.903	3	11.301	15.172	.000
Residual	93.852	126	.745		
Total	127.755	129			

Table B5: Regression:The Influence of Clarity of Responsibility on Information Quality

Variable	R	Beta	T	Sig
We develop some great strategies, but we never know if they are working R	.302	.344	3.587	.000
Partnership working means it is difficult to know who is responsible at the end of the day R	.350	.214	2.230	.028
We have to collect a lot of statistics, but a lot are not useful for how to manage our services R		.139	1.494	.138

Model Summary	**R**	**R^2**	**Adjusted R^2**	**Std error of estimate**
	.363	.132	.111	.950

Analysis of Variance (ANOVA)					
	Sum of squares	Df	Mean Square	F	Significance
Regression	17.266	3	5.755	6.377	.000
Residual	113.726	126	.903		
Total	130.992	129			

Table B6: Regression: The Influence of the Components of an Innovative Culture

Variable	R	Beta	T	Sig
New ideas are generally accepted by people in my organization	.826	.423	10.115	.000
We regularly make time to reflect on what doesn't work	.913	.234	5.158	.000
We are motivated to develop new ideas	.939	.233	5.162	.000
We regularly make time to reflect on what works well	.947	.213	5.045	.000
We are encouraged to suggest new things	.950	.168	3.610	.000
Our organization is good at learning from what we do because we have the systems in place to make that happen	.952	.086	2.114	.037
We are always on the lookout for things we can do differently that will make a difference to our users		.039	.743	.459

Model Summary	**R**	**R^2**	**Adjusted R^2**	**Std error of estimate**
	.953	.907	.902	.313

Analysis of Variance (ANOVA)

	Sum of squares	Df	Mean Square	F	Significance
Regression	118.88	7	16.983	178.759	.000
Residual	12.12	124	.000		
Total	131.000	131			

Chapter XVI

The Process of Converting Consultants' Tacit Knowledge to Organisational Explicit Knowledge: Case Studies in Management Consulting Firms

Ricky Laupase
Edith Cowan University, Australia

ABSTRACT

Management consulting firms are typical examples of knowledge-intensive organisations in which the consultants' knowledge, in particular tacit knowledge, is critical to the success of the firms. The firm's success depends on its continuous effort to retain the consultant's tacit knowledge. This chapter will explore the conversion processes of consultants' tacit knowledge to the organisational explicit knowledge by focusing on how organisational structure, culture and information technologies support the conversion processes. For the purpose of this study, Nonaka and Takeuchi's (1995) spiral evolution knowledge conversion model will be revisited. To address the issue, three case *studies on management consulting firms in Australia were conducted. Findings of research will report on the respondents' perception of the importance of tacit knowledge and conversion of consultants' tacit knowledge to organisational explicit knowledge with reference to organisational structure, culture and information technology. From the findings, the researcher will establish the so-called guidelines for converting such knowledge and, hence, propose a suggestion for future research.*

INTRODUCTION

Today's economies are increasingly focused on knowledge, which is recognised as the key driver of economic performance. As expressed by Drucker (1993, p. 42), "knowledge is the only meaningful resource today; the traditional 'factors of production' have not disappeared, but they have become secondary." In other words, given today's economy, the traditional factors of labour, capital, and land are no longer perceived as the most important resources. People and organisations have begun to realise the importance of knowledge and regard it as the most important asset. Knowledge is a meaningful resource at present and inevitably in the future. One way to improve economic performance is to treat knowledge as providing a competitive advantage through the conversion of tacit individual knowledge into explicit organisational knowledge. In this way, people do not reinvent the wheel for each project carried out by the organisation (Devlin, 1999; Drucker, 1993; Nonaka, Takeuchi, 1995; Stewart, 1997).

In a management consulting firm, consultants are the holders of the individual knowledge that generates revenue. The tacit knowledge of a consultant is critical to the success of a project, but it can be more beneficial to a firm if it can be converted to explicit knowledge. By doing so, the firm is able to prevent the reinvention of the same methods to solve the same problems that have already been solved in the past. Moreover, other consultants can apply these methods even when the person who was originally involved is no longer employed by the firm.

According to Nonaka and Takeuchi (1995), knowledge conversion is a process of interaction between tacit and explicit knowledge. This interaction ensures a continuous interplay between the two entities, i.e., the individual and the firm (Inkpen, 1996). However, the process is dependent upon other inherent variables, such as organisational structure, culture and information technology (Dilnutt, 1999). In this paper, the researcher, therefore, aimed:

- To observe the conversion processes of consultants' tacit knowledge to organisational explicit knowledge,
- To evaluate how organisational structure, culture and information technology support this conversion process, and

- To provide guidelines for converting consultants' tacit knowledge to organisational explicit knowledge.

KNOWLEDGE CONVERSION MODEL

This study is based on the spiral evolution model of knowledge conversion developed by Nonaka and Takeuchi (1995). According to this model, there are two stages that need to be completed in order to convert consultants' tacit knowledge to explicit organisational knowledge, i.e., the socialisation process and the externalisation process.

The Socialisation Process

The socialisation process involves sharing of tacit knowledge between consultants. Tacit knowledge is subjective; it is experience-based knowledge which too often cannot be expressed in words, sentences, numbers or formulae because it is context specific (Nonaka, Takeuchi, 1995). Consultants can share this knowledge by working in the same environment, or simply by spending time in a same place. This can be a formal situation, such as at a meeting or in conference room, or it can be informal, such as in a restaurant, a café, or an office corridor.

In this process, the experience is not shared through written or verbal instructions, rather it is conducted through self-transcendence, that is, the self is freed in order to become a larger self that includes tacit knowledge of others (Nonaka, Konno, 1998). A consultant needs to be receptive to the new knowledge and to use it in order for this process to work. According to Nonaka and Takeuchi (1995), socialisation is most effective if it is done orally and/or through dialogues of a meeting.

Externalisation Process

Externalisation process is comprised of two important phases. First, it requires the expression of consultants' tacit knowledge in the form of words and concepts. They could be expressed as metaphors, analogies, and narratives.

- Metaphor is an attempt to understand one element of experience in terms of another (Morgan, 1997).
- Analogy refers to the commonality of the relational structure of attributes between concepts (Dawson, 2000).
- Narrative is a story and the main vehicle for transmitting knowledge from one generation to another throughout the world (Remenyi, Williams, Money, Swartz, 1998).

The second phase ensures the translation of consultants' tacit knowledge into readily understandable or explicit forms (i.e., in documentation and/or databases). Explicit knowledge is objective, rational, context free and can be expressed in words, sentences, numbers or formulae (Nonaka, Takeuchi, 1995).

As indicated earlier, the individual-to-organisation knowledge conversion model that will be used in the study is that of Nonaka and Takeuchi (1995). The model incorporates inherent variables that support knowledge conversion, i.e., organisational structure, organisational culture, and information technology (IT). The model is illustrated in Figure 1 below.

The following sections will discuss the moderating influences, which are comprised of organisational structure, culture and IT.

Organisation Structure

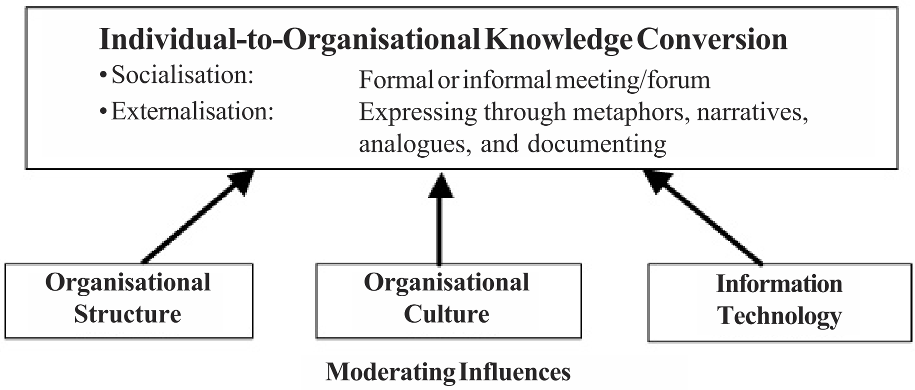
The structure of an organisation is defined as "the formal relationships and allocation of activities and resources among people" (McKenna, 1999). The structure of an organisation determines how an organisation operates its business. Typical organisations usually have different management levels (Buzan, Dottino, Israel, 1999). In other words, in many consulting firms, there are three levels of management: top management (i.e., senior executives), middle management (i.e., middle managers) and lower management (i.e., junior consultants), which together constitute the structure.

The structure of an organisation is also characterised by three types of knowledge conversion (Lessem, Palsule, 1997):

1. Hierarchical structure: where top-level management assumes a leadership role and gives oral and/or written instructions to their subordinates. The senior executives are, therefore, the creators of the managerial concepts of decision-making. In this type of organisation, knowledge is created explicitly (i.e., it is documented or computerised).
2. Flat structure: where low and middle management levels operate as entrepreneurs. They contribute their opinions and are sponsored by the senior executives. In this type of organisation, the senior executives provide support rather than give oral and/or written instructions and, therefore, knowledge is created tacitly within low and middle management.
3. Hybrid structure: where management levels are important actors who work together in an organisation. The senior executives articulate the visions of the organisation and the junior members deliver the visions. Middle management synthesises both tacit knowledge from senior executives and junior members and tries to deliver the vision explicitly in terms of the creation of new products and services. In this type of organisation, knowledge is created tacitly and explicitly, and shared among all levels of management.

This research aimed, firstly, to establish which organisation structure was adopted in the management consulting firms involved in the study and, secondly, to identify the effect that organisational structure may have on the individual-to-organisation knowledge conversion process with reference to Figure 1.

Figure 1: Individual-to-Organisational Knowledge Conversion Research Model



Organisational Culture

Culture in an organisation is defined as an aggregate of the shared understandings of individuals which influence the collective behaviour of the organisation (Lyles, Schwenk, 1992). An organisation is made up of individuals who have their own unique norms, values and behaviours (Prusak, 1996). The collective behaviours, norms and values of individuals within an organisation create its culture (Dilnutt, 1999) and, therefore, holds the organisation together.

Management consulting firms are typical examples of highly knowledge-intensive organisations as they depend upon the knowledge and expertise of their consultants (Apostolou, Mentzas, 1999). Consultants perceive their knowledge and expertise as wealth. It is, therefore, advisable that consultants are willing to share their knowledge and expertise. Motivation to willingly share knowledge can come from rewards such as promotion and salary increases that are based on employees' performances rather than being based on seniority and favouritism (Robbins, Barnwell, 1994). Rewards can also be in the form of praise, recognition, time off, empowerment, bonuses, work selection, advancement, and professional development.

As part of the study, the researcher also examined whether reward, as part of organisational culture, motivates consultants to convert their tacit knowledge to explicit organisational knowledge.

Information Technology (IT)

IT in an organisation is defined as the means by which it acquires, stores, and distributes information with computerisation that can be done quickly and easily (Maglitta, 1996). IT includes electronic mail, groupware, data warehouses, videoconferences, and network bulletin boards. The Internet, intranet, and extranet are also the technologies that make the above application possible since they have been widely used to transcend the traditional organisation's boundaries so as to allow authorised people around the world to access data sources.

Although these technologies look promising for knowledge conversion processes, poor implementation or over-emphasis of these technologies can inhibit their effectiveness (Leonard-Barton, 1995). Therefore, advances in IT do not guarantee support for the process of knowledge conversion. Furthermore, knowledge is continuously recreated and re-constituted through dynamic, interactive social networking activity (Brooking, 1999), while IT can play a role in the development of knowledge (Swan, Newell, 2000). IT can enhance knowledge development because it disregards physical location and removes barriers to allow for collaborative teamwork and knowledge sharing (Chesbrough, Teece, 1998).

Many multinational management consulting firms use appropriate technologies (e.g., e-mail and groupware) for knowledge sharing (Chaudhry, Ng, 2001). As part of this study, the researcher also examined to what extent the Internet and associated technologies supported the socialisation and externalisation knowledge conversion processes in these firms.

THE RESEARCH

Three case studies were conducted in December 2000 on three management consulting firms in Australia. Two are internationally recognised management consulting firms and one is a national consulting firm. Two senior management personnel (i.e., the chief executive officer and director) were interviewed; the former was in Melbourne and the latter was in Perth. One middle management person (i.e., the manager) was interviewed in the office in Melbourne. Each interview lasted between 45 and 60 minutes. The three interviews (i.e., one from each firm) were tape-recorded and later transcribed. Qualitative data analysis software, Nud*ist, was used to assist in the analysis of the transcriptions.

Semi-structured interviews were conducted to provide the interviewees with "freedom" to respond to the questionnaires (Gorman, Clayton, 1997). This interview technique was used to enable natural and spontaneous communication with the interviewees and, thereby, achieve more rigorous results.

The interview questionnaires focused on the knowledge conversion process in attempt to uncover an organisational point of view of how knowledge conversion was supported. During interviews, data were collected with respect to the following propositions:

- **Proposition One**: Formal meetings encourage consultants to share tacit knowledge with others through a socialisation process.
- **Proposition Two**: In externalising tacit knowledge, metaphors, narratives and analogies are important, as they assist individuals to articulate tacit knowledge.
- **Proposition Three**: Hybrid organisational structure can support knowledge conversion processes.

- **Proposition Four**: Reward systems, as part of a supportive organisational culture, will encourage knowledge conversion activities.
- **Proposition Five**: Information technologies will not support, facilitate and enable knowledge conversion processes.

In the following sections, Cases 1, 2, and 3 represent the management consulting firms in Melbourne, Perth, and Melbourne. Each proposition as listed above will be discussed below.

Proposition One: Formal Meetings Encourage Individuals to Share Tacit Knowledge With Others Through a Socialisation Process

This section will discuss the importance of meetings to help encourage the sharing of tacit knowledge. The study found that meetings were the most common joint activities in any organisations. Meetings are usually scheduled weekly, fortnightly, and monthly to discuss a range of issues in the consulting practice, as described in Table 1.

Table 1: Meetings in the Socialisation Process

		Case 1	*Case 2*	*Case 3*
Formal Weekly	*Attendees*	Directors, Managers,	Directors and	Directors and
	Discuss	- the projects'	- who does what in a project	- allocation of consultants in a project - new
Formal Fort-	*Attendees*	Directors	N/A	Managers, Senior
	Discuss	- the progress of consultants' work in a project - whether	N/A	- the projects that are going on - the progress
Formal Monthly	*Attendees*	N/A	Consultants, Senior Consultants,	N/A
	Discuss	N/A	- specific issues that include the	N/A

Respondents believed that their organisations held meetings to discuss their business situations on a weekly, fortnightly and monthly basis. Cases 1 and 3 did not hold formal monthly meetings, while Case 2 did not hold a formal fortnightly meeting, as shown in Table 1.

The consultants in these organisations met to initialise a project, check and obtain reports from other consultants on progress of a project. As shown from the above table, none of these meetings were held mainly to share knowledge. Furthermore, being together in a formal meeting did not guarantee that tacit knowledge would be shared among the attendees. However, they indicated that sometimes they would share knowledge, but not necessarily in a formal meeting.

Proposition Two: In Externalising Tacit Knowledge, Metaphors, Narratives and Analogies are Important as They Assist Individuals to Articulate Tacit Knowledge

An individual's ideas or images can be articulated in the form of metaphors, analogies and narratives, and their translations into explicit forms were described to the interviewees. However, all interviewees had only limited understanding of the externalisation process of knowledge conversion. In due course, the use of the three articulation techniques and their translations into documents should be encouraged in order to externalise tacit knowledge.

To convert tacit knowledge into explicit knowledge, all firms used induction programs, such as case studies. A case study within a training session that corresponds with the use of metaphors, narratives, and analogies was indicated in the externalisation process. Other methods found in the interviews were explicit presentations and mentoring. These two methods of conversion processes emerged during the study, which were not indicated earlier in the literature review.

The translation of these expressions of tacit knowledge was part of the process. However, there was no indication that the attendees in the training sessions, who are present at "explicit presentations" and who are mentored, actually translate their new tacit knowledge into explicit forms (i.e., documentation, databases). In other words, they did not create written documentation for their knowledge development which can be accessible by others in the firm, as described in Table 2.

All three firms held training sessions, gave explicit presentations, and provided mentoring to transfer consultants' tacit knowledge to the juniors, but none converted this knowledge into explicit organisational knowledge. It appears that individual consultants do not have the time to do this, as they need to fulfil other commitments. Nonetheless, the tacit knowledge of senior staff members was highly valued and needs to be transferred via induction programs and captured in written documents or databases. This would minimise the loss of knowledge from specialists.

Table 2: Expression and Documentation in the External Process

Externalisation	Methods		Case 1	Case 2	Case 3
Expression of Tacit	Metaphor, Narratives,	Anticipated	Case Study in a	Case Study in a	Case Study in a
		Results Emerged from	* *Mentoring, Explicit Present-*	* *Mentoring, Explicit*	* *Mentoring, Explicit*
Documentation of Tacit	Written Documents,		Have the intention to document expressed tacit knowledge but never	Have the intention to document expressed tacit knowledge but never	Have the intention to document expressed tacit knowledge but never

** Mentoring and Explicit Presentations Emerges in the Interviews*

Proposition Three: Hybrid Organisational Structure Can Support Knowledge Conversion Processes

The study also found that each firm under investigation employed a different organisation structure. Case 1 had a group of account managers that oversees the clients and particular existing projects. Each project had an account manager and consultants who reported to the principal consultants. Managers did not direct, but rather provide support for the consultants. Therefore, this firm had implemented what it called a "network" organisation structure. This structure used an arbitrator to allocate people to projects. Top management would approach this arbitrator to establish available consultants for an urgent task. They would not approach the consultant directly, but would ask the arbitrator as to whether this person could be allocated to the task. Once the person was known to be available, the arbitrator would then allocate this person to a project. This showed that top management did not control the allocation of tasks in the firm. Consultants were also able to acquire advice and to provide other consultants with advice to accomplish a job. Thus, within this firm, there was considerable cooperation in the way consultants shared knowledge with each other.

Case 2 claimed to use a "loose" hierarchical structure that operates in a matrix environment. Partners and staff were placed in different pools which were categorised along three dimensions: (1) post-implementation services and office administration; (2) industry groups, such as financial services, technology and media communication, energy and utilities, products, and healthcare; (3) staff hierarchies, such as partner, director, manager, experienced consultant, consultant, administrator and secretary. These dimensions operated globally and a consultant in a pool could work across dimensions and anywhere the world. For example, when a project commences, all levels of consultants were pulled out of the pool and allocated in a hierarchical fashion (i.e., a partner, a director, a manager, a senior consultant, a junior consultant) in terms of delegating tasks and reporting. A consultant would need to report to his/her senior consultant, who would then report to the manager of the project, and so forth. When the project is completed, all consultants are placed back into the pool. Thus, the loose structure operated semi-hierarchically, that is, the hierarchy operates only for the duration of the project.

Case 3 used divisions such as tax services, assurance and advisory, business process management, and work solutions. This firm also claimed to use a "network" organisational structure where consultants across divisions would share knowledge when working on the same project. For example, a consultant in the assurance and advisory division would work with a consultant from business process management. They would work and share their knowledge while working together. Each consultant was encouraged to give advice and take suggestions to achieve better service and the clients' satisfaction.

The evidence of the "loose" and "network" organisation structures strengthens the process of knowledge conversion in different ways. In Case 2, a "loose" organisation structure can turn into a hierarchical structure when a project comes in and turn loose again when the project is completed. In Cases 1 and 3, the use of "network" organisation structures allows equal treatment of every employee to give and take advice from others. These structures are believed to enhance knowledge conversion processes as they encourage consultants to share knowledge.

Proposition Four: Reward Systems, as Part of a Supportive Organisational Culture, will Encourage Knowledge Conversion Activities

Reward systems, as part of organisation culture, are seen to encourage knowledge sharing since people will share knowledge if they can get something in return, which might be in the form of recognition, praise, advancement, time off, or money. Case 1 implemented a professional development session and encouraged employees to attend. The staff were rewarded for attending sessions. Staff were encouraged to present their knowledge explicitly during the professional development, as long as it was relevant to the firm's objectives and on-going development. The reward was provided based on attendance and the relevancy of the topic.

Case 2 used a competency-based performance model to evaluate staff members' performances and career development. The model evaluated them based on their contributions to the knowledge-based system of the firm. An employee would be rewarded if he/she made a significant contribution. However, no reward would be provided if an attempt to share knowledge was not evident. The competency-based performance model was introduced to improve consultants' knowledge, skills and attitudes towards their work.

Case 3 used an incentive program that provides a monthly "best performance" and "best practice" reward. This firm also provided rewards for a bi-monthly business achievement, that is, staff members who contributed or had expressed a knowledge- sharing attitude. Every Friday, staff members gathered in the lounge to witness the reward recipients receiving their reward.

The case studies found that rewards are given to staff members based on several criteria. Firstly, they are given based on the consultants' participation in professional development sessions and the relevancy of the topic relating to the firm's objectives and on-going development. Secondly, rewards are given based on the evaluation of consultants' improvement in knowledge, skills, and attitudes based on a competency model. Lastly, the consultants are rewarded if they have a positive attitude towards knowledge sharing.

Proposition Five: Information Technologies will not Support, Facilitate and Enable Knowledge Conversion Processes

Case 1 used IT in several areas. A local area network (LAN) was implemented to link clusters of computers and to map a network drive which staff was able to access. "Microsoft Outlook" was used to facilitate communication among employees and with clients via the Internet. At the time of the interview, this firm was developing a technology that would provide information as quickly as possible with a web-enabled user interface. This would also enable staff members to use the products off site. For example, if staff needed information about work to be done for a certain client, then a list of clients that correlates with the work is shown on screen.

Case 2 organisation used IT to facilitate its communication amongst the staff members via an intranet with clients and the Internet. "Lotus Notes," a groupware application, was used for e-mail and it provided a client/server database (i.e., a knowledge database) to create, store, and modify documents accessed by other staff on and off site. Users were able to share explicit knowledge by storing lessons learnt from a project in a knowledge database which were accessible globally by authorised users. Employees from around the world were encouraged to share their experiences on the intranet.

Case 3 also implemented a LAN and wide area network (WAN) for communication amongst employees and with clients. Lotus Notes, a groupware application, was used to send e-mails to clients and as a global database server. The technology assisted the consulting practice activities, for example, proposals could be prepared faster with information that can be collated effectively and efficiently.

All three firms however, indicated that technology was not the first priority of the consulting practice when considering knowledge conversion. The most important issue was to develop an effective organisation structure and culture to assist the conversion processes. Although technology was not the first priority, it played a significant role in the knowledge conversion process as it provided the knowledge in a readable form, thus, beneficial to the users. Therefore, the conversion process was partially supported by IT.

Guidelines for Converting Tacit to Explicit Knowledge

As a result of this study, the researcher proposes the following guidelines that could be used to assist consultants to convert their 'valuable' tacit knowledge to organisational explicit knowledge. The following guidelines may be used by other consultants where appropriate:

- Conduct informal meetings, rather than formal meetings, because an informal atmosphere relaxes the tension of formal relationships between consultants in an organisational structure and removes any uneasiness about posing any questions necessary to clarify their understanding.
- Implement the use of metaphor, analogy, and narrative in order to express the consultants' tacit knowledge. The process of expressing this type of knowledge may be implemented in induction programs such training, explicit presentation, and mentoring.
- Translate the expressed tacit knowledge by associating it with the reward systems in exchange for the time and energy spent on the process.
- Implement the "loose" and/or "network" organisational structures. The "loose" organisational structure can become a hierarchical structure when a project comes in and become loose again when the project is completed. The "network" structure allows equal opportunity for consultants to share knowledge with their colleagues.
- Introduce reward systems to encourage tacit-to-explicit knowledge conversion by inclusion in the skill evaluation process that should be conducted once or twice per year.
- Utilise groupware applications (i.e., Lotus Notes) and e-mail technology (i.e., Microsoft Outlook) to store the expressed tacit knowledge. Consultants should be encouraged to access and use the "lessons learnt" that are kept in a database.

CONCLUSION

The researcher realised that since there are only three case studies conducted, the findings of this study are provisional. The conclusions at this stage of this research are briefly as follows.

During the investigation, the organisations realised the importance of their tacit and explicit knowledge. However, they lacked guidelines on how to convert individual tacit to firm explicit knowledge. Formal meetings did not necessarily support knowledge sharing amongst consultants, while informal meetings did encourage such a process as a result of the socialisation process. Metaphors, narratives, and analogies assisted in the expression of tacit knowledge. However, time constraints were seen as a problem for the documentation or the externalisation process.

Despite the hybrid structure that was proposed to support the conversion process, a "loose" structure and a "network" organisational structure emerged during the study and supported the knowledge conversion processes in management consulting firms. Reward systems, as part of a supportive organisational culture, encouraged the conversion process. However, IT facilitated the process only partially, because it was rather regarded as a tool to accelerate the activities of the consulting practice.

REFERENCES

Apostolou, D., & Mentzas, G. (1999). Managing corporate knowledge: A comparative analysis of experience in consulting firms (Part 1). *Knowledge and Process Management*, *6*(3), pp. 128-138.

Brooking, A. (1999). *Corporate Memory: Strategy for Knowledge Management*. London, Tokyo: International Thomson Business Press.

Buzan, T., Dottino, T., & Israel, R. (1999). *The Brainsmart Leader*. Hampshire, VT: Gower Publishing Limited.

Chaudhry, A. S., & Ng, S. (2001, 20-23 May 2001). Knowledge management in the corporate sector: A study of knowledge sharing practices in a multinational company. Paper presented at *Managing Information Technology in a Global Environment,* Canada.

Chesbrough, H., & Teece, D. J. (1998). When is virtual virtuous? Organizing for innovation. In D. A. Klein (Ed.), *The Strategic Management of Intellectual Capital*.

Dawson, R. (2000). *Developing Knowledge-Based Client Relationships: The Future of Professional Services*. Boston, Auckland, Melbourne: Butterworth & Heinemann.

Devlin, K. (1999). *Infosense: Turning Information into Knowledge*. New York: W.H. Freman and Company.

Dilnutt, R. (1999). *Knowledge Management as Practiced in Australian Organisations: A Case Study*. Unpublished DBA, Southern Cross, Sydney.

Drucker, P. (1993). *Post-Capitalist Society*. New York: Harper Business.

Gorman, G. R., & Clayton, P. (1997). *Qualitative Research for the Information Professional: A Practical Handbook*. London: Library Association Publishing.

Inkpen, A. (1996). Creating knowledge through collaboration. *California Management Review*, *39*(1), pp. 123-140.

Leonard-Barton, D. (1995). Implementing and integrating new technical processes and tools. In R. L. Ruggles (Ed.), *Knowledge Management Tools*.

Lessem, R., & Palsule, S. (1997). *Managing in Four Worlds*. Oxford, Malden: Blackwell Business.

Lyles, M. A., & Schwenk, C. R. (1992). Top management, strategy and organisational knowledge structures. In L. Prusak (Ed.), *Knowledge in Organisations*.

Maglitta, J. (1996). Know-how, Inc. *Computer World*, *30*(1).

McKenna, R. (1999). *New Management*. New York, Sydney, Singapore: McGraw-Hill.

Morgan, G. (1997). *Images of Organisation*. Thousand Oaks, London: Sage Publications.

Nonaka, I., & Takeuchi, H. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford University Press.

Prusak, L. (1996). *Knowledge in Organisations*. Boston: Butterworth-Hieneman.

Remenyi, D., Williams, B., Money, A., & Swartz, E. (1998). *Doing Research in Business and Management*. London, Thousand Oaks, New Delhi: Sage Publications.

Robbins, S. P., & Barnwell, N. (1994). *Organisation Theory in Australia*. New York, London, Sydney: Prentice Hall.

Stewart, T. A. (1997). *Intellectual Capital: The New Wealth of Organizations* (1st ed.). New York: Doubleday/Currency.

Swan, J., & Newell, S. (2000). Linking knowledge management and innovation. Paper presented at the *European Conference on Information Systems*, Vienna, Austria.

Chapter XVII

Communicated Knowledge in Electronically Enabled Business Interactions

Violina Ratcheva
The University of Nottingham, United Kingdom

ABSTRACT

Virtual teams have been increasingly cited as an efficient and flexible novel form of organisational arrangements affected by the emergence of the electronic business space. The purpose of forming such teams is a new 'knowledge creation'. The paper argues that unraveling the mystery of knowledge creation processes in virtual partnerships requires an in-depth understanding of the complex interaction processes involved in forming computer-mediated business relationships. The focus, therefore, is on the process of collective 'knowing', defined as the team's actions and interactions embedded in unique social activities in virtual teams, rather than on knowledge being a pre-given resource possessed by the team members. The paper presents the preliminary *results of a qualitative research study on seven virtual partnerships and proposes an initial conceptual framework of the knowledge creative processes taking place in virtual business relationships.*

INTRODUCTION

Virtual teams have been increasingly cited as an efficient and flexible novel form of organisational arrangements becoming increasingly popular in a global business environment (Kristof et al., 1995; Townsend et al., 1996; Grenier, Metes, 1995). Teamwork in a virtual organisation is essential to tap into the best talent to create the highest quality and fastest response to customer needs. The key purpose of such teams is a new 'knowledge creation' and applying it into novel combinations of products and services (Seufert et al., 1999). Virtual teams are usually formed by experts or scientists with diverse expertise and, therefore, the knowledge required for successfully completing a project is not 'owned' by any team member, but is embedded in the dynamics and patterns of a team's communications and interactions which can enable members to blend their individual expertise and collectively develop the required new knowledge.

The view adopted in this paper is that new knowledge creation is collectively constructed and embedded in the organising practices of virtual teams' activities. Despite the lack of consensus amongst scholars on the exact nature of the virtual organising principles, recent studies suggest that virtual teams are not simply an evolutionary form of co-located teams and they represent novel patterns of interactions and social exchange (Ratcheva, Vyakarnam, 2000). On one hand, the boundaries of such partnerships are blurred and only socially constructed by the network members. On the other, the issues around socialising in such teams are distinctively different because the co-existence of 'space' and 'place' represents a fundamental change in the business environment. Although the two spaces are not mutually exclusive and sometimes overlap with each other in the organisation and execution of activities, the rules governing the two spaces are fundamentally different. To survive, therefore, companies adopting a virtual business model must not only exploit geographical differences and overcome geographical constraints in the physical world, but also exploit opportunities and face threats in the new electronic space (Lombard, Ditton, 1997).

This paper argues that unravelling the mystery of knowledge creation processes in distant relationships requires an in-depth understanding of the complex interaction processes involved in forming business relationships enabled by computer-mediated communications. The focus, therefore, is on the process of 'knowing' in distant interactions involving unique social activities rather than 'knowledge' as a pre-given resource possessed by team members. The paper draws upon the results of a qualitative research study of seven virtual partnerships and presents an initial framework of the knowledge creative processes in virtual business relationships.

DEFINING TEAMS ENABLED BY ELECTRONIC SPACE

A number of studies try to capture the essence of virtual organising principles (Davidow, Malone, 1992; Mowshowitz, 1997). They have described mainly an organising logic that is especially relevant when a collection of geographically distributed, functionally and/or culturally diverse entities are linked by electronic forms of communication and rely on lateral, dynamic relationships for coordination. The virtual organisation is often described as one which is replete with external ties, managed via teams that are assembled and disassembled according to need (Grenier, Metes, 1995; Lipnack, Stamps, 1997), and consisting of employees who are physically dispersed from one another, creating a "*best-of-everything*" organisation (Miles, Snow, 1995).

Focal building blocks of such structures are the distributed cross-functional expert teams collaborating globally. The specific characteristics of the virtual teams, therefore, are best identified in the boundary-crossing nature of the team's communications, interactions, relationship forming across space and time and organisations enabled by information technologies (Kristof et al., 1995; Townsend et al., 1996; Grenier, Metes, 1995). Davidow and Malone (1992) describe the formation of such teams as, *"something like atoms temporarily joining together to form molecules, then breaking up to form a whole new set of bonds."*

In summary, the virtual teams represent novel pattern of organising contractual work. Disagreements, however, exist amongst authors about how different the computer-mediated partnerships are from other forms of network relationships (Staples et al., 1999; Ratcheva, Vyakarnam, 2001; Kraut et al., 1999). The view adopted in this paper is that the virtual teams are not simply an evolutionary form of co-located entrepreneurial or new product development teams and that they represent novel patterns of interactions. The differences, however, do not purely stem from the different locations and variety of communication media used, but more importantly from the different patterns of social exchange, including conveying social messages and developing inter-personal and trustworthy relationships—factors which can critically affect the individual willingness to actively share personal knowledge.

'KNOWLEDGE' AND 'KNOWING' IN BUSINESS INTERACTIONS

The recent emergence of new organisational forms, increased virtualization of working arrangements supported by information and communication systems and moving away from the traditional views about 'time' and 'space', inevitably transformed the understandings about the nature of knowledge and how it is created. In this context, knowledge is emerging as highly complex, dynamic and fuzzy, embracing different languages, experiences, working cultures, processes, interactions, interpretations, routines and information. Reflecting on the somewhat unsettled global business environment, a number of authors recently argued that the nexus of knowledge creation exists in the communicative relations between people and should be considered as dynamic rather than static, and as mainly a collectivist rather than an individualist phenomenon (von Krogh, Roos, 1995; Baumard, 1999; Nonaka, 1994; Spender, 1998; Augier, Vendela, 1999). Further arguing the need for moving our attention away from 'knowledge' as an asset to 'knowing' as a process, Spender (1998) emphasised that:

> *To treat knowledge as a mere asset, a static entity like any other…is to miss the opportunity to shift our theorising into a genuinely dynamic framework. …Knowledge based theory should have the capability to handle a shift of analytic focus from firm's intangible knowledge assets onto the processes that generate, distribute and apply them.*

Similarly, Cook and Brown (1999) advocate a clear distinction between 'epistemology of possession', which treats knowledge as something possessed by an individual or group, and 'epistemology of practice', an aspect of our interactions with the social and physical world. Knowledge as a 'practice' refers to the coordinated activities of individuals and groups in performing their 'real work' as it is informed by a particular organisational or group context.

Viewing knowledge creation as a practice also led to the recent reconceptualization of the ways communities of practice are perceived. They are not communities in the conventional sense, but groups of people across which know-how and sense-making are shared. A community of practice develops a shared understanding of what it does, how to do it, and how it relates to other communities and their practices (Brown, Duguid, 1998). This changing understanding comprises the community's collective knowledge base. The process, therefore, of developing the knowledge and the community are significantly interdependent: the practice develops the understanding, which can reciprocally change the practice and extend the community. Hence, the knowledge and practice are intricately involved. Similar understandings about knowledge creation, transfer and use and their importance for fostering continuous innovations, led to the development of similar approaches defined as the 'networking community view of knowledge management' (Swan et al., 1999) and a 'knowledge networking framework' (Seufert et al., 1999). A common characteristic is their emphasis on knowledge as constructed through active networking amongst individuals, groups, organisations and communities.

By following the above perspective on studying knowledge management practices, it is adopted the view that a holistic understanding of the knowledge creation processes in virtual working environment requires an integrated viewpoint of the 'collective knowledge' in the context of the unique nature of the social communication and interaction processes taking place in virtual partnerships.

UNDERSTANDING KNOWLEDGE CREATION IN VIRTUAL PARTNERSHIPS

From the idea-generation phase of new product or service around which a new team of experts is formed, to the launch phase, the creation of new knowledge can be viewed as a central theme of the virtual partnership formation. The purpose of forming such teams, therefore, is developing collective knowledge which is not held by any individual member. However, this collective knowledge is not present by definition when the team is assembled and it is only consequently developed. It emerges as highly complex, dynamic and fuzzy, embracing different languages, experiences, working cultures, processes, interactions, interpretations, routines and information.

According to Nonaka's (1994) 'spiral' model of knowledge creation, the organisational knowledge is created through continuous dialogue between tacit and explicit knowledge. While the explicit knowledge is easy to communicate and express as it resides in symbols, technical documentation, etc., the tacit aspect can only be described as personal non-verbal forms of knowledge embedded in routines and cultures (Polanyi, 1966). Badaracco (1991) also refers to the tacit knowledge in individuals and social groups as 'embedded' knowledge. Nonaka (1994) points out in his model that the knowledge creation process depends on developing interactive relationships between the ontological and the epistemological dimensions of knowledge. While the epistemological dimension refers to 'knowledge' as 'justified true beliefs' which reside in people, the justification can only be achieved through social interactions between individuals to which Nonaka refers as the ontological dimension.

The social interactions to which Nonaka refers, reside inside a particular company's organisational environment and, therefore, the new knowledge creation processes are well embedded in the organisational culture, routines, established procedures, etc. The social interactions in a virtual environment are rather different and recently writers started to advocate considering virtualisation as a major social process (Diemers, 2000). Virtualisation has led also to major reconceptualisation of organisational roles, norms and cultures which traditionally used to constitute the environment in which social interactions took place. In contrast to the 'real' environment in which face-to-face social interactions take place, virtual networks are only a media platform, where according to Harisim (1993), common interpretative spaces of social networks constitute 'social spaces'. The social interactions enabled through mediated forms of communications need further careful considerations and probably reconceptualisation of our current understandings about what constitutes a 'social space'.

A logical step further in these analyses is how new knowledge is created through personal interactions in a space which does not really exist in any of the attributes traditionally associated with an organisational environment. According to

Nonaka and Konno (1998), to bring personal knowledge into a social context within which it can be amplified, it is necessary to have a 'field', defined as 'Ba', that provides a place in which individual perspectives are articulated and higher-level concepts are developed interactively. 'Ba', therefore, can be thought of as a shared physical, virtual or mental space or shared space of relationships which provides a contextual platform for advancing individual and collective knowledge. Therefore, the potential for developing new knowledge is embedded in the team members' experiences and know-how and as such, it resides, or is stored in patterns of connections, routines, norms and procedures, or the interrelationships of individuals' actions (Weick, Roberts, 1993).

So far an emphasis has been placed on the mechanisms of knowledge creation. It was highlighted earlier in the paper that the intellectual power of virtual teams is in their diffuse expertise and ability to blend the different experiences out of which to create a new collective knowledge. This process can be assisted by the existence of *"redundant information"* (Nonaka, 1994) or *"common knowledge"* (Grant, 1996), but the process also needs triggering and coordinating forces. Such triggers are referred to as forces, rather than mechanisms, as they are usually team specific, negotiated by the team members, dynamic in nature as they change through the life of the partnership and are influenced by changes in the membership, the project progress, external influences, etc. Previous research on self-organising teams indicates that such teams trigger organisational knowledge creation through two processes appearing simultaneously or alternatively. The first facilitates the building of mutual trust amongst members, which accelerates the sharing of personal experiences. The second process involves conceptualisation of the implicitly shared experiences through continuous dialogue amongst members (Nonaka, 1994). The interplay between these two processes which enable the creation of new knowledge is further explored in the following text in seven small companies which adopted a virtual business model for their current operations.

RESEARCH METHODOLOGY AND SAMPLE DEFINITION

Seven companies took part in a longitudinal qualitative study investigating the interaction and communication patterns in virtual teams. The results presented in this paper are the preliminary outcomes of the second stage of a research project specifically focusing on successful practices in developing new knowledge resulting in novel products, procedures, processes, etc. A common characteristic of the sample companies is that they have gone through major strategic and structural change processes during the late 90s in order to maintain their competitive positions. These change processes revolved around a re-definition of the vision and the identification of key areas where innovations and work processes improvements could continually support the companies' strategic edge (see Table 1 for companies' background information). One of the outcomes of the restructuring initiatives was the increased reliance on multidisciplinary virtual teams to handle a variety of business initiatives, formed across organisational and country boundaries.

The present study was carried using a multi-method approach. The companies selected were initially considered as focal points for identifying project partnerships. Each company was asked to identify one virtual partnership in which the particular organisation had played a leading role in terms of resource commitment and the outcomes of the partnership were highly satisfactory. In order to maintain consistency between cases, the teams were selected according to the following criteria:

- Use of a variety of communication channels, with electronic communications being the main one throughout the lifespan of the project;
- Teams involving members from more than two organisations (or independent experts);
- Teams involving members with diverse expertise (different functional or subject areas);
- Partnerships and the outcomes of which were considered by the approached companies as highly successful in terms of new knowledge creation.

Further consistency between cases was achieved by measuring the collective knowledge created in each partnership using the Innovation Assessment Questionnaire previously used by Sethi (1995). Evaluation was also carried out using a creativity scale (Andrew, Smith, 1996), which allowed examination of how original the project outcome was (novelty dimension) and how useful/useless it was (appropriateness dimension). The partnerships which took part in the study had high scores for both novelty and usefulness of the achieved outcomes.

Table 1: Companies' Background Information

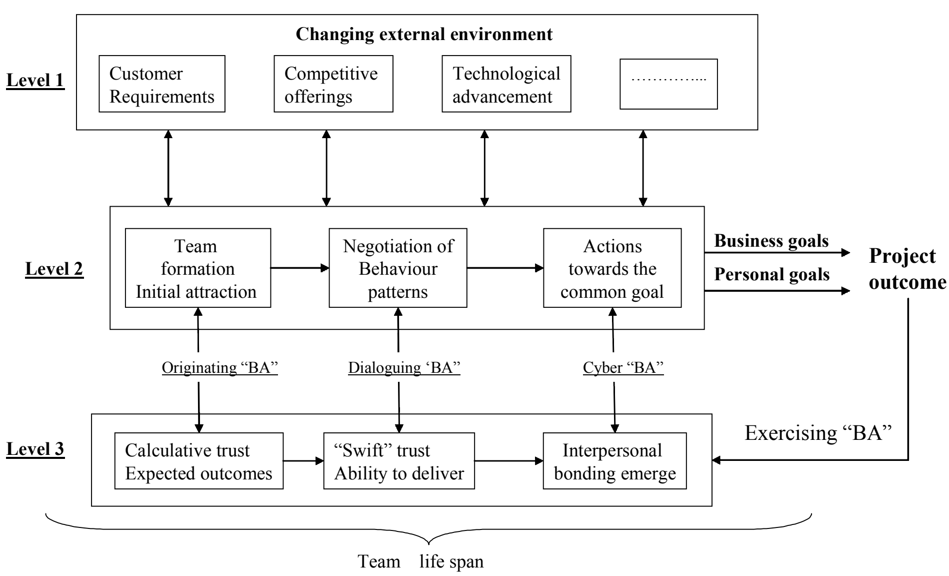
Cases	**Main activities**	**Team boundaries**	**Number of team members**
Case 1	Engineering and software project consulting	Different organisations, operating in 2 countries	8
Case 2	Engineering consultancy	Different organisations, operating in 3 countries	7
Case 3	Electronic modem assembly	Different organisations, operating in 2 countries	9
Case 4	Assembly of electronic connectors	Different organisations, operating in 3 countries	10
Case 5	Research and development engineering consultancy	Different organisations, operating in 3 countries	7
Case 6	Management consultancy	Different organisations, operating in 4 countries	6
Case 7	Medical equipment services	Different organisations, operating in 2 countries	8

The identified seven virtual partnerships were further investigated in-depth using a variety of data collection approaches. The data was analysed using content analysis and a coding scheme procedure (Weber, 1985) in order to illuminate the underlying differences between the partnerships and identify the key factors/ processes affecting the team's ability to create a new collective knowledge.

SUMMARY OF THE RESEARCH RESULTS

The analyses of the empirical data allowed one to establish some common patterns of teams' development, interactions and communications between team members which allowed them to blend their individual expertise and jointly develop new collective knowledge. The preliminary results from the data analysis led to the development of an initial conceptual framework of the knowledge creative interaction processes according to which there are three interrelated levels of interactions (see Figure 1). Levels 1 and 2 represent the knowledge flows throughout the formation and development of the partnership. As the development of inter-personal and trustworthy relationships follows specific patterns, it is included as a third level in the framework which presents the process of formation of inter-personal relationships throughout the lifespan of the partnership and the way they affect the work-related interactions. The three levels are considered in interaction, rather than separately, because new knowledge is created only through achieving successful synergy between them.

Figure 1: Knowledge Creating Interaction Patterns



The process usually starts as a group of experts self-organise themselves as a team to exploit a spotted market opportunity or to apply a technological advancement. Three interrelated stages of relationship development are considered (level 2). Because of the temporary nature of the project, team members usually import into the partnership their perceptions and understandings about each other's potential to contribute. These observations are consistent with the Luhmann (1986) definition of *'impersonal trust',* according to which the initial development of team's relationships are based on the appearance of *"everything in proper order"*, rather than on an emotional bond, knowledge or past history of interactions. In the same way, the concept of *'swift'* trust maintains that, *"unless one trusts quickly, one may never trust at all"* (Meyerson et al., 1996). Positive expectations of trust, therefore, motivate members to take a proactive part in the team, which can result in strengthening the trustworthy relationships amongst team members. A previous empirical study (Ratcheva, Vyakarnam, 2000) similarly established that the factors causing the initial attraction amongst team members are based on recognition of complimentary expertise, sound professionalism, previous joint working experience and potential access to other business networks. Relationships building at that stage, therefore, are based on the potential to act and are highly depersonalised. As indicated at Level 3, they are calculative in nature and initial trust is based on expectations. This is followed by negotiating the boundaries of team behaviour patterns, which proved to be an influential factor in team integrity and follow-up performance. Once the working rules are established, team interactions are characterised by cyclical inputs of actions, deeper communication and sharing of ideas and new initiatives. This cycle is close to what Nonaka and Konno (1998) refer as 'originating ba', when the knowledge-creation process begins. They have also established that at that stage the actual physical activities and face–to-face experiences are the key to sharing of tacit knowledge.

At the second cycle of partnership development (Level 2), the team as a whole starts to develop its own behaviour patterns, which proved to be an influential factor in achieving team's integrity and follow-up performance (Ratcheva, Vyakarnam, 2000). The established norms of behaviour and team roles are specific and unique for each team and depend on the goals to be achieved. Nonaka and Konno (1998) refer to this stage as 'dialoging ba' which is more consciously constructed. As virtual teams do not have structures of authority, the particular roles in the team adopted by each member are identified in a process of dialog, sharing mental models, reflection and analysis. According to Nonaka and Konno (1998), to construct 'dialoging ba' and trigger conversations, is important to select people with the right mix of specific knowledge and capabilities. The expertise required in the team should be also redefined as a result of actively interacting with the external environment in terms of changed customer requirements, monitoring new competitive offerings, new technological advancements, etc. There also should be established formal mechanisms for continuous monitoring of market changes. It is expected that the external changes will lead to redefinition of roles and responsibilities in the team, bringing complimentary external expertise. This will cause further changes in the team's patterns of interactions and knowledge base. Developing a team with an appropriate mix of expertise results in speeding up the progress of the project which increases members' confidence in the ability of the team to deliver and, as a result, stimulates accelerated interpersonal relationships.

Once the working rules are established, teams' interactions are directed towards the project's final goal and are characterised by cyclical inputs of actions, deeper communication and sharing of ideas, and new initiatives. It is likely that at that stage team members work from distant locations and the communications and interactions are related to the task's performance and project assembly. This cycle of interactions is a variation of what Nonaka and Konno (1998) define as 'cyber ba' or a place of monologue. Similarly 'cyber ba' is associated with generation and systematisation of explicit knowledge supported by information and network technology, followed by final justification of the product concept.

A successful project outcome incorporates achieving personal and business goals. Therefore, the end of the project is not an end of the knowledge creation at the individual and team level. Similarly to the 'exercising ba' (Nonaka and Konno, 1998), the explicit knowledge materialised in the project outcome is converted into a new tacit knowledge through a process of reflection and learning and brought into new projects and partnerships.

CONCLUSIONS

As new media and communication technologies have led to significant changes in the ways we interact and work together, it is important not to constrain this phenomenon to its novel information processing side, but to consider virtualization as a social process. These distant ways of work arrangements and business partnerships have a significant impact on social interactions and relationship development in a business context and led to a reconceptualisation of the traditional understandings about organisational norms, roles, identity and culture. The author adopted the view that the creation of new knowledge is socially embedded in interaction and communication practices. Therefore, new knowledge creation processes in virtual partnerships reside in the connections of experts, and the interaction and communication patterns and rules established amongst team members determine how knowledge is accumulated.

This chapter presented an initial framework of the dynamic knowledge creation processes in virtual teams. A next step of this study is to further test the proposed framework by developing a larger number of in-depth case studies on virtual partnerships.

The proposed framework also indicates that establishing and cultivating competence networks involves highly complex social processes. These will require managers to adopt new roles and knowledge workers to develop new understanding of the challenges of working in distributed organisational environments.

REFERENCES

Andrew, J., & Smith, D. (1994). Getting beyond me-too marketing: Determinants of the creativity of marketing programs for mature products, Working Paper: Case Western Reserve University.

Augier, M., & Vendelo, M. T. (1999). Networks, cognition and management of tacit knowledge, *Journal of Knowledge Management, 3*(4), pp. 252-261.

Badaracco, J. (1991). *The Knowledge Link.* Boston: Harvard Business School Press.

Baumard, P. (1999). *Tacit Knowledge in Organisations.* London: Sage.

Brawn, J. S., & Duguid, P. (1998). Organising knowledge. *California Management Review, 40*(3), pp. 90-111.

Cook, S. D. N., & Brown, J. S. (1999). Bridging epistemologies: The generative dance between organisational knowledge and organisational knowing, *Organization Science, 10*(4), pp. 381-409.

Davidow, W. H., & Malone, W. S. (1992). *The Virtual Corporation.* New York, NY: Edward Burlinghame Books/Harper Business, Harper Collins.

Diemers, D. (2000). Information quality and its interpretative reconfiguration as a premise of knowledge management in virtual organizations, In. Y. Malhotra (Ed). *Knowledge Management and Virtual Organizations*, Hershey, PA: Idea Group Publishing, pp. 365-379.

Grant, R. (1996, Winter Special Issue). Toward a knowledge-based theory of the firm, *Strategic Management Journal,* 17, pp. 109-122.

Grenier, R., & Metes, G. (1995). *Going Virtual: Moving Your Organisation into the 21st Century.* Upper Saddle River, NJ: Prentice Hall.

Harasim, L. M. (1993). Networlds. Networks as social space, In L. M. Harasim (Ed.), *Global Networks; Computers and International Communication*, Cambridge MA: MIT Press, pp. 15-34.

Kraut, R., Steinfield, C., Chan, A. P., Butler, B., & Hoag, A. (1999). Coordination and virtualization: The role of electronic networks and personal relationships, *Organization Science, 10*(6), pp. 722-740.

Kristof, A. L., Brown, K. G., Sims, H. P. Jr., & Smith, K. A. (1995). The virtual team: A case study and inductive model, In M. M. Beyerlein, D. A. Johnson & S. T. Beyerlein (Eds). *Advances in Interdisciplinary Studies of Work Teams: Knowledge Work in Teams,* Greenwich, CT: JAI Press.

Lipnack, J., & Stamps, J. (1997). *Virtual Teams: Reaching Across Space, Time and Organisations with Technology.* New York, NY: John Wiley & Sons.

Luhmann, N. (1986). The autopoiesis of social systems, In F. Geyer and J. Van der Zouwen (Eds.), *Sociocybernetic Paradoxes,* Beverly Hills, CA: Sage. pp. 172-92.

Meyerson, D., Weick, K. E. , & Kramer, R. M. (1994). Swift trust and temporary groups'. In R. M. Kramer & T. R. Tayler (Eds.), *Trust in Organisations: Frontiers of Theory and Research,* Thousand Oaks, CA: Sage Publications, pp. 166-195.

Miles, R., & Snow, C. (1995). The new network firm: A spherical structure built on a human investment philosophy, *Organisational Dynamics,* 23, pp. 19-32.

Mowshowitz, A. (1997). Virtual organisation, *Communications of the ACM, 40*(9), pp. 30-37.

Nonaka, I. (1994, February). A dynamic theory of organisational knowledge creation, *Organisation Science, 5*(1), pp. 14-37.

Nonaka, I., & Konno, N. (1998). The concept of 'Ba': Building a foundation for knowledge creation, *California Management Review, 40*(3), pp. 40-54.

Polanyi, M. (1966). *The Tacit Dimension.* New York: Anchor Day Books.

Ratcheva, V., & Vyakarnam, S. (2000, October). A holistic approach to virtual entrepreneurial team formation, *The International Journal of Entrepreneurship and Innovation,* pp. 173-182.

Ratcheva, V., & Vyakarnam, S. (2001). Building virtual relationships in a distributed organisational environment, In Y. Malhotra (Ed). *Knowledge Management and Business Model Innovation,* Hershey, PA: Idea Group Publishing, pp. 170-201.

Sethi, R. (1995). New product innovativeness and cross-function teams, Doctoral Dissertation, University of Pittsburgh.

Seufert, A., G. von Krogh, & Bach, A. (1999). Towards knowledge networking, *Journal of Knowledge Management*, *3*(3), pp. 180-190.

Spender, J. (1998). *Pluralist Epistemology and the Knowledge Based Theory of the Firm*. Working Manuscript, New York Institute of Technology, New York, NY.

Staples, D. S., Hulland, J. S. & Higgins, C. A. (1999). A self-efficacy theory explanation for the management of remote workers in virtual organizations, *Organization Science*, *10*(6), pp. 758-776.

Swan, J., Newell, S., Scarbrough, H., & Hislop, D. (1999). Knowledge management and innovation: Networks and networking. *Journal of Knowledge Management*, *3*(4), pp. 262-275.

Townsend, A., DeMarie, S., & Hendricson, A. (1996, September). Are you ready for virtual teams? *HR Magazine*, pp. 123-126.

von Krogh, G., & Roos, J. (1995). *Organisational Epistemology.* London: St. Martin's Press, Macmillan Press.

Weber, R. (1985). *Basic Content Analysis,* Thousand Oaks, CA: Sage Publications.

Weick, K. E., & Roberts, K. H. (1993). Collective mind in organizations: Heedful interrelating of flight decks, *Administrative Science Quarterly*, 38, pp. 357 – 381.

Chapter XVIII

The Readiness of IDSC to Adopt Knowledge Management

Ahmed Abdel Kader Hussein
Maastricht School of Management, MSM, The Netherlands

Khaled Wahba
Cairo University, Egypt

ABSTRACT

Over the last two years Knowledge Management has become the latest hot topic in the business world. Companies are realizing that their competitive edge is mostly the brain power or intellectual capital of their employees and management. Many organizations are drowning in information, but starving for knowledge. In order to stay ahead of the pack, organizations must leverage their knowledge internally and externally to survive. Knowledge management is believed to be the current savior of organizations. Creative and innovative people form the core of any organization. In turn, those people form the corporate memory. The Information Decision Support Center for the Cabinet of Ministers for the Egyptian Government (IDSC) faces a problem of employees' high turnover rate

(17%), which threatens to cause IDSC to lose its memory. One common mistake many organizations make when they implement KM initiatives is to place too much emphasis on the technological aspect of KM and ignore the human resources aspects. IDSC developed a knowledge management system called the Organizational Memory (http://www.home.idsc.gov.eg/), but ignored the human factor of KM. The purpose of this chapter is to test the readiness of employees and managers working at IDSC to adopt knowledge management. Human issues were clearly shown to outweigh any technology constraints, and views of managers and employees differed to some extent. It is recommended that these human and managerial concerns be addressed if KM is to be successful in organizations.

INTRODUCTION

Background

A study conducted by KPMG consulting (2000) on 500 companies in USA and UK reveals that 81% of the respondents said they had or were considering a KM Program; 38% had a KM program in place; 30% were currently setting one up; and 13% were examining the need for a KM program.

This chapter focuses on various human issues with regard to KM in the Egyptian Cabinet Information and Decision Support Center (IDSC). These issues are often overlooked and their importance underestimated, and attention needs to be paid to these human aspects so that IDSC can effectively achieve the benefits of KM.

Problem Definition

Creative and innovative people form the core of any organization. In turn, those people form the corporate memory. IDSC faces a problem of employees' high turnover rate (17%) which threatens IDSC with losing its memory. One common mistake many organizations make when they implement KM initiatives is to place too much emphasis on the technological aspect of KM and to ignore the human resources aspects. IDSC developed a knowledge management system called the Organizational Memory (http://www.home.idsc.gov.eg/), but ignored the human factor of KM .The purpose of this study was to test the readiness of employees and managers working in IDSC to adopt knowledge management by focusing on the various human aspects related to knowledge management.

Research Questions

In order to determine the human factors influencing the development of a successful KM program in IDSC, the research, therefore, focused on questions such as:

- Was IDSC ready to adopt a knowledge management program?
- Are employees and managers working at IDSC ready to be part of a knowledge management program?
- What was the knowledge management environment in IDSC?

And additionally:
- What were the employee perceptions of sharing knowledge?
- What were the impediments to sharing knowledge in IDSC?
- Was privacy of employee information an issue in IDSC?
- What were the difficulties in managing knowledge in IDSC?
- Did IDSC maintain innovation and creativity in its problem solving approaches given the availability of the knowledge base?
- Did conflict arise between an employee's career ambitions and the knowledge management culture of the organization?

Research Methodology

Collected data is the heart of the study. There are many sources of data such as interviews, meetings, etc. Other important sources of information are *theory* and personal experience. In order to determine the human factors influencing the development of a successful KM program in IDSC, we developed two questionnaires, one aimed at the senior and middle managers in the IDSC and the other aimed at lower ranking employees. Questions were adapted from previous research on KM conducted by Jordan and Jones (1997) amongst others.

The sample was restricted to managers and employees who have spent more than two years working in IDSC and have direct or indirect relation to the success or failure of the KM program. The sample size was 40 employees and 20 managers.

Assumptions and Limitations

Assumptions

This study assumed that there was stability in the organization structure, no management change, cultural stability and no major technology change.

Limitations

However, there were a number of limitations. The number of participants was relatively small. The survey also relied on self-reported responses, and as such is subject to limitations of all such surveys. IDSC can also not be considered to be representative of all market sectors in Egypt. These limitations should be taken into account when considering the findings of this research.

KNOWLEDGE AND KNOWLEDGE MANAGEMENT

What is Knowledge?

The word *knowledge* can, at a first glance, seem easy to define, but a literature search would seem to indicate otherwise. It defines some abstract material, which we cannot see. We try out apparent synonyms, like information, data or competence, but this does not give us the truth. Discussions of knowledge are becoming increasingly important the more it is recognized that a company's future is largely dependent on its ability to handle this intangible asset. A common element in the discussion and definition of knowledge is that knowledge basically takes two forms, *tacit* and *explicit* knowledge.

- ***Tacit Knowledge***: is seen as being subjective, practical, and analog. It is highly personal, hard to formalize and, therefore, difficult to communicate to others. It is deeply rooted in action and in an individual's commitment to a specific context - a craft or profession, a particular technology or product market, or the activities of a work group or team.
- ***Explicit Knowledge:*** is seen as being objective, theoretical, and digital. Explicit knowledge is formal and systematic and can therefore be easily communicated and shared, in product specifications or a scientific formula or a computer program (Nonaka & Takeuchi 1995).

A detail that we question in this definition is that explicit knowledge would, by definition, be objective. Is a subjective thought put on paper an objective truth? No! But the words can also have a different meaning. Tacit knowledge is part of a person, a *subjec*t, while explicit knowledge exists as an *objec*t, a visible form. Sveiby (1997) seems to agree with Nonaka and Takeuchi's definitions, but he gets there in an awkward and sometimes contradictory way. Sveiby reasons that knowledge has four characteristics:

- Knowledge is tacit;
- Knowledge is action-oriented;
- Knowledge is supported by rules;
- Knowledge is constantly changing.

The first characteristic suggests that explicit knowledge is not knowledge. This characteristic derives from a view that knowledge, in a strict sense, cannot exist outside an individual. Some knowledge can be formalized, made explicit, but then it becomes static, whereby it loses another of Sveiby's characteristics. This means that knowledge that has been made explicit/static must be interpreted and mixed with personal knowledge in order to make it true knowledge again.

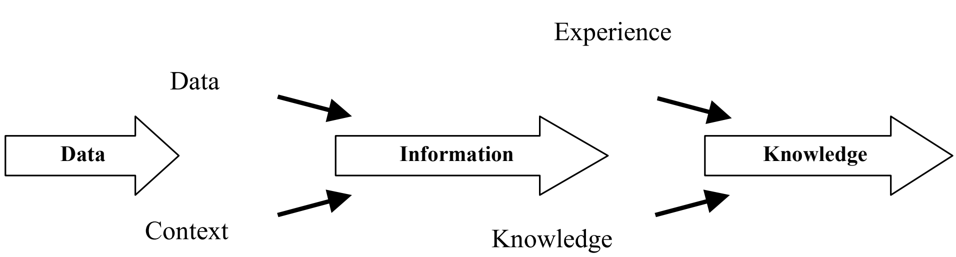
Sveiby also splits knowledge along another dimension; he separates *know-how* from *know-what*. Know-how is closely related to tacit knowledge. Know-what is closely related to explicit knowledge because it can easily be put on paper. Both are important for *the ability to act.* It would seem that all knowledge has a dimension of tacitness and is, therefore, difficult to explain in words. Knowledge is also action-oriented through the way we generate new knowledge by analyzing the sensory impressions we receive and because we are constantly losing knowledge. This dynamic quality of knowledge is reflected in verbs like learn, forget, remember, and understand. There are also rules for conscious and unconscious processing of knowledge. These rules help us to act and save us a lot of energy when we do not need to think before we act. The knowledge is, also, constantly changing, but when tacit knowledge is made explicit through language, it becomes static.

Data, Information, and Knowledge

Earl and Scott (1998) characterize knowledge as the final product in a chain where data combined with other data and a context transforms into information; information together with experiences and already known knowledge make up knowledge; see Figure 1.

Theorists do not think that the model can be dismissed that easily. In the light of static knowledge not being "real" knowledge that needs human processing to form "real" knowledge, reminds us of Earl and Scott's model. Additionally, data, and perhaps information, is the only thing we can actually store in computers. The process should also be viewed in reverse. The way it is presented by Earl and Scott, it gives the impression that we should gather as much data as possible in order to transform it to knowledge. A knowledge manager would be at least as interested in the opposite direction. He would want to identify valuable knowledge and then look for the information needed to build that knowledge; and in the end, what data he needs to build the information.

Figure 1: Data, Information and Knowledge (Earl & Scott,1998)



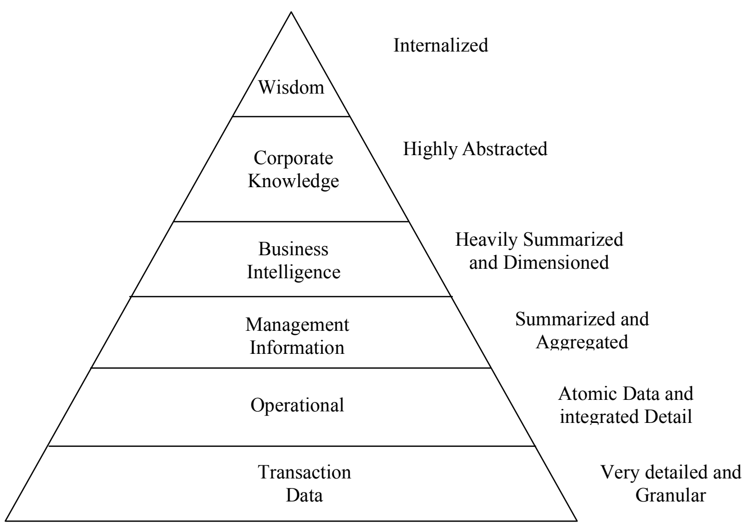
Knowledge Hierarchy

The Knowledge Pyramid

Theorists and practitioners of knowledge management often open the what – is-knowledge discussion with the knowledge pyramid , which portrays the world of knowledge as rising from raw transaction data at the bottom to wisdom at the top. Some disagreements exists among various parties about specific details, but general consensus has been reached concerning the overall thrust and composition of the knowledge pyramid (see Figure 2).

- Raw transaction data and tacit data are the bottom of the knowledge pyramid. Transaction data is recorded in databases and other data stores and used in a variety of ways.
- Operational data reflects complete, integrated transactions, referred to as atomic detail.
- At the management information level, more significant changes occur. This level contains lightly summarized data that has been grouped, stored, filtered or organized to reveal a context.

Figure 2: Knowledge Pyramid (Alan, Raddund,1998)



Information usually takes the form of aggregated numbers, words, and full statements. It often combines the numbers and statements in a summarized form that conveys a meaning that is greater than any revealed by the raw data alone. Knowledge theorists and practitioners agree, however, that knowledge and information are unclear, and several differentiate between the two (see Table 1).

Table 1: Attributes of Data, Information, and Knowledge

Attribute	Data	Information	Knowledge
Level of Detail	▪ Low level of detail ▪ Atomic detail	Integrated, aggregated detail	▪ Highly abstracted ▪ Detail removed
Context	No context	Full context	Extended context
Scope	Very narrow scope	Scope limited to the particular context	Extends beyond the scope of the information
Timelines	No timelines	Limited timelines	Timeless

- Continuing up the knowledge hierarchy, highly summarized information, which many refer to as business intelligence. Business intelligence results when data and information are heavily processed, organized, filtered, selected, correlated, and analyzed extensively.
- Further summarization of the initial information leads to knowledge. Knowledge, in this case, can be described as insights derived from the information and data that can be acted upon and shared in a variety of ways and circumstances.
- Finally, at the top of the knowledge pyramid is wisdom. Wisdom appears to be the most abstract and timeless of knowledge.

Knowledge Management

The purposes and tasks for knowledge management must be clarified and defined in order to suggest proper measures for knowledge management.

A Definition of Knowledge Management

Knowledge Management (KM) has had a pervasive presence in recent research and is well recognized as a possible contributor to organizational success and a determinant of sustained competitive advantage. Organizations have embraced KM as a primary focus area, recognizing intellectual capital as an asset that can be leveraged to create value for stakeholders.

Gartner Group (1998) defined Knowledge Management as: "Knowledge Management promotes an integrated approach to identifying, capturing, retrieving, sharing and evaluating an enterprise's information assets. These information assets may include databases, documents, policies, procedures, as well as the un-captured tacit expertise and experience stored in individual heads."

KPMG consultants (2000) define KM as "The systematic and organized attempt to use knowledge within an organization to improve performance." Malhotra (2000) offers the following definition of KM **:** "KM caters to the critical issues of organizational adaptation, survival, and competence in the face of increasingly discontinuous environmental change. Essentially, it embodies organizational processes that seek synergistic combination of data and information processing capacity of information technologies, and the creative and innovative capacity of human beings."

The Components of Knowledge Management

The components of knowledge each support the other, but one does not depend on the other. An individual may very well protect his knowledge, but without sharing it with others or without using past experience when faced with similar problems. Knowledge may be captured and shared without anyone ever taking advantage of it. An individual may recycle his personal knowledge in similar situations without sharing it with others.

It is, hence, important to be aware of all of them in order to achieve maximum benefit from Knowledge Management.

Identify Valuable Knowledge. To quote Stewart (1997), *"In the new economy, the scarce resource is ignoranc*e." This may seem like a contradiction, but it is very important. Because we collect too much knowledge and information, both personal and corporate, the less important overshadows and hides what is important. We share too much knowledge *just-in-cas*e, and too little *just-in-tim*e. Today we have so many information systems that provide us with information and knowledge that people get overloaded. It is important to stress that the selection of what knowledge to handle in the KM-Process is a critical success factor and very important to analyze. It must then be presented in a way so as to attract the attention of the person who needs it.

It is, hence, important for Knowledge Management to identify both what knowledge is needed and what ignorance can be accepted. This last point is so important that we grant it its own place in the definition of Knowledge Management. When businesses use a lot of effort and investments to implement Knowledge Management, little or no benefits will derive if the company handles knowledge that is unimportant to the business's activities.

Capture Knowledge. One aspect of Knowledge Management, stressed by some authors including Stewart (1997) - is that the knowledge that is captured in the Structural Capital and, therefore, belongs to the company, is most valuable. These assets - company processes, cook-book solutions, information systems, and computer programs do not leave the office at five o'clock.

One of Knowledge Management's tasks is to capture the individuals' knowledge in a form that is stable explicit knowledge. This makes it more valuable in two senses:

- It makes the company less dependent on the individual (reduced risk),
- and the knowledge can be distributed electronically (made available to the whole organization, independent of time and space).

This is under the condition that the captured knowledge is put to use by someone. Value is only created when the knowledge is used. It is not certain that Structural

Capital will be used the most and, thereby, generate the most value. Hence, the Human Capital may still be the most valuable.

Davenport and Prusak (1998) try to differentiate when an organization should capture its knowledge in structural capital and when it is not worth the effort. They argue that small companies (less than 300 employees) have little or no need of capturing knowledge into the Structural Capital. Instead, they should concentrate their efforts on sharing information about who knows what. In a large organization, such as IDSC, the potential gains from mass distribution make the cost of capturing worthwhile.

This also brings us to a more general task for Knowledge Management in connection to sharing, protecting and recycling: *"Knowledge Management should connect people to data and it should do this on a just-in-time basi*s*"* (Stewart, 1997), not *just-in-cas*e.

Create Knowledge – Innovate. Particularly, there are two different views of how knowledge is created. The first is a linear view, building on the view that knowledge is the last step in a refining process of data; data is refined to information, which in turn is refined to knowledge. Nonaka and Takeuchi (1995) criticize this (as they see it, western) view of knowledge creating as an information processing activity. Instead they suggest that it is the interaction and communication of tacit and explicit knowledge that creates new knowledge and innovation. It is through socialization, externalization, combination and internalization that we will create new knowledge and change already existing knowledge. This *knowledge spiral* will support and catalyze innovation and knowledge creation.

Share and Reuse Knowledge. With Sveiby's (1997) knowledge view in mind, there are two ways of information sharing: through tradition and through information.

By tradition is meant a person-to-person transfer, where I watch you and learn by imitating. Nonaka and Takeuchi would call this a tacit to tacit transfer, or socialization. Through information, knowledge can be transferred with the use of other media, such as paper, drawing, database, etc., i.e., the knowledge is transferred via externalization (combination) and internalization.

If true knowledge can only exist in an individual, this means that knowledge that has been captured in some kind of explicit form - instruction or case description - must be made alive in a person. This is accomplished through interpretation, reflection, testing and mixing with personal experience and knowledge already in the individual's possession. It is a process that takes time and effort.

Both tradition and information have their respective pros and cons. Information has the advantage that it can be mass distributed independently of time and place. The process of making knowledge explicit, and making explicit knowledge tacit, are time consuming processes and much of the knowledge is lost in the process. This can be compensated for by the large potential for sharing. Tradition is the only way to transfer many types of knowledge. On the negative side, its effects are very limited by time and space even if some new technologies, such as video-conferencing, may compensate for some of its limitations.

Reduce Risk. By *reducing risk* is meant to avoid the loss of important knowledge or experiences. One way of accomplishing this is by capturing the knowledge in an explicit form. Another way is by sharing it with others, thereby also sharing the responsibility of protecting the knowledge. In this second way, *reduced risk* is achieved through *sharin*g and *recycling* knowledge.

A negative effect of Knowledge Management is an increased risk of knowledge theft. When tacit knowledge is captured in digital format, it is easier to copy the knowledge and spread it to competitors.

Create Value. To justify Knowledge Management, it must add value or cut costs. Knowledge Management creates value of various kinds. Davenport and Prusak (1998), Stewart (1997), and Nonaka and Takeuchi (1995) echo many of the same values when talking about how Knowledge Management creates value. They argue that Knowledge Management will enable a more efficient way of working and generate revenue in the form of higher *productivity* and *efficienc*y. With Knowledge management, the employees' *motivation* when they have access to others knowledge will improve their ability to act, as well as their personal learning.

Values in financial terms can also be distinguished through growth in *shareholder valu*e, and lower *costs* when Knowledge Management enables sharing of knowledge to more people and results in higher quality of delivered products and services. The most important common argument for Knowledge Management is that knowledge is the only source of *sustained competitive advantag*e.

Stewart (1997) argues that when capturing knowledge into Structural Capital, it shortens the lead time between learning and knowledge sharing. Hence, the employees can share the knowledge quicker. Nonaka and Takeuchi (1995) hold that through Knowledge Management, *improved innovation* rather than higher efficiency is to be expected.

Knowledge Management (KM) Systems

Knowledge management (KM) systems are designed to gather, store and retrieve/disseminate information. These three basic functions are then complemented by incentive structures to ensure that the system is fully exploited.

Establishing the basic requirements of a KM system is fairly straightforward, We are involved in the:

- Gathering of information – to gather information, the company needs to establish procedures for documentation of projects, findings, and so on. The procedures should include how to document the information and how to control the relevance and quality of the selected material. It is important to avoid nonessential information. The main feature should be ease of use.

- Storage of information – storage should be in a database with easy access from all organizational levels.
- Retrieval of information – the system should also be able to compile data according to user needs and preferences. The structure of the database - the number of retrieval dimensions – depends on intended use.

Having established the KM market structure, implementation is not simply a question of employing a suitable IT solution. The challenge is to encourage people to come to market with their information.

Focus on Behavior, not Technology

One common mistake many organizations make when they design KM systems is to place too much emphasis on the technological aspects of the system. Knowledge is primarily a personal and social commodity and should be treated accordingly. The social aspects of knowledge sharing are crucial to the system's success. In order to make the system work it is important that it is easy to use and provides sample opportunities and incentives for personal interactions. This is particularly important for complex and contextual information that is best conveyed person-to-person.

Incentive Systems

Information has a price. It takes time to produce it and to find and consume it. It is, therefore, important to establish an incentive system that rewards knowledge sharing. Usually, employees are rewarded neither for sharing information, nor for searching for it. This lowers the motivation to use the KM system. It is thus extremely important to compensate employees for their work with the KM system, by perhaps providing extra time for them to document their work or by giving a bonus based on their diligence in recording their work.

Challenges Facing Knowledge Management

KPMG Consulting (2000) gave the following reasons for KM failing to meet expectations: lack of user uptake owing to insufficient communication, failure to integrate KM into everyday working practices, lack of time to learn how to use the system, a perception that the system was too complicated, lack of training, and a sense that there was little benefit in it for the user. Suggestions for successfully implementing KM projects also included: focusing on a department or group and building on that success; revamping the incentive system to reward information-sharing behavior (publishers of knowledge), and allocating a specific person(s) to the function of KM (Davenport, 1997; Kowalkowski, Angus, 1998).

Qualitative Research – Exploratory Research

Objectives

The research aimed at testing the readiness of IDSC's people to adopt knowledge management.

Design

The research design is the *logical* plan for how the study is conducted. It tells us how we got from *here* to *ther*e, where *here* may be defined as the initial set of questions to be answered, and *there* is some set of conclusions (answers) about these questions (Yin, 1994).

It is a logical model of proof that allows the researcher to draw inferences concerning causal relations among the variables under investigation. The research design also defines the domain of generalizability, that is, whether the obtained interpretations can be generalized to a larger population or to different situations (Yin, 1994). Also, the research design is the key to validity and reliability.

Two methods were used in the exploratory research:

- Surveys;
- In-depth Interviews.

Surveys

Two questionnaires were developed: one aimed at the senior manager in the IDSC and another aimed at lower ranking employees. The questionnaire aimed at testing the readiness of IDSC's people to adopt knowledge management. The questionnaire covered items such as:

- knowledge acquisition (do employees look for knowledge from internal or external sources, and is knowledge acquired deliberately or opportunistically?).
- ownership (do the employees generally regard their knowledge as highly personal or as being owned at the collective level?).
- memory (is knowledge chiefly held explicitly or tacitly?).
- challenges in implementing KM and in managing knowledge, and how IDSC encourages employees to share, contribute and reuse knowledge.

The employee questionnaire had some similar sections, but also covered areas on sharing of knowledge and barriers, impact on creativity, incentives, and privacy issues. The findings of these questionnaires helped in answering the major and minor research questions.

In-depth Interviews

The in-depth interviews were with the IDSC senior managers in order to assess the current knowledge management environment in IDSC and impediments facing managers in sharing knowledge. The interviews lasted around one hour and were conducted while the managers were filling out the questionnaire.

Defining the Population

IDSC consists of three branches located in three different buildings. There are 600 employees and managers in IDSC, 300 of them are working in support departments (as drivers, security, office boys, etc.). Those 300 were excluded; the other 300 was the survey population.

The sample consisted of 40 employees who spent more than one year in IDSC and 20 middle and senior managers.

About IDSC

The Information and Decision Support Center (IDSC) was initiated to support the Egyptian Cabinet's decision-making process in socio-economic development. It also acts as a catalyst for building Egypt's information infrastructure. Ever since its initiation in 1985, IDSC has been working on the process of building up Egypt's Information Technology (IT) industry and decision-support infrastructure, in addition to developing a base for the nation's software and hi-tech industries.

IDSC evolved around Egypt's dedicated efforts to join the international IT revolution, and institutionalize the decision-making process through accessing information. IDSC was also established with the long-term vision of providing public access to information, particularly business people and investors.

Over the past one and a half decades, the Center has successfully achieved its basic goals of setting up an information core for the Cabinet's decision-making process, and has also created channels for the local and international flow of information.

IDSC Objectives

- Developing information and decision-support systems for the Cabinet and top policy makers in Egypt.
- Supporting the establishment of end-user information and decision-support centers in the different ministries and governorates.
- Encouraging, supporting and initiating informatics projects that will accelerate Egypt's management and technological development.
- Participating in international cooperation programs and agreements, particularly in the areas of information and decision support.

The Organizational Memory

Some months ago, IDSC decided to build an online organizational memory (http://www.home.idsc.gov.eg/) which is a part of a knowledge management initiative in

IDSC. The main reason for this initiative was the high employee turnover of experienced staff which threatened the loss of IDSC's human memory .

The main objectives of this organizational memory were to:

- **Prevent Knowledge Loss** – It enabled IDSC to retain critical expertise and prevent critical knowledge loss resulting from retirement, downsizing.
- **Improve Decision-Making** – It identified the type and quality of knowledge required for effective decisions and facilitates access to that knowledge.
- **Permit Adaptability and Flexibility** – It allowed employees to develop a better grasp of their work, propose innovation solutions, work with less direct supervision.
- **Provide Competitive Advantage** – It increased the competitive advantage of IDSC.
- **Develop Assets** – It improved the organization's ability to capitalize on legal protection for intellectual property.
- **Leverage Investment in Human Capital** – Provided through the ability to share lessons learned, document processes, and the handling of exceptions, and capture and transmit tacit knowledge.

THE QUESTIONNAIRE

Part 1: Personal Information

The questions in this part were designed to get general information about the respondent.

Part 2: Questions Concerning the Methods Used by Staff to Acquire Information in IDSC

Questions in this part were each designed to:

- Discover whether the respondents had an overview of the knowledge available in IDSC or not.
- Measure a specific part of the knowledge management definition: identification, capturing, retrieval, sharing and evaluating. The aim was to identify weaknesses and strengths.
- Show how well the external and internal contacts and sources of information were used to spread and gather knowledge.
- Identify IDSC efforts to encourage the capturing and sharing of knowledge.

Part 3: Questions Concerning Knowledge Management in IDSC

- The first two questions in this part were each designed to measure if the IDSC employees understand what is knowledge management and what is the purpose of knowledge management.

- The third question in this part was designed to measure the degree of knowledge sharing between employees in IDSC.
- The fourth question in this part was designed to measure the degree to which tacit knowledge is shared between employees in IDSC.
- The fifth question in this part was designed to identify the barriers to sharing knowledge in IDSC. Employees and managers were asked to rank these barriers in a descending order, from the most important barrier to the least important one.
- The sixth and seventh questions in this part were designed to assess the impact of knowledge management and the availability of a knowledge base on creativity.
- The last three questions in this part were concerned with the privacy issues regarding knowledge sharing and the relation between competitiveness and knowledge sharing from the employee and manager point of view.
- In Part 3 two questions were added to the manager's questionnaire. The first question (question number 16) asked managers to rank difficulties facing them in the management of knowledge, the second question (question 17) asked managers to rank the impediments to knowledge transfer in IDSC.

ANALYSIS

The response rate was 100%, as the authors accompanied the respondent until he/she finished the questionnaire.

Analysis of Part 1

This part tried to find groups of respondents with different or common result profiles (see Table 2).

Table 2

Name	31% of the respondents mentioned their names.
Sex	62% of the respondents were females.
Group of age	60% of the respondents were under 30, 30% were under 45, 10% were under 60.
Job title	60% of the respondents are technicians (programmers, Web developers), 30% are researcher, 4% are executives, 5 % are head of department, 6% are managers, 1% were general managers.

Analysis of Part 2

Questions in Part 2 concerned the methods used by employees to acquire information in IDSC (see Table 3).

Table 3: Questions Concerning Methods Used by Employees and Managers to Acquire Information in IDSC

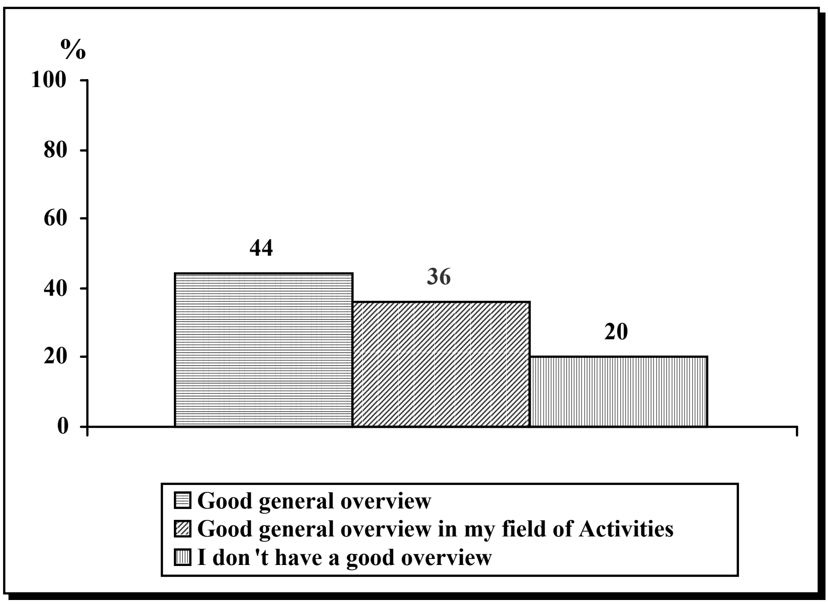
Which external sources do you use to obtain information ?	
Internet	90%
Universities	10%
Research institutes	6%
Testing institutes	3%
Other (governmental agencies)	60%
What kind of media do you use predominantly to obtain information?	
Telephone	80%
Facsimile	13%
E-mail	94%
Internet	90%
Intranet	14%
Magazines/Catalogues	4%
Professional literature	11%
Other	-
What additional private efforts do you undertake to obtain personal information benefits?	
None	30%
Further education and training in my leisure time	55%
Private relationships	9%
Private research work	20%
Magazines	5%
Others	-
What kind of information do you need in your work ?	
Technical	40%
Commercial	50%
Product information	8%
Information about other companies	2%
Information about clients	5%
Latest news	18%
Others	6%

Do you have an overview on the knowledge available in IDSC?

This question was designed to test whether employees and managers had an overview of the knowledge available in IDSC as the more they were aware of what knowledge exists in IDSC the higher the chance of sharing knowledge and using knowledge-based and organizational memory.

44% of the respondents proved to have a good general overview of the knowledge available in IDSC; they were mainly managers, heads of departments and team leaders. 36% of the respondents proved to have a good general overview in their field of activities mostly researchers and technicians. The remaining 20% which do not have an overview of the knowledge available in IDSC were executives and technicians (see Figure 3).

Figure 3: Staff Overview of the Knowledge Available in IDSC



How do you start to solve a problem?

This question were designed to test how managers and employees start to solve a problem, with the answer giving us a chance to see how much they depend on know-how available from previous projects which increase the importance of knowledge management as a tool to create organization memory and give IDSC the ability to become learning organization.

59% of respondents started solving a problem by using know-how from previous projects, 21% by telephone inquiries, 14% would establish a team and 7% would delegate the problem to others.

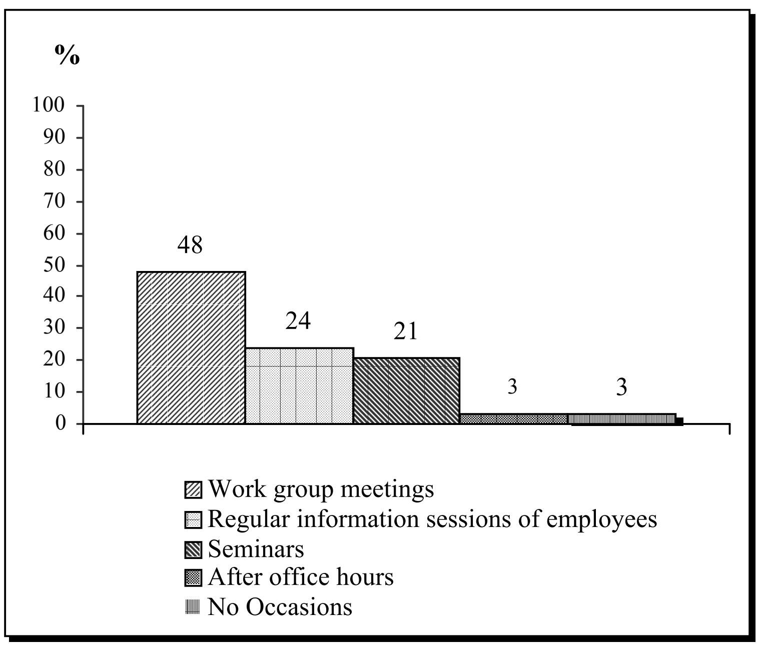
The next four questions were designed to show how well external and internal contacts and sources of information are used to spread and gather knowledge in IDSC and what kind of information they need. Employees and managers were able to choose more than one item.

It is obvious that the Internet and governmental agencies were the main source of information used by employees and managers. Internet, mail, and telephone were the main media used to obtain information. Technical and commercial information was the main kind of information obtained by employees and managers in IDSC.

What occasions exist for an exchange of information in IDSC?

This question was designed to identify on what occasions employees and managers share information. Also, there was a weekly meeting for the whole IDSC and every employee can attend the meeting, but only 24% of employees said that it was a useful meeting. 48% of employees said the work group meeting was the most useful occasion to share information in IDSC (see Figure 4).

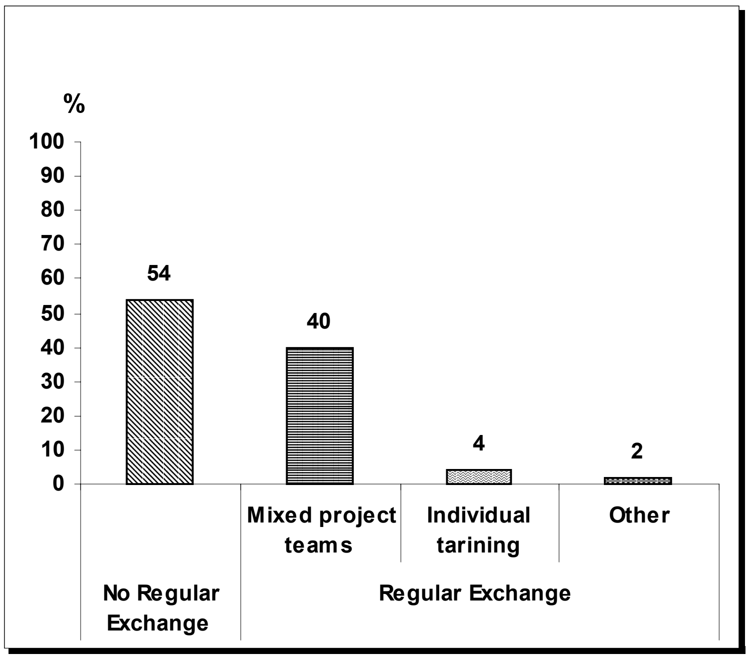
Figure 4: Information Exchange Occasions in IDSC



How does information exchange take place between older experienced employees and younger employees?

This question was developed to investigate whether the tacit knowledge was transferred from managers and experienced employees to new ones and how it was transferred. 54% of the respondents revealed that there was no regular exchange of information, 46% revealed that there was a regular exchange of information through mixed project teams (40%), individual training (4%) and (2%) other ways, like personal contacts inside IDSC (see Figure 5).

Figure 5: Information Exchange Among Staff in IDSC



Analysis of Part 3 (Employees Questionnaire)

Questions in Part 3 concern the knowledge management environment in IDSC.

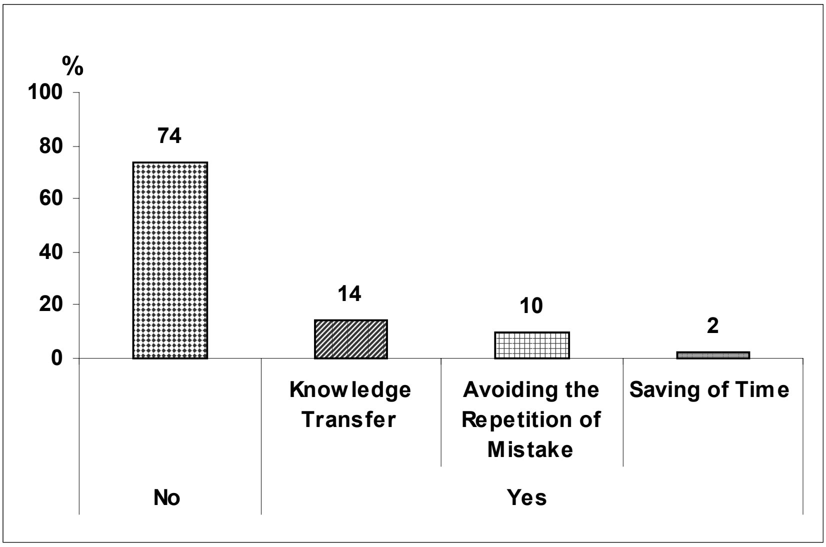
Do you have a general overview of what knowledge management is about?

Even though the IDSC has a KM system in place, 74% of respondents did not have a general overview of what KM is about. This shows that the IDSC management created the Organizational memory system to preserve, share and retrieve information and knowledge without taking into consideration the necessity of increasing KM awareness among employees.

What do you think should be the purpose of knowledge management?

Figure 6 shows that 14% of employees and managers who had a general overview on knowledge management thought that the main purpose of KM was knowledge transfer ,10% thought the main purpose of KM was to avoid repetition of mistakes, and 2% think it was for time saving.

Figure 6: Staff Perception about Purpose of Knowledge Management



Employee Perceptions on Sharing Knowledge

Table 4 shows that 30% of employees in the survey shared knowledge "often" or "always" and 70% "occasionally." Despite this, 28% of the employees felt that it was common or very common for key information to be too localized, creating problems of access.

Table 4: Employee Perceptions of Sharing of Knowledge

How well do employees share data, information and knowledge?	**Do Not**	**Poorly**	**Occasionally**	**Often**	**Always**
	0%	0%	70%	20%	10%
How often is essential know-how available, only in the heads of a few employees (and difficult to access when they are unavailable?)	**Very Rare**	**Rare**	**Occasional**	**Common**	**Very Common**
	0%	12%	60%	20%	8%

Employee Barriers to Sharing Knowledge

Employees were asked to rate a list of potential barriers or obstacles to knowledge sharing in their organizations. They were allowed to add any other items to the list (see Table 5).

In the literature, items such as “turf protection” and “people scared that their ideas will get hijacked” were sometimes given as high barriers to knowledge sharing. These research findings indicate that these barriers were ranked second and third respectively.

There was a lot of personal information kept by individuals (often only in their heads) which was not being shared, and there was not enough communication.

Table 5: Employee Barriers of Sharing of Knowledge

Average Ranking	***Employee Barriers to Sharing Knowledge***
1	Strong departmental barriers
2	"Turf protection" knowledge is power
3	People scared that their ideas will get hijacked
4	Lack of communication
5	Culture of working alone in closed offices
6	Expert knowledge in the heads of individuals
7	Distrust of other colleague’s data
8	Personal data stores are common
9	Organizational rigidity and specialization, lack of multi-skilling
10	Rapidly changing technology, makes keeping up difficult

Employee Privacy Issues

Some 20% of the employees indicated that they felt compelled to share knowledge with their colleagues because of the knowledge sharing environment at IDSC. They were asked if they felt that privacy was a concern when it came to sharing knowledge. Although most were satisfied, 30% indicated that their privacy was invaded during the process of sharing knowledge. This percentage increased to 90% when personal work documents and e-mails were specifically included. 74% of the employees felt that their sharing of knowledge decreased their competitiveness with other colleagues for promotion. Table 6 shows a summary of the results in this area of research.

Table 6: Summary of Employee Opinions on Privacy Issues

Employee Privacy Issues	***Yes***	***No***
Do you feel that privacy of employees is an issue concerning the sharing of knowledge?	30%	70%
Does sharing of knowledge in your job situation decrease your competitiveness with other colleagues for promotions?	74%	26%
The knowledge gathering process may require reviewing your personal work documents and / or e-mails so as to add information to the knowledge repository. Do you feel this invades your privacy?	90%	10%
Do you feel compelled to share your ideas with colleagues because of the knowledge sharing culture at your firm?	20%	80%

Difficulties in Managing Knowledge

Senior and middle managers were asked to rate a set of items which from past research had been shown to cause difficulties in managing knowledge in organizations. Their responses highlight the uncertainty experienced by many organizations with KM. Identifying the right leader/team for knowledge initiatives, what knowledge should be managed, attracting and retaining the right staff, measurements and standards were added as further problems. And a major concern was the necessity of changing people's behavior. Noticeably "overcoming technical limitations" is last of the 10 items. This shows that IDSC was less concerned about the technical issues than the human and managerial ones. Table 7 gives an ordered listing of the managers' biggest difficulties in managing knowledge.

Table 7: Difficulties in Managing Knowledge in IDSC

Rank	***Managers' Difficulties in Managing Knowledge***
1	Identifying the right leader/team for knowledge initiatives.
2	Attracting and retaining talented people.
3	Determining what knowledge should be managed.
4	Defining standard processes for knowledge work.
5	Changing people's behavior.
6	Mapping the organization's existing knowledge.
7	Expert knowledge in the heads of individuals.

Management Viewpoint on Knowledge Transfer

Senior knowledge management personnel were given a list of impediments to knowledge transfer, based on prior research, and asked to rate them. Table 8 shows that they ranked organizational structural changes and staff turnover as the key impediments to knowledge transfer. Other management issues were also important, but technology concerns only came in eighth.

Table 8: Management Viewpoint on Impediments to Knowledge Transfer

Rank	***Impediments to Knowledge Transfer***
1	Organizational culture
2	Staff turnover
3	Non-standardized process
4	Incentive system
5	Lack of ownership of the problem
6	Resistance to cultural change
7	Configuration /physical feature of workspace
8	Information/communication technology restraints

CONCLUSION AND RECOMMENDATIONS

Employees in IDSC acknowledge change management efforts to date, but do not feel that they are actively resisting the process of knowledge sharing. They are concerned about losing power they may have through sharing knowledge, and think that this will affect their competitiveness and promotion possibilities. They also perceive that the available knowledge base will aid creativity and productivity. They perceive that the major barriers to sharing knowledge are departmental barriers, expert knowledge often being held in the minds of individuals and lack of communication. Invasion of privacy is particularly an issue with them, especially when personal e-mails and documents are expected to be reviewed for possible addition to the knowledge base. Rapidly changing technology was their tenth rated concern.

A successful KM implementation clearly requires a culture of sharing, and a focus on human beings more than technologies and tools. This research has confirmed this. IDSC is not ready to implement a successful KM program. There is a need to communicate the role of KM in the IDSC more fully to employees. Job descriptions and performance reviews should take into account the efforts made by employees in this regard. IDSC needs a strong incentive and reward system to encourage employees to share knowledge and to help in building the culture of sharing knowledge. Departmental barriers must be eliminated by forming cross functional teams to foster an environment where employees could walk into anyone's office to seek help. In addition, individual career successes should be tied to leveraging knowledge.

Measures of knowledge sharing must be built into everyone's performance objectives. A tool like the Balanced Scorecard (Kaplan and Norton 1996) could for instance be used to weigh the results of IDSC's knowledge-management initiative. IDSC should not only emphasize on the technological aspect of KM and must increase its effort to improve the humanitarian aspects.

REFERENCES

Davenport, T.H. (1997, June). Known evils: Common pitfalls of knowledge management, *CIO Magazine*.

Davenport, T.H., & Prusak, L (1998). *Working Knowledge: How Organizations Manage What They Know*. Boston: Harvard Business School Press.

Earl, M., & Scott, I.A. (1999, Winter). Chief knowledge officer, *Sloan Management Review*, pp. 22-38.

Earl, M., & Scott, I.A. (1998). *What on Earth is a CKO*? London Business School.

Gartner Group. (1998, November). *21st Century Vision, Information Strategy*, *3*(9).

Jordan, J., & Jones, P. (1997, June): Assessing your company's knowledge management style, *Long Range Planning, 30*(3), pp. 392-398.

Kaplan, R.S., & Norton, D.P (1996) *Using the Balanced Scorecard as a Strategic Management System* Boston: Harvard Business School

Kowalkowski, F., & Angus, J. (1998, March). Implementing knowledge management projects, *Information Week*, March 16.

KPMG Consulting. (2000). Knowledge Management Report 2000, Retrieved from the World Wide Web at: http://www.kpmg.co.uk/kpmg/uk/services/manage/pubs/km2000.pdf.

Malhotra, Y. (2000, Summer). Knowledge management for e-business performance: Advancing information strategy to Internet time. *Information Strategy: The Executive's Journal*.

Nonaka, & Takeuchi, H. (1995). *The Knowledge-Creating Company*, New York: Oxford University Press.

Radding A., (1998). *Succeeding in the Information–Based Global Economy*, 1st edition, Computer Technology Research Crop. ISBN 1-56607-059-7.

Stewart, T. (1997). *Intellectual Capital-The New Wealth of Organizations*. Doubleday.

Sveiby, K.-E. (1997). *The New Organizational Wealth: Managing and Measuring Knowledge Based Assets.*Berrett-Koehler.

Yin, R.K. (1994) *Case Study Research: Design & Methods (2nd ed.)*. London: Sage.

Chapter XIX

Knowledge Reuse in an Application Service Provider

Greg Timbrell, Karen J. Nelson, and Tony J. Jewels
Queensland University of Technology, Australia

ABSTRACT

This qualitative study of support personnel in an Enterprise Systems Application Service Provider assesses and confirms Markus' Theory of Knowledge Reuse. Following disappointing knowledge capture outcomes during implementation and the consequential inability to reuse that knowledge effectively, enterprise systems applications support managers are recognizing the importance of lifecycle knowledge management as they face the first major upgrade of their clients' enterprise systems. This study also explores the dominant knowledge reuse types of support personnel. We extend Markus' typology to include Primary Data Miner to explain management's dominant knowledge reuse situations.

INTRODUCTION

In her paper, Markus (2001) proposes a Theory of Knowledge Reuse based on published accounts of situations involving the creation and use of written and computer-based records for the preservation, future access and reuse of knowledge. This study tests Markus' Theory in an organization that provides enterprise systems application service provision (ASP) to five state government agencies in Australia.

Following the spate of Enterprise Systems (ES) implementations prior to the turn of the century, we now find several organizations facing their first major systems upgrade since deployment. The extent and cost of these major upgrades can match or exceed the initial implementation and ASP management is beginning to appreciate the need to recall their lessons and practices from these initial projects. In effect, they are acknowledging the potential value of reusing the procedural, declarative and rationale knowledge (Zack, 1999) from these earlier implementations, as a means of reducing the financial risk to the enterprise (Marshall et al., 1996).

This study forms part of a research program entitled, "Enterprise Resource Planning (ERP) Lifecycle Knowledge Management" (Gable et al., 1998). A central premise of this work is that an organization's ES knowledge management / sourcing strategy effects knowledge requirements in later lifecycle phases. Effective ES knowledge management is considered to offer significant commercial and practical benefits throughout the ES lifecycle (Gable et al., 1998). Within this research program, a recent major issue study involving the application service provider and their clients (Chang, 2000a; Chang, 2000b) identified knowledge management as a top ES lifecycle issue. The purpose of our study is to test Markus' theory within this same context and, in doing so, to inform academe and practitioners on ways to improve knowledge management for support personnel in general and the ES lifecycle in particular.

The research method entails a comprehensive, qualitative study of employees in the ASP help desk and support area using semi-structured interviews with questions based on the theoretical framework presented by Markus. From these interviews, the researchers determine the dominant knowledge reuse situation in each employee's role.

This chapter has two aims: 1) To assess Markus' knowledge reuse typology; and 2) To explore the commonality of dominant knowledge reuse types in employee groups.

The results from this research provide confirmation of Markus' work. To provide an explanation of knowledge reuse by management, we propose an extension to her typology. The study also uncovers several interesting knowledge dynamics of the ASP ES support team. In this chapter, we first describe the Enterprise Systems context. We then outline Markus' underlying concepts and knowledge reuse typology. Following a description of the case organization and methodology, we discuss the results and applicability of Markus' theory in this context. Finally, we note some additional interesting findings arising from the study to discuss future trends in lifecycle knowledge management and submit our conclusions.

The Enterprise Systems Context

Davenport (2000) posits that organizations regard an ES project as a one-time exercise and so fail to attend to ES knowledge management issues, such as requesting (contracting for) knowledge transfers from consultants, or adequately maintaining the transferred knowledge. His expectation is that knowledge transfers leave the client organization better positioned to maintain and evolve their system and to generate returns from the ES investment.

According to Chan and Rosemann (Chan, 1999; Chan, Rosemann, 2001), ES implementations require a wide range of knowledge including: project knowledge, technical knowledge, product knowledge, business knowledge and company-specific knowledge. Where an organization does not have the requisite expertise, it will seek knowledge-based resources from third-party providers such as consulting firms (knowledge vendors), which act in the capacity of implementation partner (Timbrell, Gable, 2001; Timbrell et al., 2001).

Following completion of an ES implementation, the implementation partner usually withdraws from the organization and responsibility for managing the ES falls back to the client. Continuing success of the ES becomes reliant on the client's skill and knowledge in running, supporting, maintaining and upgrading the ES. In order to keep the ES "live" and relevant, the client must draw from their ES capabilities transferred-in during the implementation period, develop them internally or seek expert support (knowledge) externally. Such external support is usually available from the vendor, the implementation partner and other third parties, and is often expensive (Timbrell, Gable, 2001).

Self-sufficiency is the knowledge objective of an internal ES and, indeed, most support functions. Where the client plans to outsource its ES to an Application Service Provider (ASP), the need for internal, post-implementation, ES knowledge self-sufficiency reduces for that organization. ASP vendors cite this alleviation of "future skills risk" as one of their competitive advantages (Bennett, Timbrell, 2000). Responsibility for most of the project, technical and product knowledge management transfers to the ASP support team.

To achieve operative knowledge self-sufficiency, the ASP must, inter alia, systemically identify, qualify and record ES knowledge into appropriate knowledge and information reservoirs for later reuse by themselves, their successors and relevant others in their organization. This context provides a suitable opportunity to test Markus' theory of knowledge reuse.

Markus' Underlying Concepts

Organizations adopt one of two strategies in their approach to knowledge management activities: codification or personalization (Hansen et al., 1999). A related dimension, knowledge complexity, which in turn affects the cost of knowledge transfer (Kogut, Zander, 1997), influences codification. Markus' (2001) work focuses on the transfer and reuse of knowledge that has been explicated and codified for storage and discusses the role, cost and incentives of good knowledge repositories.

The underlying concepts in Markus' (2001) framework are: knowledge reuser and the purpose of knowledge reuse; what the recipient needs to know, knows, and doesn't know; and challenges the recipient faces at each stage of knowledge reuse: question definition; document / expert location; document / expert selection; and knowledge application. The roles in her framework are: the knowledge producer, the originator or documenter of the knowledge; knowledge intermediary, those who prepare the knowledge for reuse; and the knowledge consumer, who retrieves the knowledge and applies it in some way. It is important to note that the same individual (or group) or different individuals (or groups) or some combination can perform the three roles. In defining different situations in which knowledge is reused (i.e., knowledge reuse situations) the differentiating characteristics are the "knowledge distance" (measured in terms of knowledge redundancy between the producer and reuser) and the purposes of reuse. Markus' dependent variable is successful knowledge transfer and reuse.

The resultant typology arising from these concepts and characteristics includes four types of knowledge reuse situations: shared knowledge producers, shared knowledge practitioners, expert-seeking novices and secondary data miners (Table 1).

Table 1: Markus Knowledge Reuse Typology

Shared Work Producers	Closest in knowledge distance, they produce knowledge for their own later consumption while working on a shared work product as either a homogeneous work group or a cross-functional team. An example is an ES implementation team revisiting design decisions later in the project.
Shared Work Practitioners	Sharing a community of practice, knowledge is produced by specialists who occupy the same role in different locations, such as help desk personnel in the ES support area. They produce knowledge for each other to use and frequently rely on networks to assist them in locating documents or experts.
Expert-Seeking Novices	Furthest in knowledge distance, this type has potentially the greatest difficulty in all phases of knowledge reuse situations, such as defining the questions, locating and judging the quality of the knowledge sources and applying the expertise. Customers of the ASP may fall into this category.
Secondary Data Miners	Completely divorced from the knowledge producers, they apply analytical expertise to extract knowledge from repositories. Their rationale for knowledge reuse may differ significantly to that which initially motivated the knowledge explication by the producer.

BACKGROUND AND METHODOLOGY

In this study, the ASP studied has five government agencies as clients. In 1998, the ASP coordinated the simultaneous implementation of SAP R/3 in these five agencies. Three and a half years later, the ASP is coordinating the first major upgrade across its entire client base. To assist in the original implementation, the ASP employed a major international consulting company. For the upgrade process, however, the general manager believes his organization is experienced enough to execute the upgrade with the assistance of a few key individual contractors. He also recognizes the importance of knowledge access, capture and reuse both for the current upgrade process and future upgrades.

In 1999, Chang (2000b) conducted a survey of major issues in the planning, implementation and ongoing management of the SAP R/3 systems established under the guidance of the ASP. The results of this survey positioned knowledge management as a major concern for both strategic management and operational staff. In order to extend this finding and to capture the rich contextual evidence available, the research team decided to conduct a series of face-to-face interviews with the support and help desk personnel of the ASP. The overall purpose of conducting these interviews was to enable the employees to express their understanding of the issues at hand (Patton, 1980, p. 205).

The interview technique used was a combination of the standardized, otherwise known as structured, interview (Fontana, Frey, 1998, p. 47) and guided interviews. The research team prepared a semi-standardized set of questions that would take about three quarters of the interview time and the remainder of the scheduled time was used to revisit issues that had arisen during the more structured questioning, by referring to the question topic guide. The interviewer's technique was based on the styles described by Fontana and Frey (1998, p. 52-53) as "balanced rapport" and "interested listening," meaning that a casual, yet impersonal, attitude that neither evaluated nor judged the interviewees' responses was maintained.

All twenty-eight support and help desk personnel within the ASP agreed to be interviewed over a six-day period. The interviews were scheduled in advance and fully supported by the general manager. The interviews were conducted in a dedicated office at the ASP's premises by one researcher and took from 30 to 40 minutes each. The questions established the employee's role and how long they have spent in that role. Specific questions, designed to confirm the defining characteristics according to Markus' theory, explored instances of the employee's knowledge reuse situations. The researcher noted responses and observations while the interview was in progress and, because the tight schedule did not allow time for comprehensive and timely write-ups, the interviews were tape-recorded. Following the interview period, the researcher scrutinized the taped data and augmented the interview notes with information overlooked during the initial note-taking activity. Two tapes were unusable and the data from these interviews has not been included in our analysis.

Data analysis consisted of manually highlighting responses that related to the defining characteristics of Markus' knowledge reuse situations (distance and purposes of reuse) from the completed interview notes. Data collected that did not fit into the existing typology was noted and reserved for later re-examination. The highlighted responses were then extracted into a customized database for comparison and reporting purposes. This process allowed the dominant knowledge reuse situation experienced by each employee to be determined and these findings are listed in Table 2.

Table 2: Dominant Knowledge Reuse Situation

Type	Role	Years in role
Shared Work Producer	Help Desk Supervisor	4
	Help Desk	6
	Help Desk	1.25
	Help Desk	3
	Business Analyst	3
Shared Work Practitioner	Business Analyst	2.5
	Business Analyst	3
	Business Analyst	27
	Upgrade Project Team Leader (C)	0.25*
	ABAP Programmer (C)	0.25*
	ABAP Programmer (C)	0.25*
	Intranet Developer	4.5
	Intranet Developer	3
	Systems Admin	2
	Systems Admin	1
	Systems Admin	3
	Help Desk	1
Expert-seeking novice	Business Analyst	0.25
Secondary data miner	General Manager	8
	Systems Operations Manager	3
	Development Manager	2.5
	Principal Business Analyst	3
	Senior Business Analyst	3
	Business Analyst	9
	Business Analyst	2
	Project Officer (Bus analyst support)	0.75

** The three contractors each have approximately six years SAP experience in various technical roles across several clients.*

DISCUSSION

The first observation arising from the interviews is that all employees experienced more than one type of knowledge reuse situation, with many employees experiencing all types. This is consistent with Markus' expectations. Depending on the situation, an employee that is dominantly exhibiting "Shared Work Producer" knowledge reuse characteristics might become an "Expert-Seeking Novice" under differing circumstances. Yet, each employee tended towards a natural or dominant application of knowledge reuse.

Another observation was that certain groups showed a commonality of knowledge reuse situations. Help desk employees (except for one member) prevalently displayed Shared Work Producer characteristics. This is consistent with Markus' framework. She posits that the purpose of knowledge reuse for the Shared Work Producer is to "keep track of current status and things needing attention" or to "recall reasons for decisions when decisions need to be revisited." Consistent with Markus' characteristics of Shared Work Producers, one help desk member commented that, he:

> *...doesn't believe that anybody else outside the three member team would be interested in reusing our knowledge except maybe for statistical purposes.*

The single help desk member whose dominant knowledge reuse typology was a Shared Work Practitioner was originally a contractor who took up a permanent position with the ASP. She is a very experienced help desk operator, having worked on several other help desks previously. Having access to personal contacts that can assist her in solving technical enquiries, this employee ranges outside the homogeneous team to "acquire new knowledge that others have generated." She, in accordance with Markus' Shared Work Practitioners' characteristics, will "get advice about how to handle a particularly challenging or unusual situation that is new to the team from other similar practitioners in other geographic locations."

Other Shared Work Practitioners included the systems administration staff, technical developers, the two ABAP (proprietary SAP development language) programmers (both contractors), the upgrade project team leader (a contractor) and some business analysts. One of the business analysts of this group summarized the modus operandi of this group:

> *...if I can't find the right expert or expertise in-house, I use my personal network contacts.*

Each Shared Work Practitioner has and uses personal networks as a major source of technical knowledge in the enterprise systems context. In particular, the contractors each have a network that they can call upon when faced with a challenging or difficult problem. This network increases in quality and range as they work in different organizations. Interestingly, the general manager believes that the use of informal networks *"are more prevalent in the key staff"* and is generally unaware of the importance and reliance of these operational technical knowledge workers on their personal connections.

The single Expert-Seeking Novice in the group was a newly recruited graduate with little prior business experience. As a junior or trainee business analyst, he is learning his trade and tends to ask arcane questions during that process. When talking about the formal repository he mentioned, he:

> *...only stumbled across the existence of the database. Nobody told me it existed.*

The only other instances of Expert-Seeking Novices' knowledge reuse was (not unexpectedly) reported by a help desk operative who, in describing help desk calls, noted that:

> *...most people just want a quick solution without needing a rationale.*

The group that dominantly exhibited the typology of Secondary Data Miners consisted of management and the senior business analysts. The "knowledge distance" of this group from the knowledge producers is closer than what is suggested in the typology, yet the characteristics of their principal knowledge reuse situations fit this category. Markus described a "data miner" more in the nature of an independent researcher or organizational "outsider," defined by their analytical skills and distance from the context of the knowledge in the repository. Our evidence implies, however, that management, who are relatively close to the knowledge producers, using their advanced analytical skills, also reuses organizational knowledge in accordance with Markus' definition for the secondary data miner category, i.e, "to answer new questions or develop new knowledge through analysis of records produced by others for different purposes." Therefore, the researchers conclude that an additional knowledge reuse situation arises when management mines organizational data to analyze productivity, discover new or confirm intuitive trends and developments, or manage knowledge content and quality. An appropriate label for this typology is Primary Data Miner.

OTHER GENERAL OBSERVATIONS

Some other interesting observations were made within this study that are relevant to the knowledge management of the ES lifecycle and could be worthy of further investigation.

Management generally regarded knowledge capture during the initial implementation as a failure. The Principal Business Analyst noted that:

> *...the initial required knowledge from the implementation is gone and irrecoverable likening it to 'sand slipping through fingers'.*

Following disappointing knowledge capture outcomes during implementation and the consequential inability to reuse that knowledge effectively, the General Manager has instigated a strategy for capturing and recording the current upgrade processes to support future upgrade projects. In particular, he wants to capture the specialized knowledge of the contractors. To achieve this goal he initiated "knowledge transfer sessions," however after some trials he noted, *"Staff were not enthusiastic about these and perceived them as a waste of time."* Additionally, he introduced a knowledge database with the clear intention that it becomes a repository for ES upgrade knowledge and believes this knowledge strategy to be effective. From the interviews, we discovered that contractors did not believe they had write access to the knowledge database and so did not contribute to the database. Furthermore, they tended to make personal records for their own reuse in future contracts and did not demonstrate a disposition for creating documentation for the future reuse of their clients.

Secondly, those experts who were proficient in a previous ES (in this case Dun and Bradstreet) were assumed to carry that proficiency into the new system (SAP R/3). This assumption is made about help desk personnel and leading technical experts. This assumption seems related to the ASP's implementation strategy of "technology swapping" whereby the processes and reporting of the old system is implemented in the new system. One proponent of "technology swap" defended it by saying:

> *For established procedures there, is already a rationale so, therefore, it's easier to adapt a new system to these established procedures.*

Clients and staff consider intimate knowledge of the application of the old software to these (consistent) processes an advantage in building expertise in the application of the new system to these processes.

Finally, if you are inexperienced in the organization, then the initial knowledge source is the normal organizational role for that knowledge domain. But if you are experienced, then the formal job titles become less important and the real expert status derives from experience of successful past interactions. This is consistent with other research findings, for example, Andrews and Delahaye (2000).

FUTURE TRENDS AND CONCLUSIONS

Support organizations have the most to gain from systems (including ES) lifecycle knowledge management and knowledge sourcing strategies. Implementation knowledge such as specific testing techniques, project and methodological experience, can erode over time due to lack of consistent reuse, total loss from staff turnover or file destruction, or cultural / management devaluation of the knowledge. The mix of knowledge sources brought to bear at various times during a systems lifecycle can affect its success. Furthermore, the incidence of support and knowledge requirements during different phases of the lifecycle could possibly reflect or even predict the success or failure of a knowledge intensive product. Further research will be conducted to prove this assertion.

Overall, the study supports Markus' Theory of Knowledge Reuse within an ES lifecycle upgrade-phase context. Workgroups showed consistency in their dominant reuse typology. The researchers propose an extension to Markus' typology of Primary Data Miner to explain management's dominant knowledge reuse situations. The knowledge reuse situations of this group were similar in terms of analytic behavior to those proposed as Secondary Data Miners, but consistently differed on proximity to the knowledge context. The findings also reveal the prevalence of informal networks in the support context and their important role in enterprise (and other) systems lifecycle knowledge reuse.

REFERENCES

Andrews K. M., & Delahaye, B. L. (2000). Influences on knowledge processes in organizational learning: The psychosocial filter. *Journal of Management Studies, 37*(6), pp. 797 – 810.

Bennett, C., & Timbrell, G. (2000). Application service providers: Will they succeed? *Information Systems Frontiers*, *2*(2), pp. 195-211.

Chan, R. (1999). Knowledge management for implementing ERP in SMEs. *Proceedings of the 3rd Annual SAP Asia Pacific, Institute of Higher Learning Forum*, SAPPHIRE 1999. Singapore, 1-2 November 1999.

Chan, R., & Rosemann, M. (2001). Managing knowledge in enterprise systems. *Proceedings of the Americas Conference of Information Systems*, Boston, USA, 3-5 August 2001.

Chang, S-I., Gable, G., Smythe, E., & Timbrell, G. (2000a). Methods for distilling key issues using a Delphi approach. *Proceedings of the 11th Australasian Conference on Information Systems.* Brisbane, Australia, 6-8 December 2000.

Chang, S-I., Gable, G., Smythe, E., & Timbrell, G. (2000b). A Delphi examination of public sector ERP implementation issues. *Proceedings of the International Conference of Information Systems*, Brisbane, Australia, 10-13 December 2000.

Davenport, T. H. (2000) *Mission Critical: Realizing the Promise of Enterprise Systems*. Boston, MA: Harvard Business School Press.

Fontana, A., & Frey, J. (1998). Interviewing: the art of science. *Collecting and Interpreting Qualitative Materials.* Denzin N., & Lincoln Y., (Eds.). Thousand Oaks, CA: Sage., pp. 47-78.

Gable, G. G., Scott, J. E., & Davenport, T. D. (1998). Cooperative ERP life-cycle knowledge management. *Proceedings of the Ninth Australasian Confer-*

ence on Information Systems. Sydney, Australia, 29 September – 2 October 1998, pp. 227-240.

Hansen, M., Nohria, N., & Tierney, T. (1999). What's your strategy for managing knowledge? *Harvard Business Review, 77*(2), pp. 106-116.

Kogut, B., & Zander, U. (1992). Knowledge of the firm: Combinative capabilities, and the replication of technology. *Organizational Science, 3*(3), pp. 383-397.

Markus, M. L. (2001). Toward a theory of knowledge reuse: Types of knowledge reuse situations and factors in reuse success. *Journal of Management Information Systems*, *18*(1), pp. 57-93.

Marshall, C., Prusak, L., & Shpilberg, D. (1996). Financial risk and the need for superior knowledge management. *California Management Review*, *38*(3), pp. 77-101.

Patton, M. (1980). *Qualitative Evaluation Methods*. Beverley Hills: Sage.

Timbrell G. T., Andrews, N. M., & Gable, G. G. (2001). Impediments to inter-firm transfer of best practice: In an enterprise systems context. *Australian Journal of Information Systems*, Special Edition, NSW Australia, pp. 116-125.

Timbrell G. T., & Gable, G. G. (2002). The SAP ecosystem: A knowledge perspective. *Enterprise Resource Planning Solutions and Management*. Hershey PA: Idea Publishing.

Zack, M. H. (1999). Developing a knowledge strategy. *California Management Review*, *41*(3), pp. 125-145.

Chapter XX

The Use of Action Research in the Improvement of Communication in a Community of Practice: The MOISIG Case

Anabela Sarmento, João Batista, Leonor Cardoso,
Mário Lousã, Rosalina Babo, and Teresa Rebelo
MOISIG, Portugal

ABSTRACT

Research projects conducted under the action research approach are expected to present a dual contribution: to solve real problems and to add some new knowledge. This chapter introduces a case in which the researcher and the research client are the same entity. The research question and the problem to be solved concern communication in communities of practice using information technology. A description of the community of practice under study is provided, as well as the action research approach and the research cycles concluded. Results concerning the research question, the problem under resolution and the ethical question (researcher and research client being the same entity) are discussed. The evaluation of the results leads to the main conclusion that the

action research approach is helpful for both learning processes and problem solving, even when the researcher and the research client are the same entity.

INTRODUCTION

The issues related to interpersonal communication are very important in any context. In a community of practice (CoP) these issues are critical, thus members try to make all available communication means productive, especially those that can facilitate the communication processes that happen inside the CoP. By doing so, the information is spread through multiple formal and informal contacts that arise in face-to-face and virtual meetings. In these circumstances, it is crucial that there are several means of communication allow an efficient process of sharing information. For that reason, the technologies that facilitate communication without constraints of time and space have been drawing great interest and attention. However, it is necessary to recognize the simple fact that just because the members of a CoP have access to the technology does not mean that communication among them really occurs. We have to consider that a gap may occur between the use of technology and the necessary skills needed to use it with proficiency. In a CoP, success in using communication technology depends greatly on the attributes of its members (for instance, motivation, interests, training) on the characteristics of the CoP, and on the structure, flexibility and ease of use of the technology.

The development of the efficiency and effectiveness of the communication process in a CoP depends on the correct use of the available technology. Furthermore, we also have to consider that the success of the communication depends on the degree of comfort the members of the CoP experience each time they use technological tools, i.e., if they are satisfied with the tools and motivated to use them. In this sense, although we recognize the potential that exists by using technology, only face-to-face interaction offers the immediate context and feedback necessary to solve complex problems, because it allows the creation and sharing of a common ground of values, beliefs and meanings.

The several available communication technologies present advantages as far as time and information sharing are concerned. However, they do not seem adequate to deal with complex, sensitive and subjective information. Fahey and Prusak (1998) point out that the technology does not replace the interactive richness, the communication and the learning inherent to the dialogue and the face-to-face meetings. Thus, in our opinion, in all contexts communication remains a human act and although we can identify improvements due to the technological evolution, people will keep an irreplaceable role.

To sum up what has been said above, we can say that a CoP that depends only on asynchronous communication shows great difficulties in surviving and developing without moments of dialogue and face-to-face interaction among its members.

Communication is related to patterns, channels and frequencies as well as to content, clarity and efficacy. Furthermore, those issues are related among them and to the process of information sharing and language. This means that, in the absence of a common ground, the information that circulates among members does not necessarily result in communication. Nor does communication happen when members do not share the same concepts. Thus, each member of a CoP is constantly involved in a process of creating shared knowledge, building a new meaning necessary to the creation of an environment suitable for communication, mediated or not by technology.

In the context described above, we realize that communication is a very important factor in the development of a CoP. The elements of a CoP are not necessarily co-located; they can be distributed geographically. In these circumstances, technology becomes a very important factor in the development of a CoP. However, technology should not disturb social interaction among the members. They must feel it as an extension of natural devices of communication. This being so, the research question of the present study is: What is the role of information technology (IT) in the development of a CoP, and how can communication in a CoP be improved using IT? In this article we will present and describe a case of a CoP and their use of IT. We will explore the way in which the technology was used to improve communication among group members.

This chapter is structured as follows: In the next section we present the MOISIG as well as the communication problem that this CoP has tried to solve. We then describe the action research (AR) approach and its different activities, which were applied to solve the communication problem. We finish by discussing the issues raised (communication, IT and the use of AR in the resolution of problems) and presenting some final remarks.

MOISIG

MOISIG means **M**anagement, **O**rganisations and **I**nformation **S**ystems **I**nterest **G**roup. It is a group of researchers composed of six members who come from different areas of knowledge (Organizational Psychology, Information Systems and Management), as well as from different regions of Portugal. This group tries to develop knowledge in the inter-related areas of Management, Organizations and Information Systems. It has been in existence for almost three years and during this period its members have collaborated on several projects concerning their common interests (Cardoso et al., 2000; Sarmento et al., 2000a, 2000b; Batista et al., 2001). All members are affiliated with Portuguese public universities and are involved in academic teaching and researching activities. Its initial goals included sharing the learning and the knowledge of its members and supporting the development of the individual research work. All the group members believe that research is sometimes a very isolated and lonely activity and that it can be more rewarding when shared with other researchers of different institutions with common interests. The development of cooperative research through a cooperative network is another objective.

At a certain point, this group became aware that it had made concrete the concept of CoP - Community of Practice - namely, by its objectives, by its ownership, by the connection elements that unite its members, and by the existing expectations about its duration (Wenger & Snyder, 2000). In fact, the characteristics of the CoP presented by those authors are the same that the group recognises in itself (Table 1).

Table 1: The CoP's Model from Wenger and Snyder (2000)

Purposes	Members	What holds it together?	How long does it last?
Develop the members' capabilities; Build and exchange knowledge.	Select themselves.	Passion, commitment, identification with the group's expertise.	Only depends on the interest of maintaining the group.

One of the most important characteristics of this model is the spontaneous birth of the community. Other characteristics found in the MOISIG CoP are that its purposes are directly related to the development of the members' capabilities and there is a willingness to build processes to share and exchange knowledge. The members of this community are self-selected and the "passion, commitment, and identification with the group's expertise" is "what holds it together" (Wenger & Snyder, 2000, p.142). As for "how long does it last," it depends on the interest of the group's maintenance: It will last as long as their members want it to last. However, it is possible to forecast the longevity of the group if we consider the fact that "the strength of communities of practice is self-perpetuating. As they generate knowledge, they reinforce and renew themselves" (Wenger & Snyder, 2000, p.143).

Communication is one of the factors involved in the development of this CoP. It occurs in two ways:

- Face-to-face meetings. These meetings are regularly arranged for each member to present his/her work, doubts and problems. All the members have the opportunity to learn contexts, develop processes of sharing and collaboration and discuss ideas in an unconstrained environment;
- Use of electronic communication means. The MOISIG has a private electronic mailing list and an associated web site, built in the Yahoo® Groups (Yahoo! UK Ltd). This electronic mailing list allows daily communication and reinforces collaborative learning (http://uk.groups.yahoo.com/group/moisig/).

These two ways of communication complement each other. Although most of the communication process is being done through the electronic mailing list, face-to-face meetings give members the opportunity to present their individual work, to finish group tasks and to reflect about the group dynamics (relations between persons, roles, responsibilities, future perspectives, etc.). Because all the group members are dispersed geographically, and the face-to-face meetings only happen once a month or every two months, the information and communication system is very important.

Most of the communication processes take place by email, so it is very important that this media is reliable and easy to use. All members must be sure that their messages will reach all the recipients at the same time without delays. The associated web site should also allow uploading files without significant storage space constraints.

During the development of projects, group members have to perform some tasks while being apart from each other. On those occasions, the information and communication system should allow synchronized meetings.

In the first year and a half, the group experienced some problems concerning the electronic mailing list they were using. Sometimes some email messages bounced, causing lack of coordination and some misunderstandings between the group members. Also, it was rather difficult to coordinate group tasks, such as writing common documents.

The group decided to solve its communication problem. At the same time, this process appeared as an opportunity to contribute with a case for the research question presented in the introduction. To approach this dual situation, the group decided to use the AR methodology. In the next section we describe the major issues of this approach, stressing its value solving these kinds of problems.

RESEARCH METHOD

Action Research

Action research is an interpretive research approach formerly developed in social sciences (Lewin, 1946; Rapoport, 1970; Susman & Evered, 1978; Hult & Lennung, 1980; Susman, 1983). Nowadays, this approach is used in several scientific areas. Information systems are one of them (Checkland, 1981, 1990; Baskerville & Wood-Harper, 1996; Lau, 1997).

The objective of action research is twofold. On one hand, projects using this approach should contribute to solving real problems and, on the other hand, it should add some new scientific knowledge. This is expressed in the definition of action research proposed by Rapoport: "Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework" (Rapoport, 1970, p. 499). Recent work continues to acknowledge these characteristics, recognizing that there are two masters that must be served in an action research process, namely: the research client and the research community (Kock & Lau, 2001, p. 9). Susman and Evered have proposed a third aim of the action research approach, being "to develop the self-help competencies of people facing problems" (Susman & Evered, 1978, p. 588).

Another definition proposed by Hult and Lennung states that: "Action research simultaneously assists in practical problem-solving and expands scientific knowledge, as well as enhances the competencies of the respective actors, being performed collaboratively in an immediate situation using data feedback in a cyclical process aiming at an increased understanding of a given social situation, primarily applicable for the understanding of change processes in social systems and undertaken within a mutually acceptable ethical framework" (p. 247). This definition emphasizes several characteristics of action research, which are considered in the so-called canonical action research form (Baskerville & Wood-Harper, 1998), based on the work of Susman and Evered (1978) and Susman (1983).

According to Baskerville and Wood-Harper (1998), the canonical action research form is distinguished by the following aspects:

- It is iterative;
- It has a rigorous structure;
- The researcher's involvement is collaborative;
- The primary goals are organizational development and advancement in scientific knowledge.

The researcher's involvement being collaborative "implies that the researcher is an equal co-worker with the study subjects" (Baskerville & Wood-Harper, 1998). This means that the researcher could simultaneously be the one that studies the problem and the object being studied. He can also work collaboratively in the problem being analysed and in the situation under research, being one of the participants. Although this situation could be very complicated, it has already appeared in other research cases (Smith & Coenders, 2002).

Figure 1 represents the canonical action research form. This picture emphasizes the iterative nature of this approach, and shows the five activities of the process (Baskerville & Wood-Harper, 1998):

- Diagnosis: the problem is identified and some causes are pointed out;
- Action planning: the action to be taken is specified;
- Action taking: the planned action is implemented;
- Evaluation: the consequences and changes caused by the action are identified and evaluated;
- Specifying learning: as action research serves two masters, lessons learned should be specified for each of them.

Client-System Infrastructure

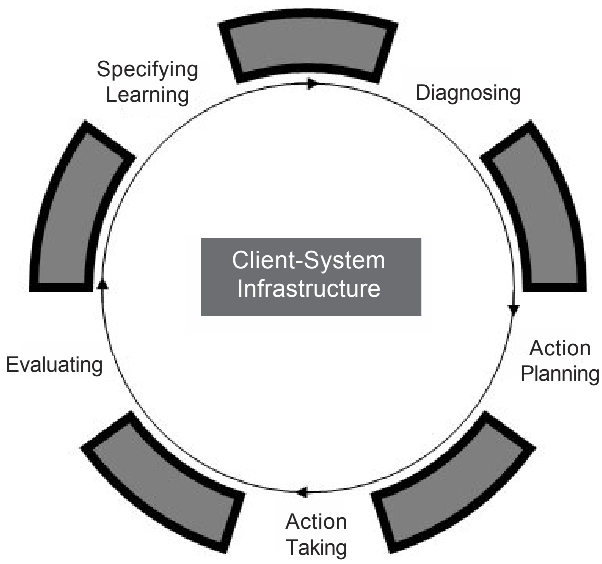
In the case described in this chapter, the canonical action research approach was used. In this approach, the client-system infrastructure must be specified. As

Baskerville and Wood-Harper (1998) state, "The client-system infrastructure is the specification and agreement that constitutes the research environment."

The research environment was the MOISIG. This group, as previously presented, is a Portuguese Ph.D. students' community of practice. In this case, both the researcher and the research client are the MOISIG group. This situation can be understood as problematic to the MOISIG members, and even carrying important ethical questions. The members of the group considered these questions before the project evolved, so it would be possible, at the end, to consider the results as valid ones. In fact, the MOISIG members were interested in solving their problematic communication situation and, at the same time, contributing to a better understanding of the research question explained earlier in the introduction.

In the next section we will describe the action research cycles of this case, according to the model of Susman and Evered (1978) (see Figure 1).

Figure 1: Action Research Process Model of Susman (adapted from Susman and Evered, 1978, and from Baskerville and Wood-Harper, 1998)



RESEARCH CYCLES

First Cycle

As it has been presented in a previous section, the members of the MOISIG group are geographically dispersed, and in order to communicate they use an electronic mailing list. Many of the artifacts developed by the group are done asynchronously, thus needing a good coordination of tasks and deadlines. This process carries some difficulties:

- Coordination in the collaborative development of documents. In some circumstances, some elements of the group included changes in the original version of a document, which implies several new versions almost simultaneously. This lack of coordination occurs because each member of MOISIG changes the document off-line and sends it to the electronic mailing list afterwards;
- The group depends on a particular supplier of email service. As all the messages exchanged are stored in a supplier's computer, there is a fear of lack of privacy. Furthermore, as all members of the group have a TCP/IP connection to the Internet and can not be permanently online, it is difficult to be synchronised. Moreover, sometimes email messages bounce, which is the source of a few misunderstandings.

To solve this problem, the group decided to use a new application based on the peer-to-peer (P2P) approach (Lousã et al., 2001): the Groove® (Groove Networks, Inc.) (http://www.groove.net).

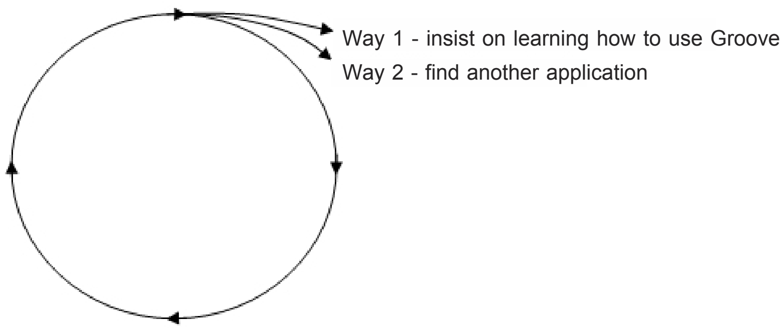
These kind of applications do not use an intermediary server. The communication is processed directly from user to user. According to the description of this product, Groove is a virtual space for small group interaction. Business interaction in Groove includes capabilities that lend themselves to natural and intuitive group dynamics. These capabilities include:

- Communication tools: live voice over the Internet, instant messaging, text-based chat and threaded discussion;
- Content sharing tools: shared files, shared pictures and shared contacts;
- Joint activity tools: co-browsing, PowerPoint presentation walkthroughs, live co-editing of Microsoft Word documents, group calendar.

Activities in Groove occur in shared spaces – secure spaces where invited members interact. Each Groove shared space is stored locally, on the computer of each member of the shared space. When one member adds something new to the space, that change is reflected on everyone's computer system – every member of the space remains completely synchronised with all the other members.

When the MOISIG initially experienced the Groove, two of its members already knew the application. They decided that the best way to help the other members learn to use it was to hold a session together in the same physical room. Before the first session all six members filled out a questionnaire about their knowledge concerning Groove, as well as their expectations. At the end of the session another questionnaire concerning the outcomes and difficulties was filled out. The results were then compared. There were another three sessions, with each member now being at his/her own location.

Figure 2: Action Research Process Model Applied to MOISIG's Case



After using this application for a while, the group pointed out some difficulties:

- The full use of this application demands a very well-equipped computer system;
- Synchronisation among users is rather difficult, as it is not always easy to schedule a moment to be together sharing the same space. Moreover, when some members synchronise, they should expect a substantial period of time waiting for their own spaces to synchronise contents;
- There were also some difficulties with being in the same shared space, due to the use of different versions of the tool;
- All the members have a TCP/IP Internet connection, that is, they are not permanently connected. Furthermore, each member must pay for the use of a phone line and the calls necessary to connect to the Internet, which are expensive in Europe. Thus, each synchronised meeting in Groove could represent a significant financial cost.

Although all the members consider that the application has great potential to be used in a collaborative environment, the difficulties that emerged prevented the group from using it. These difficulties and the costs that synchronised meetings can represent were difficult to overcome. Generally speaking, the group was frustrated with the use of the application, due to all of the reasons presented above, and because some of these difficulties took a long time and a lot of energy to discover why they were happening and how to solve them. In the process of experimenting this tool, the group never stopped using the YahooEgroups electronic mailing list (http://groups.yahoo.com/).

The group also assessed the approach used to improve the communication among group members. Everyone agreed that the use of the canonical action research approach seemed adequate for this case. The group identified a problem and tried to solve it. The members planned an action, put it into practice and evaluated the results. At the end of this process the group reflected upon the outcomes of the experience, trying to decide if the problem was solved or if they should take another cycle of action.

As for the next step, there were two possibilities: (1) to insist on learning how to use Groove and how to use it together, trying to overcome all the difficulties that arose and trying to use a permanent server to overcome the constraints of synchronisation and updating of shared space, and/or (2) to find another application not so demanding that also supported communication, collaboration and coordination of tasks among group members.

The group chose the first option, insisting on learning how to use Groove. They thought that this way would prove easier to update the created shared environment. The step taken next was to find a computer system that could act as a server, permanently connected to the Internet, thus helping all the members to be synchronised (all the members could have, in this way, his/her shared space updated).

Members who weren't able to participate in synchronised meetings or wanted to work in a shared file or update any artifact, would do so without needing to be in the shared space at the same time with the other members.

Just before starting to use the server, a doubt arose. A day after a synchronized meeting with only two members (3 others couldn't be present and the 4th had problems with his computer system when he tried to start the application), two other CoP members were able to see the dialogue that took place between their colleagues and their shared space was automatically updated. They concluded that the permanent server was not necessary. Somehow the application updated the shared space, as the description of the characteristics of a P2P system state (Lousã et al., 2001).

Although this problem was solved, one of the members still couldn't open the application and participate in the meetings by having access to the files, documents and other artifacts made available.

Being so, the group decided that the main problems remained and that it was better to move on to another approach.

Second Cycle

The problem was the same. How could communication among group members be improved? As Groove was not the solution, and as the group saw that the problem was in the technology used, they decided to try another application but, instead of choosing a P2P tool, it would be a client-server tool.

This application was not so demanding and also supported communication, collaboration and coordination of tasks among group members. It was the WebCT™ (WebCT, Inc.), an application usually used in e-learning (http://WebCT.com).

To learn how to use this application, the group applied the same methodology used in the first cycle, i.e., members filled out a questionnaire before and after the first use of the system. Results show that group members considered this application much simpler, without the potential of Groove, but easier to use, and also with the necessary characteristics to encourage collaboration, communication and coordination of tasks. It is also possible to build a repository of documents and artifacts. It also has a chat and a calendar, among other communication tools.

To date, the group still uses this application, with good results. Although this new application offers considerable potential, the group does not want to give up the electronic mailing list they are using. The reason being, in the email system of WebCT, people must open the Internet browser and enter the shared space to manage their email messages, instead of using their usual client email application. In other words, the email system in WebCT is closed to the system and not compatible with general email systems. This is not very practical and, together with the fact that the MOISIG members use TCP/IP connections, would make communication much more expensive.

An advantage of this tool is that the information depends on an authority that is closer to the user and that administrates the server, thus transmitting more confidence. Besides, the limit of storage depends only on the server capacity. The last two characteristics, together with the ease of using the tool, are the most relevant ones as far as the differences between YahooEgroups and WebCT are concerned.

DISCUSSION

After diagnosing a difficulty with communication in the MOISIG CoP, the use of the AR approach revealed to be productive in planning and taking action aimed at solving the problem. It helped the group to reflect upon the applications adopted, as well as reflect upon the basic concepts that support each application. It also helped the group to learn from these experiences. The use of the AR approach implies a structured intervention and thus obliged the group to fulfill several activities of the process development and to contribute to the efficiency (time) and effectiveness of the communication between the MOISIG members.

The analysis of the results of this case show that AR seems to be adequate to help groups (and other entities) to reflect upon their problems or research subjects, and thus help a learning process to occur. This approach was applied to its two masters (Kock & Lau, 2001):

- The research client: The approach was efficient in the intervention made to solve a problem;
- The research community: The application of this methodology in the context described above allowed us to think on issues concerning the relationship between information systems and communities of practice.

If we consider MOISIG as a CoP (Wenger & Snyder, 2000; Wenger, McDermott & Snyder, 2002), the sharing of information among members is very important. As the group dispersed geographically, the use of technological tools that assure an efficient communication process is vital to the development of this CoP. Thus, the group has always had, as a major concern, the need to improve its way of distance communication that led to the experimentation with different technological tools.

The use of the AR approach in this process allowed us to reflect upon some questions concerning the use of IT by a group with the characteristics described above.

From the analysis of this case emerges, among other issues, the concern relating to the improvement of communication processes. This was one of vital importance for MOISIG. The group, before entering a process of trial involving other tools, had always at its disposal a chat tool – a resource that allows synchronisation. However, the group has never used it. Even when the members feel an urgent need to communicate something that requires immediate feedback, members use the telephone. The refusal of using a tool such as "chat" is related to the already stated difficulty for group members to synchronise, because the work timetable of each member is different. This difficulty was also identified when they used Groove and WebCT.

This characteristic of the group takes, according to us, an important role in group communication because it is an obstacle to the full use of the tools discussed previously. This fact reinforces the assumption that the selection of any tool to support communication should take into consideration the characteristics of the group and its elements. In this specific case, the difficulty of synchronizing each professional timetable, and thus allowing all 6 members to be online at the same time to perform a task, inhibits any potential profit that might be gained from the advantages of the tools used. On the other hand, the systematic use of the electronic mailing list reinforces the idea that it is more important to adapt the characteristics of the IT to the users, rather than to the technology *per se*. In fact, the group still uses the electronic mailing list as the most important means of communication because it does not require synchronisation and offers freedom of access. That means that the tool fits the characteristics of the community. It also fits the kind of Internet connection that the group members have access to.

There is also another characteristic of MOISIG that should be taken into consideration: the face-to-face meetings. At this moment, more than a habit, all the members of the group feel these meetings are a real need. They are useful to the performance of some tasks, especially those that require debate or a decision to be made. It is in those meetings that the component of interpersonal knowledge happens more intensely, that the group values and norms are created and consolidated and that the group identity is established. The need for face-to-face meetings raises some questions: is it possible for a group with such characteristics to be developed without face-to-face meetings? Can the members of a CoP work without the use of a technology? What is the role of face-to-face meetings in the creation and the development of a CoP?

On the other hand, does the fact that the members of MOISIG have the possibility of meeting face-to-face regularly interfere with the choice of the information and communication technologies they use? Does the fact that the group knows that it is possible to meet face-to-face, even occasionally, prevent the group from fully using technology? The analysis of this case leads us to consider that the face-to-face meetings fill the gaps that exist in the daily technological-based communication. If, by any chance, the group could not meet face-to-face regularly, would it try to enrich communication by using other technological devices or would it try to overcome the timetable constraints? Once again, there are the characteristics of the group and constraints of its action that should be taken into consideration in the choice of a technological support of communication.

This case indicates that the most complete and sophisticated tools are not always those that work better. It depends on the group, its objectives, characteristics and resources available. The assessment of the group is, thus, indispensable in the selection of a communication tool.

In the described case it seems that the use of AR was very helpful in both perspectives: intervention and research. Nevertheless, we would like to point out a methodological issue: in this particular case the researchers are the elements of the group. Can the researched entity and the research person be the same person? In those situations, how can the researcher assure that there is no bias? This fact raises some ethical questions and, as Hult and Lennung (1980) suggest that AR should be "undertaken within a mutually acceptable ethical framework."

As far as ethical questions are concerned, the group took methodological precautions in the research process in order to prevent subjectivity in the analysis of the results. For instance, the completion of questionnaires by each member before and after the sessions with Groove and with WebCT: also after the sessions each member reported her / his opinion and experience without previous knowledge of the other members' opinions and reports. The analysis of these reports was a starting point for group debate and reflection. At the end of this process, we struck a positive balance by using this way of data gathering as it allowed us to control any possible influence of opinion that could happen among group members. Furthermore, as the group was aware of the ethical issues involved, all the members tried to evaluate each moment separately, i.e., the moment in which they were the clients of the research (problem resolution) and the moment in which they were the researchers (reflection and assessment).

In our opinion, this methodological issue can be overcome by the use of procedures that guarantee a clear separation of roles. If this concern exists, the use of AR can be very efficient, in particular at the level of initiating problem resolution. In these cases, the researcher knows deeply the client, its needs and the context of the problem.

FINAL REMARKS

In the case presented in this chapter, the use of AR was very helpful and suitable because it allowed a more efficient intervention and created an opportunity to reflect on issues concerning the relation between information technologies and communities of practice. One of the most important results that should be taken into consideration is the need to study and assess the group characteristics (client) in order to increase the possibility of success in the use of technological support, because the most sophisticated and powerful tools are not necessarily the most adequate for all situations.

Baskerville and Wood-Harper (1998) point out that while the activity of specifying learning (the last stage in a AR cycle) is formally undertaken last, it is usually an ongoing process. As a matter of fact, from the point of view of the intervention, the MOISIG's communication problem is not totally solved because the electronic mailing list is not the most efficient answer to all the requirements of the group. For example, the collaborative production of documents can be quite complicated using just an electronic mailing list.

MOISIG will continue this dual process of learning and problem solving using the AR approach. Whether the action is successful or unsuccessful, the knowledge gained in the action research presents 3 advantages: "First, what Argyris and Schön (1978) call 'double-loop learning,' the restructuring of organizational norms to reflect the new knowledge gained by the organization (or the group) during the research. Second, where the change was unsuccessful, the additional knowledge may provide foundations for diagnosing in preparation for further action research intervention. Finally, the success or failure of the theoretical framework will provide important knowledge to the scientific community for dealing with future research settings" (Baskerville & Wood-Harper, op. cit.).

TRADEMARKS

Groove ® (Groove Networks, Inc.)
http://www.Groove.net/
Groove®
Groove Networks, Inc.
100 Cummings Center
Suite 535Q
Beverly, MA 01915
phone: (978) 720-2000
fax: (978) 720-2001

WebCT™ (da WebCT, Inc.)
http://WebCT.com
WebCTTM, Inc.
6 Kimball Lane, Suite 310
Lynnfield, MA 01940
1-781-309-1000

Yahoo!® Groups (Yahoo! UK Ltd)
http://www.yahoo.com/
Yahoo! UK Ltd
10 Ebury Bridge Road
London
SW1W 8PZ
Phone 020 7808 4400
fax 020 7808 4203

REFERENCES

Argyris, C., & Schön, D. (1978). *Organizational Learning: A Theory of Action Perspective.* Reading, PA: Addison-Wesley.

Baskerville, R. (1993). Semantic database prototypes. *Journal of Information Systems 3*(2), pp. 119-144.

Baskerville, R. (2001). Conducting action research: High risk and high reward in theory and practice. *Qualitative Research in IS: Issues and Trends.* Trauth, E. (ed.). Hershey, PA: Idea Group Publishing, pp. 192-217.

Baskerville, R. & Wood-Harper, A. T. (1996). A critical perspective on action research as a method for information systems research. *Journal of Information Technology*, 11, pp. 235-246.

Baskerville, R., & Wood-Harper, A. T. (1998). Diversity in information systems action research methods. *European Journal of Information Systems, 7*(2), pp. 90-107.

Batista, J., Sarmento, A., Rebelo, T., Lousã, M., Babo, R. & Cardoso, L. (2001) MOISIG - A knowledge management example. *Managing Information Technology in a Global Economy.* Khosrow-Pour, M. (Ed.). Information Resources Management Association International Conference, Toronto, Canada. Hershey, PA: Idea Group Publishing, pp. 922-923.

Cardoso, L., Babo, R., Batista, J., Lousã, M., Rebelo, T., & Sarmento, A. (2000, October). MOISIG - A spontaneous community of practice. In *Proceedings of the First European Conference on Knowledge Management (ECKM),* Bled, Slovenia, pp. 77-81.

Checkland, P., & Scholes, J. (1990). *Soft Systems Methodology in Practice.* Chichester: Wiley.

Checkland, P. B. (1981). *Systems Thinking, Systems Practice*. England: John Wiley & Sons.

Fahey, L., & Prusak, L. (1998). The eleven deadliest sins of knowledge management. *California Management Review, 40* (3), pp. 265-276.

Hult, M., & Lennung, S.-A. (1980). Towards a definition of action research: A note and bibliography. *Journal of Management Studies,* 17, pp. 241-250.

Kock, N., & Lau, F. (2001). Information systems action research: Serving two demanding masters. *Information Technology & People, 14*(1).

Lau, F. (1997). A review on the use of action research in information systems studies. *Information Systems and Qualitative Research - Proceedings of the IFIP TC8 WG 8.2 International Conference on Information Systems and Qualitative Research* In Lee, A., Liebenau, J., & DeGross, J. (Eds.) London: Chapman & Hall, pp. 31-68.

Lee, A. (1999). Researching MIS. *Rethinking Management Information Systems*. Currie, W., & Galliers, B. (Eds). Oxford: Oxford University Press, pp. 7-27.

Lewin, K. (1946). Action research and minority problems. *Journal of Social Issues, 2*(2), pp. 34-46.

Lousã, M., Cardoso, L., Batista, J., Sarmento, A., Rebelo, T. & Babo, R. (2001, October). Relato de uma experiência com uma ferramenta de apoio ao trabalho colaborativo que suporta o conceito P2P. Poster presented at the *Second Portuguese Conference on Information Systems*, Évora: Portugal.

Orlikowski, W. J., & Baroudi, J. (1991). Studying information technology in organizations: Research approaches and assumptions. *Information Systems Research 2*(1), pp. 1-28.

Rapoport, R. (1970). Three dilemmas of action research. *Human Relations*, 23, pp. 499-513.

Sarmento, A., Batista, J., Cardoso, L., Lousã, M., Babo, R., & Rebelo, T. (2000a, October). MOISIG: Management, organizations, and information systems interest group. *First Portuguese Conference on Information Systems,* Guimarães: Portugal.

Sarmento, A. et al. (2000b, May). Knowledge management and information systems – Which relation? *VIII Congress of Accountancy and Auditing,* Aveiro.

Smith, J. & Coenders, M. (2002, October 15-19). Designing e-feedback to support legitimate participation: Towards a redefinition of feedback in online learning environments. Paper presented in the *E-Learn 2002 - World Conference on e-learning in Corporate, Government, Healthcare & Higher Education,* Montreal, Canada.

Susman, G. (1983). Action research: A sociotechnical systems perspective. *Beyond Method: Strategies for Social Research*, G. Morgan (Ed.), Newbury Park: Sage Publications. pp. 95-113.

Susman, G., & Evered, R. (1978). An assessment of the scientific merits of action research. *Administrative Science Quarterly, 23*(4), pp. 582-603.

Wenger, E. & Snyder, W. (2000). Communities of practice: The organizational frontier. *Harvard Business Review,* January-February, pp. 139-145.

Wenger, E., McDermott, R., & Snyder, W. (2002). *Cultivating Communities of Practice.* Boston: Harvard Business School Press.

Yin, R. (1994). *Case Study Research: Design and Methods* (2nd ed.). Thousand Oaks: Sage Publications.

About the Authors

Elayne Coakes is a senior lecturer in Business Information Management at the Westminster Business School, University of Westminster, UK, teaching mainly in the Strategies for Information Management field. Her research interests lay in the sociotechnical aspects of information systems, especially knowledge management systems and at Westminster she is the co-ordinator of a research cluster, looking at Information and Knowledge Management. She is a member of the BCS Sociotechnical Group and active in promoting this view of information systems strategy and development. She has co-edited a number of books in this field, as well as writing conference papers, articles in journals and several chapters in books. Elayne is also an associate editor of *OR Insight* with special responsibility for knowledge management and is currently involved in editing a special edition of the journal *JORS* on knowledge management and intellectual capital. Her PhD, recently submitted, is a sociotechnical view of the insufficiencies of boundaries and stakeholders in the strategic planning of information systems.

*   *   *   *

El-Sayed Abou-Zeid is assistant professor of Management Information Systems at the John Molson School of Business, Concordia University, Montreal, Canada. He received his PhD in theoretical nuclear physics from Alexandria University. His articles have appeared in journals such as the *Journal of Knowledge Management* and *Journal of Global Information Technology Management* and several refereed conferences such as the IFIP WG 8.1 working conferences. He is a member of IFIP TC8/WG 8.1 (Information System Design and Evaluation), ACM, and IEEE. His current research interests are knowledge management support systems, strategic alignment of KM systems, cultural ontology and conceptual foundations of IS.

Witold Abramowicz is currently the chair of the Department of MIS at The Poznan University of Economics, Poland. His particular areas of interest are information filtering to MIS, information retrieval, and applications of knowledge discovery in MIS. He received his MSc from The Technical University of Poznan, Poland, PhD from The Wroclaw Technical University, Poland, and habilitation from The Humboldt University Berlin, Germany. He worked for three universities in the Switzerland and Germany for 12 years. He chaired seven scientific international conferences and was a member of the program committees of 71 other conferences. He is an editor or co-author of 11 books and 69 articles in various journals and conference proceedings.

Anders Avdic was born in Arboga, Sweden, in 1950. He received his bachelor of science in 1985 in Systems Science. That same year, he held a position as lecturer at Öbrero University in Örebro, Sweden. In 1995, he wrote his Licentiate thesis on Systems Development Using a Spreadsheet Program. He maintained his position as senior lecturer at the University until 1999. During that year, he completed his doctoral thesis entitled, "User and Developer, User Systems Development." Dr. Avdic is currently a member of the VITS research group in Linköping, Sweden. His research interests include end user computing, local systems, and knowledge management. Dr. Avdic also enjoys other activities as a seaman and a boring-machine operator.

Rosalina Babo is professor at the Institute of Administration and Accountancy (ISCAP)/Polytechnic School of Porto (Portugal). She is the director of the Information Systems Department. Her primary areas of research are the impact of e-business on Portuguese organisations, knowledge management and usability evaluation.

Joao Batista is professor at the Institute of Accountancy and Administration, University of Aveiro, Portugal. He lectures courses in Informatics. His primary area of research is information systems. Specific research interests are collaborative systems, organizational learning and communities of practice.

Michael Boahene is currently a director at Holism Information Systems Management based in Melbourne, Australia. Michael has previously worked as a consultant with a number of organizations, both in Australia and internationally. His career spans software development, business analysis, project management, organizational change management and consulting. Michael's current professional interests include research into the effective use of concepts and approaches from a variety of disciplines to organize and manage information systems. This has led to pioneering a methodology for surfacing and critically evaluating underlying assumptions in IS development. Michael has written and presented a number of papers at international conferences, exploring areas such as IS methodologies, IS development issues and knowledge management foundational issues. Michael has a BSc (Hons) degree in Computer Science from the University of Science and Technology, Kumasi, Ghana, a Graduate

Diploma in Management Systems from Swinburne University, Melbourne, Australia, and a Master of IS Management, also from Swinburne University.

Bendik Bygstad is a senior lecturer at The Norwegian School of Information Technology, in Oslo, Norway. He has a Master of Sociology from the University of Oslo. He worked 15 years in the computer industry as a consultant and CIO. He is currently working on a PhD, studying the relationship between iterative and incremental software engineering frameworks, and successful organizational implementation. Other research interests include CRM and KM systems, and the use of actor-network theory related to IS implementation.

Leonor Cardoso is professor at University of Coimbra (Faculty of Psychology and Education Sciences), Portugal. She lectures courses on Work and Organizational Psychology. Her primary area of research is work and organizational psychology, namely in the domain of knowledge management and organizational learning. She will receive her doctorate in work and organizational psychology from the University of Coimbra in 2003.

Abdus Sattar Chaudhry is associate professor at the Division of Information Studies, School of Communication & Information, Nanyang Technological University of Singapore. He has earlier held administrative, teaching, and professional positions in different types of information organizations in Malaysia, Pakistan, Saudi Arabia, and USA. He holds a master's degree from University of Hawaii and a PhD from University of Illinois. His current areas of interest include organization and management of information and knowledge. He can be reached by e-mail at aschaudhry@ntu.edu.sg.

George Ditsa is a lecturer in Information Systems in the School of Economics and Information Systems, Faculty of Commerce, University of Wollongong, Australia. Mr. Ditsa holds a BSc (Hons) degree in Computer Science from the University Science and Technology, Kumasi, Ghana and an MBA (IS) degree from the University of Wollongong. Mr. Ditsa has worked for many years in the IS area as a programmer/analyst and project team leader in various organizations before taking up the lectureship position. His current research interests include strategic IS management, project management, user satisfaction of IS, cultural issues in IS management and, knowledge management and knowledge management systems. Mr. Ditsa has published numerous articles in conference proceedings and academic journals and he is about to complete his PhD on the topic: "Executive Information Systems Use in Organisational Contexts: An Explanatory User Behaviour Testing."

Fredrik Ericsson is, since autumn 2000, a PhD student in the area of information systems development at the Department of Computer and Information Science at Linköping University in Sweden. Fredrik is also a member of the Information Systems and Work Contexts (VITS) research group in Linköping, Sweden. Since 1999, Fredrik has been a lecturer at the Department of Informatics at Örebro University in Sweden. Fredrik has a Degree of Master of Science in Systems Analysis and a Bachelor of Science in Business and Economics. Fredrik's main research interests are knowledge management and organizational learning, development of information systems to support learning in organizational contexts and knowledge management.

Ahmed Abdel Kader Hussein finished his MBA in December 2001 from Maastricht School of Management (MSM), The Netherlands. Currently he is working as business analyst in the Gulf Clearing Company. One of his responsibilities there is to conducts and coordinates financial, product, market, operational, and related research to support strategic and business planning within the various departments and programs of the company. Prior to this, he was employed as a senior research analyst in the Egyptian Cabinet Information & Decision Support Center. His responsibilities include interpreting, evaluating, and interrelating research data, and developing integrated analyses and projections for incorporation into governmental strategic decision-making. Hussein holds bachelor's degree in Economics & Political Science from Cairo University, Egypt. Hussein has been chosen to be the ideal student of the faculty of Economics & Political Science and has been involved with many non-profit, charitable activities. He enjoys sports and outdoor activities. Hussein was born and brought up in the Egypt.

Murray E. Jennex is an assistant professor at San Diego State University, USA, and president of the Foundation for Knowledge Management (LLC). Dr. Jennex specializes in knowledge management, system analysis and design, IS security, and organizational effectiveness. He has managed projects in applied engineering and business and information systems development and implementation. His industrial and consulting experience includes nuclear generation, electrical utilities, communications, health services, and governmental agencies. Dr. Jennex is the author of numerous publications on knowledge management, end user computing, international information systems, organizational memory systems, and software outsourcing. He holds a BA in chemistry and physics from William Jewell College, an MBA and an MS in Software Engineering from National University, and an MS in Telecommunications Management and PhD in Information Systems from the Claremont Graduate University. Dr. Jennex is also a registered professional mechanical engineer in the state of California.

Tony J. Jewels is a lecturer in the School of Information Systems within Queensland University of Technology, Australia. An IT practitioner for over 30 years, he has developed customised inventory management software for a number of successful Australian organisations, designed software for an export award winning warehouse system, and currently researches in the area of communication practices in IT projects, using knowledge management principles. He holds a business management degree, an IT masters degree and is a certified member of the ACS in project management. He teaches IT Management and IT Project Management at both undergraduate and postgraduate level.

K.D. Joshi is an assistant professor in the School of Accounting, Information Systems, and Business Law at Washington State University, USA. Dr. Joshi holds a PhD in Decision Science and Information Systems from the University of Kentucky. Her research interest is in the area knowledge management and IT workforce. Her research has been published in *Communications of the ACM, Decision Support Systems, Information and Management, Information Systems Journal, Journal of Strategic Information Systems, The Information Society, Knowledge Management Systems: Theory and Practice, Knowledge Management Handbook,* and *Handbook of Electronic Commerce.* She has been awarded an NSF grant to study gender differences in information systems career choice.

Intae Kang is a doctoral candidate of the Department of Industrial Engineering at SNU. He holds a BS and MS in industrial engineering (both from Seoul National University). His dissertation research is on knowledge mapping and business modeling.

Yeongho Kim is also associate professor of the Department of Industrial Engineering at Seoul National University (SNU). He holds an MS (from SNU) and PhD (from North Carolina State University) in industrial engineering. His research interests have been on workflow management and concurrent engineering.

Marek Kowalkiewicz, MSc, is a postgraduate student at the Department of Management Information Systems at the Poznan University of Economics, Poland. His areas of interest focus on knowledge management and e-learning, which include knowledge representation, knowledge structures, and ontologies for KM, semantic networks, distance learning solutions, and courseware preparation. He received his degree with the highest note from the Poznan University of Economics, Poland. He is teaching MIS courses at the university, and at the same time he is a professional IT trainer, with expertise in Linux systems, Web and database programming. Marek attended many international conferences and presented his papers there.

Ricky Laupase is completing his doctoral research in knowledge management in which he has been investigating the conversion processes of individuals' tacit knowledge to organisational explicit knowledge in international management consulting firms. The main focus of his research is to find out how organisational structure and culture, and information technology, support the above conversion processes. At the moment, he is teaching a number of units for undergraduate and postgraduate levels in the School of Management Information Systems and the School of Computer and Information Science at Edith Cowan University, Western Australia. His passion is to explore and exploit information and knowledge management development and research for improving human interaction with technology.

Mário Lousã is professor at Polytechnic School of Gaya (ISPGaya), Portugal. He lectures courses on Computer Science as well as a seminar on Information Systems. His primary area of research is information systems, namely in the domain of the automatization of business process, as well as knowledge and organizational learning. He will receive his doctorate in information systems from the University of Minho (Portugal) in 2003.

Denise Johnson McManus is an assistant professor of Information Systems and an Exxon-Calloway Faculty Fellow in the Wayne Calloway School of Business and Accountancy at Wake Forest University, USA. Dr. McManus received her PhD from Auburn University. She has published in the *International Journal of Information Technology and Management, International Journal of Technology Management, Information Resources Management Journal, Information Systems Management Journal,* a case study in *The Management of Telecommunications (Irwin-McGraw-Hill)* and several conference proceedings. Her research includes telecommunications management, knowledge management and the strategic use and effects of information systems on organizations. She has held positions in three *Fortune 500* companies and has 12 years of diversified information systems experience.

Michael Middleton is a senior lecturer in the School of Information Systems at Queensland University of Technology (QUT), Australia. He is a member of the Research Centre for Information Technology Innovation, where his interests include information management, information use analysis, and digital libraries. He has won a variety of grants for research or development of teaching and learning in the area of information services. Some of these have contributed to his extensive list of publications and to the maintenance of his ongoing Internet Web resource sites. He has extensive experience as a consultant with investigations in information services areas including multicultural affairs, parliamentary services, library portals, and controlled vocabularies. He has recently completed the book *Information Management*, published by Charles Sturt University Centre for Information Studies, and his book with Len Asprey, *Integrative Document and Content Management*, is in press with Idea Group.

Helen J. Mitchell is associate head of the School of Management and Entrepreneurship at Unitech, New Zealand. Her particular areas of interest within the school are knowledge management and innovation. Over the last few years, research undertaken has focused on information management and knowledge management. While recognizing and acknowledging the importance of technology and drawing on her background and experience in technology, the research is viewed from that of the manager who looks to technology to provide the means to enhance and add value to the operation of the organization.

Karen Nelson is a lecturer in the School of Information Systems at Queensland University of Technology and a member of the Research Centre for Information Technology Innovation, Australia. Her research focuses on organizational factors implicated in the conduct of information and knowledge management in business contexts. Prior to joining the university, Karen worked in the health and financial sectors, first as a researcher and then as an information management consultant. In 1996, Karen was awarded a first class Honours degree in Information Technology and a University Medal for Academic Excellence. She is currently finishing her PhD thesis, which is due for submission in April 2003.

Yongtae Park is associate professor of the Department of Industrial Engineering and associate director of Graduate Program of Technology Management at the Seoul National University (SNU), Korea. He holds a BS in industrial engineering (from SNU) and an MS and PhD in operations management (both from the University of Wisconsin-Madison). His research interests lie in areas of industrial knowledge network, knowledge management systems, and on-line business modeling.

Violina Ratcheva is currently a lecturer at the University of Nottingham (UK), teaching Creative Problem Solving and Enterprise Knowledge Management. She received her MA degree in Economics and Retail Marketing from Varna University of Economics (Bulgaria), and MSc in Business Studies from Loughborough University Business School (UK). She has worked as accountant, lecturer in Strategic Management, researcher in European Business and a research fellow in Growing SMEs. Her main research interests are in the area of knowledge creating interactions in inter-organisational business networks. She is currently investigating interaction processes and behaviour changes of virtual teams, knowledge capturing and sharing practices in dispersed organisational environments.

Teresa Rebelo is professor at the University of Coimbra (Faculty of Psychology and Education Sciences), Portugal. She lectures courses on Work and Organizational Psychology. Her primary area of research is the work and organizational psychology, namely in the domain of organizational culture and organizational learning. She is a PhD student in Work and Organizational Psychology at the University of Coimbra.

Bonnie Rubenstein-Montano is assistant professor of MIS at the McDonough School of Business, Georgetown University, USA. Dr. Montano earned her PhD in Systems Engineering from the University of Pennsylvania (1997). Current research is in the areas of knowledge management and organizational learning. She has published in such journals as *Decision Support Systems, Environment and Planning, European Journal of Operational Research, ASCE Journal of Urban Planning and Development*, and *Information Knowledge Systems Management*.

Saonee Sarker is an assistant professor of Information Systems at Washington State University, USA. Her research interests include group adoption of technology, virtual teams, and knowledge transfer.

Anabela Sarmento is professor at Institute of Administration and Accountancy (ISCAP)/Polytechnic School of Porto (Portugal). She lectures courses on Business Communication, as well as a seminar on Information Society. Her primary area of research is the impact of information systems on organisations, namely in the domain of communication, knowledge and organizational learning, as well as in the role of the context in the use of information systems. She is also interested in the relation between communities of practice and knowledge management. She will receive her doctorate in Information Systems from University of Minho (Portugal) in 2002.

Charles A. Snyder is Woodruff Endowed professor of Management (MIS) in the College of Business at Auburn University, USA. He holds a PhD from the University of Nebraska. He has extensive managerial and consulting experience. His research interests include strategic management of information technology, knowledge management, and telecommunications management. He has more than 200 refereed publications, including the *International Journal of Information Technology and Management*, *Journal of Management Information Systems, Information & Management, the Academy of Management Review and Executive, California Management Review,* and *Decision Support Systems.* Dr. Snyder is a member of SIM, ACM, DSI, IEEE, IRMA, AIS and other regional, national and international professional societies.

Andrew Taylor is associate dean of Research and professor of Information Systems at the Bradford School of Management in the UK. He holds a BSc in Electronics and Computer Systems, an MSc in Industrial Engineering and a PhD in Knowledge Based Systems, all from The Queen's University of Belfast. Andrew spent several years working in public utilities and government agencies before returning to academia in 1984. He has published more than 100 articles and books on his research interests in knowledge based systems, knowledge management, organizational information systems and performance improvement. He acts as a consultant to many multinational companies and government departments He is a fellow of the Institution of Electrical Engineers and the Institute of Quality Insurance.

Greg Timbrell is a lecturer and researcher in Knowledge Management at the Queensland University of Technology (QUT), Australia. He has published and presented internationally in his area of expertise and advises local and multi-national organisations on how to improve their advisory and support operations using knowledge-based methods. Greg's previous experience over 25 years includes being a knowledge manager, IT manager and consultant with a major firm. He is the deputy head of the Information Systems Management Research Group at QUT and chairs the Standards Australia annual conference on knowledge management.

Ran Wang is currently a doctoral student in Information Systems at the University of Maryland — Baltimore County, USA. Her current research and dissertation focus on knowledge management and decision technology.

Khaled Whaba is an assistant professor at Cairo University (Egypt), Department of Systems and Biomedical Engineering. Dr. Wahba is also the academic advisor at the Regional IT Institute (RITI) in Cairo. He graduated (BSc) from Systems and Biomedical Engineering Department at Cairo University in 1985. He got his MSc from the same department in 1989. Dr. Wahba got his PhD from Technical University of Aachen (RWTH Aachen) in Germany in 1996. Dr. Wahba's fields of interest are: system/business dynamics, the Web-based applications, information systems, distance education, e-learning, simulation and modeling, control of dynamic systems, stochastic processes, statistics, decision making analysis, pattern recognition and knowledge management. He has supervised more than 70 theses in Master of Business Administration, Master of Science Computer Science, and Master of Science Business Information Technology as well as more than 17 senior projects in systems and biomedical engineering. He evaluated over than 350 theses and final projects in different fields, including business and computer science. Dr. Wahba has reviewed papers for submission in different international conferences in the field of information systems. Dr. Wahba is a member of the Information Resources Management Association (IRMA) and a member of the International Society for System Dynamics as well as the president of the Egypt Chapter of the System Dynamics Society. Dr. Wahba is teaching Information System, System Dynamics and Stochastic Process and System Control. He also acted as adjunct professor at the University of Louisville and as link tutor in Cairo for school of computing science, Middlesex University, UK.

Gillian Wright is chair of Strategy and Marketing at the Liverpool Business School, UK. She began her academic career after working in market research and product development in pharmaceuticals, then as a market analyst in electronics. He PhD research concerned the links between attitudes and behaviour in the context of food and health. Since then her work has focused on effective management of services, mainly in the public sectors. She is a member of the team evaluating the implementation of current government policy in healthcare and has acted as a consultant to hospitals, health commissioners, government departments and professional associations.

Piotr Zawadzki, MSc, is a postgraduate student at the Department of Management Information Systems at the Poznan University of Economics, Poland. His main areas of interest are knowledge management systems, business process automation for e-marketplaces, knowledge representation techniques and structures, ontologies for business processes and knowledge exchange. He received his master's degree from the Poznan University of Economics, Poland. He is a professional IT trainer for Education Center in Poland, with specialization in Novell & Microsoft based solution and systems integration. He is also a research student at the Poznan University.

Index

T

V

W