

From Conventions without Logic to Logical Conventions

Judith Morrisey

Manage Your Information

PO Box 490, Inglewood. WA 8932

(jmorrisey@myi.com.au)

Elysabeth Leigh

Faculty of Education

University of Technology, Sydney

PO BOX 123, Broadway, NSW 2007

(elysabeth.leigh@uts.edu.au)

Introduction

This paper presents the current results of on-going work-based research on information management processes in large and small Australian organisations. Our examination of structures shaping traditional processes, has led to an emerging understanding that many of these processes are - in fact - based on '*conventions without logic*' which paradoxically inhibit the effectiveness of tasks they are intended to support.

Workplace practice - as reported in our case studies - indicates that people involved in information processes benefit from identifying - to the extent they can - their 'tacit knowledge' and 'mental models' about the processes and associated activities. A consequence of doing so is the achievement of mutual goals by applying the notion of 'shared mental models' to methods of developing operational choices for achieving real-time organisational priorities. Such solutions, in effect, become locally agreed '*logical conventions*' which resolve real and immediate problems in ways that are sufficiently permanent to meet agreed goals - but not rigid obstructions to future needs for change.

The case studies are drawn from the files of the workplace-based consultant of the writing team - and illustrate ways in which concepts of 'tacit knowledge' and 'mental models' can be combined to identify some of the limitations caused by using 'conventions without logic' to manage information. The need for new information skills for information operatives is proposed.

Knowledge Management and Organizational Survival

"Knowledge Management (KM) is crucial to organisational survival" according to Milton et al (2001) yet its actual contribution to underpinning organisational success is not yet well understood nor widely incorporated into "business as usual" practices. The causes for this are varied, and due - at least in part - to the enormous complexity of factors involved in understanding how to *"get the right knowledge to the right people at the right time and in the right format"* (ibid). Perhaps not surprisingly, a lot of the literature exploring KM is dedicated to technological aspects of how to achieve this flow of knowledge and is focused on promoting opportunities to share information in (sometimes technologically facilitated) conversations, and communities of practice. What is missing from this is attention to the "business as usual" practices that are a less acknowledged part of knowledge management. What is involved - at least in part- is the management of documented information derived from tacit knowledge which can (indeed often does) lead to the creation of further tacit information. As Davenport and Prusak (2000) note: " We transform data into information by adding value in various ways. ... contextualised ... categorized ...calculated ... corrected ... condensed ...Note that computers can help to add these value and transform data information but they rarely help with context and humans must usually help with categorization, calculation and condensing. *A problem ... is the confusion of information - or knowledge – with the technology that delivers it.*"(our italics)

Digital technology enables rapid capture and dissemination of the data that is the basis of KM but is - itself - created out of the habits of generations of reliance on alpha/numeric systems for sequencing and ordering data. While digital technology has enabled a massive increase in the capacity for creating, storing and accessing information, many of the associated naming and managing conventions used with documents stored in repositories - from floppy disks to document management systems - have remained largely unquestioned, unchallenged and unchanged. Records Managers, Information Management professionals and technical experts have - for the most part - continued to rely on familiar "tried and true" methods for naming documents and aggregating their information.

"Adding adjustments" - when "starting over" could resolve the problem

This reliance on habitual 'conventions' for naming items and sorting them in accordance with organising principles built on familiar 'conventions' is - itself - increasingly creating a web of systemic problems with no simple post-implementation solutions. Indeed, at times, it seems that the 'solutions' offered by those with responsibility for attempting to maintain order in the daily avalanche of new information, are repeating the methodologies used by the clock maker, John Harrison, in the seventeenth century.

Dava Sobel (1995), in her history of John Harrison's creation of the first fully accurate and transportable time pieces, reports that "In more than one instance, Gould [the 20th century restorer of Harrison's clocks] found to his chagrin that 'remains of some devices which Harrison had tried and subsequently discarded had been left in situ. He had to pick through these red herrings to find the devices truly deserving of salvage." It is evident that, for his first accurate timepieces, Harrison chose to add extra steps when he encountered a problem rather than retracing his steps, undoing errors and correcting them at source. The same appears to be the case for many efforts to align the potential of digital information creation

and storage with the naming and filing conventions first developed in the time of writing on clay and papyrus.

Learning how to undo past errors, and develop relevant solutions to current KM problems and opportunities involves - for contemporary information management processors, as for Harrison - a sustained effort to re-think approaches towards many of the most familiar naming conventions and procedures that have guided familiar habits and routines. For Harrison this process eventually reduced the weight of his remarkable timepieces from 75 pounds to 3 pounds weight during the course of forty years. For information management the journey appears to be equally long and difficult. Harrison's invention was truly original and defied the contemporary wisdom of astronomers about how to establish longitude. Harrison's opponents' use of a conventional view of the world, and of maritime navigation, was rendered obsolete by his eventual success.

Conventions without Logic

In a similar way, contemporary views of naming and organising information are still widely reliant on inadequate methods. The apparent logic of alpha/numeric filing systems, for example, may seem beyond challenge. Thus the Library of Congress Subject Headings and Dewey's Decimal Classification system (as examples) both offer comprehensive solutions for organising information in a manner that enables quick retrieval relying on accepted wisdom concerning the alphabet and its apparent claims to logic.

The Alphabet as 'orderly'

However the only 'data' that the alphabet was designed to 'organise' is the 26 items it contains. Despite this - and given that 'organising' is defined as "giving orderly structure to" and 'orderly' - in turn - is defined as "methodically arranged" (Concise Oxford Dictionary) - then the alphabet has served well as an adequate way of "giving structure to" information but the method of its doing so is contrived, artificial and 'mannered' rather than 'methodical'.

Considered logically, the alphabet has neither method nor externally applicable structure - except by convention. It is only convention that 'A' is the first letter of the alphabet and "Z" is the last. If it were to be agreed that a new sequence was required, it could be achieved by throwing a set of alphabet blocks into the air and agreeing that the order in which they land is the new sequence. The only consequence would be the need to learn the new sequence. That is we accept - without question - the conventional sequence, see no need to alter it, and apply its non-logical structure to information management processes that need **both** logic and structure - and fail to see a paradox. The following exchanges on a current listserv (Records Management Association of Australia listserv) indicate the growing awareness of the problems brought on by such dependence on a 'convention without logic':

"The problem is, RM'ers think in terms of 'functions' and 'documents', but our users think in terms of 'work' and 'processes'. Whether we talk of life cycles or continuums, we aren't talking user speak."

"... in the US some user surveys 20 years ago, show[ed] that library patrons simply do not understand the difference between a 'title' and a 'subject', ... threatening 200 years of library theory. I've ... found RM system users do not understand 'descriptor', 'subject', 'title' etc."

"...a major problem with monolithic classification schemes and particularly the thesaurus format is that users cannot clearly identify "their" bits of the scheme to apply, and they are the ones it's for."

Botanical classification for achieving 'order'

In contrast botanical classification is structured in accord with the internal logic of the observable characteristics of plants. Linneaus' genius lay in establishing a system that drew its logic from the nature of the items being observed, and reduced the previously chaotic 'naming' of plants to a regularity in which the only argument is about matters of correct description of characteristics. His system is, and remains, both logical and orderly in a way the alphabet can never be.

Understandable - but regrettable - choices

Records management (RM) classification systems share some characteristics with the plant world in that the *subjects* in a records management classification system can be derived by identifying "like" characteristics of records. The chief characteristic on which subjects are usually based is that of the activity being carried out. That is, RM adopted the concept of 'subjects' to describe both individual business transactions and sets of records so that 'subjects' could be given alphabetical identification based on the word/s by which they were known. It is understandable - but perhaps a pity - that modern records management (RM) processes then drew on the alphabet-based library tradition for solutions to the problem of organising the identified business transactions for filing and retrieval.

However, when it comes to logically ordering those activities, identifying a universal 'order' based on library classification conventions becomes difficult due to the influence of specific environmental factors. The environment where activities are being recorded, is unique to the organisation where they occur, whereas library classifications are based on a widely shared 'world view' about ordering information. In contrast an organisation's classification system will be based on the circumscribed view of its participants. However - with apparently limited options and emerging from centuries of reliance on 'conventions without logic' that were seen to suit their usage - RM adopted the alphabet for listing subjects. Thus - when asked what system they use for filing - most people will say 'alphabetical'. However they are, in reality, using an alphabetically-ordered subject system where the 'logic of like subjects' is submerged by the 'convention without logic' of the alphabet.

Controlled Language

As subjects can be dreamt up by anyone, the concept of 'controlled language' is used to enable accurate retrieval of records. Using a controlled language' prevents naming transactions (assigning subjects) from becoming chaotic and assists accurate retrieval of records. In addition Records Management is adopting the concept of a Thesaurus to list terms to be used/not used together with related broader and narrower terms. Once the controlled language for a set of subjects has been identified, the whole list is then converted to alphabetical order. While a reasonably extensive Thesaurus is required to cover the variety of organisational activities, it is not a full dictionary of the English language. The concept is that a person can find their way around a Thesaurus because the words are listed in alphabetical order. Thus conventions of alphabetical ordering continue despite the intention to use 'controlled language' processes.

Modern RM practices in Australia, a world leader in this area, recommend identifying a "Function / Activity / Subject" description of the organisation (Australian Standards Association *AS 4390*). As a first step in developing the required controlled language, an hierarchical view of subjects is identified. Once this is done, a thesaurus is developed listing

all terms to be used/not used and broader and narrower terms. These are arranged in alphabetical order and cross-referenced. That is, the context originally described in the hierarchical view is largely abandoned.

The belief is that an information operator can use a thesaurus since the words are alphabetically listed. In reality, a thesaurus is no easier to use since it still requires some 'logical' entry point. The operator must know that a word is in the thesaurus order to begin a search for the preferred term. This is not an obvious or easy task, and assumes (without ever stating) that an information creator has full and prior knowledge of the thesaurus and all its vagaries.

A person trying to describe an activity they call "x", will use "x" to search the thesaurus. If they do not find "x", they have to think of a word that the thesaurus compiler might have used. In an extensive thesaurus, many minutes of thinking must precede any successful search. And during the search, the information creator has to judge each term in the thesaurus against their own word and assess what will be a reasonable alternative to their "x". This is especially the situation when a system creator (thesaurus compiler) and an information creator (worker) do not share an understanding of the nature of the work being produced. Of course a thesaurus compiler does identify words used within the organisation. However, context is rarely conveyed by a single word, located among a myriad words listed alphabetically. Designers of a thesaurus establish an hierarchical order of relationships among information at the beginning of construction and then replace this 'relational approach' with an alphabetical rearrangement of terms isolated from words which do convey context; thus effectively blocking operators' access to their 'tacit knowledge' – which might otherwise help to navigate information management procedures.

Tacit knowledge, mental models and new 'conventions' for information management

The "Dictionary of Philosophy of Mind" lists three conceptions of tacit knowledge and points out that though they *"differ from each other in significant ways, [yet] they do have one central feature in common, and that is the postulation of content states that are at once causally efficacious and inaccessible to (or not ordinarily accessed by) consciousness"*. In effect our 'tacit' knowledge enables us to move efficiently in the world without *conscious* thought and, as such, it is difficult to question while continuing to drive routine and habitual behaviours.

Mental models, on the other hand, are *"images, assumptions, and stories which we carry in our minds of ourselves, other people, institutions and every aspect of the world. Like a pane of glass framing and subtly distorting our vision, mental models determine what we see. Human beings cannot navigate through the complex environments of our world without cognitive "mental maps" and all of these mental maps, by definition, are flawed in some way."* (Senge et al, 1997)

As understanding of both tacit knowledge and mental models increases they will challenge, ever more strongly, habit-based unquestioning acceptance of 'conventions without logic' including apparently logical and well-formed systems such as the Dewey Decimal Classification and Library of Congress Subject Headings. Tacit knowledge will encourage this challenge because it is opening up an array of 'alternate understandings' including, for example, that:

- some tacit knowledge will always remain unreachable in any 'logical' reasoned manner. This reservoir of 'tacit' knowledge allows for unique creativity and developments with the capacity to surprise, amuse and amaze us. This leads to the situation where “ I” want to use “my methods” rather than a centrally mandated unfriendly system
- “my way of knowing” is inherently logical for me and assists me to manage information in more useful ways than do 'conventional forms'
- the technology now exists for me to do so

However, there are two problems inherent in using alternate understandings. First, not every one can develop workable organising systems; and second, the information so ordered must remain accessible to others because of the collaborative nature of work. These problems first led to records management and librarianship practices being developed. Back when there were few people engaged in information creation, and information was not used directly to 'do work' but rather to influence remotely the work done, the separation of 'creation' and 'managing' was useful, enabling experienced people to focus on managing information *on behalf of others*. The Knowledge Economy has irrevocably changed the ways information is created and used. Three specific factors make it illogical for records managers to continue operating in this "on behalf of others" manner:

- The number of people creating new information and knowledge
- The speed of creation and dissemination of information and knowledge
- The quantity of information and knowledge being created

Therefore, alternate understandings – new mental models - must be developed for work groups in such a way that individual contributions and perceptions are acknowledged and incorporated in mutually created and shared realities. The following two case studies explore these issues.

Methodology for the research

The research is conducted on an on-going basis - as part of business activity (see also Morrisey, 1997) using workplace observation and a process of

1. establishing that a specific information management problem exists
2. conducting interviews using standard questions, and exploring issues raised by responses
3. drawing tentative conclusions, and
4. comparing these with related situations to identify patterns

It is concerned with ways people deal with immediate and specific information management problems, and aims to test the premise that proposed solutions will be informed (and limited) by

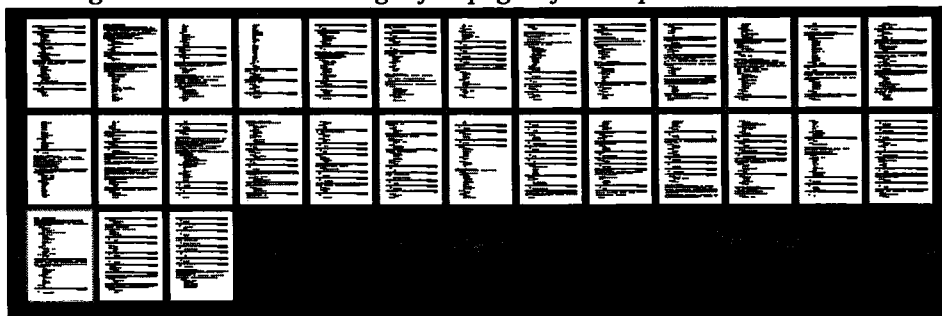
- Awareness of methods of organising information - alpha, subject, indexing, metadata, etc
- Reliance on past experiences of a) mechanical use of existing systems; b) “personal” approaches (often considered to be inapplicable for group use)
- Applying models derived from prior experiences of ‘successful’ solutions
- Understanding of how different media influence the design of solutions (paper, electronic).

It is driven by a concern that knowledge management success "won't come from simply grafting knowledge activities onto existing work processes" (Davenport and Prusak, 2000) but will emerge as KM practices become part of *business as usual*.

Case Study 1

A work unit within a large government department wanted to improve its document management. There were three key concerns: a) the quantity of documents not entering formal departmental files; b) the degree of friction between the work unit and the Department's Records Section (linked to past conflict over the departmental Thesaurus); and c) use by unit staff of a significant number of locally maintained manila files.

Figure 1 - a 'thumbnail' image of 29 pages of the Departmental Thesaurus.



Investigations revealed major reservations arising from past experiences of information being 'lost' (mis-filed) because file titles did not adequately reflect unit activities. The unit had major concerns that projects, a significant proportion of the unit's work, could not be incorporated within existing file titling conventions. Authority over the creation of file titles was also disputed. Previous attempts to resolve these issues produced expensive proposals for wholesale changes to the thesaurus - an unacceptable option since the unit was one of many within the Department.

Based on the emerging understanding set out in this paper the project strategy was to conduct workshops to identify the unit's language for describing their work; and then negotiate with the Records Section to incorporate that language into the departmental Thesaurus.

Results

Agreement was reached on file titling, although software restrictions dictated a compromise whereby new titles formulated by the unit were sequenced to suit Records Section needs. The objective was to ensure that each group felt that their needs were being equally acknowledged.

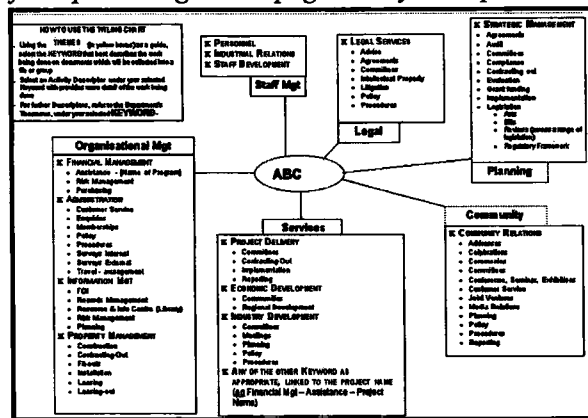
Then agreement on new terminology for inclusion in the Thesaurus was reached. Despite the Records Section's fearful expectation of requests for a major revamp of the Thesaurus this process meant that only *one* new Keyword was requested together with a few accompanying 'activity' descriptors. It transpired that most of the useful descriptions of unit work were already in the Thesaurus, staff had simply been discouraged by the difficulty of using the Thesaurus. The unit also agreed to adopt some Thesaurus terms, although not their first choice.

This was influenced by the benefits arising from the third outcome - the development of a mind-map like pathway or Index to the Thesaurus. This grouped all Keywords and first level Activity Descriptors into six segments, turning a daunting 40 page document (figure 1) into a single image describing the entire activity of the Department at a very high "helicopter" level (figure 2).

This *Graphical Index* tool enabled anyone unfamiliar with the Thesaurus, to choose an option from six rather than several hundred options, by uncovering the ‘like things’ at a helicopter level that had been lost when the original hierarchical Thesaurus became an alphabetical list.

An unintended - but pleasing - result was that the work unit and the Records Section resolved much of the past friction. Gratifyingly, a recent restructure of the Department adopted the Graphical Index to assist new staff understand the Department’s work structure and existing files.

Figure 2 - a method for representing on one page the key concepts in a complex Thesaurus



Case Study 2

A small business expanded to take on permanent staff requiring regular salary payments. The owners had previously withdrawn funds as needed, paying salaries electronically via on-line banking. Records were created with a low-end payroll package, which could transfer data to the business accounting software.

Adding permanent staff, who are not family members, was a new activity and the owners needed procedures which took minimum time with maximum confidence in the results. New software, introduced to record wages, brought with it a degree of anxiety, because of *prior experiences* of significant data loss during initial application of new software. Meeting legal obligations and desiring certainty that staff were being paid, also influenced what happened next.

The owners settled on printed reports for each step in the payments process, including a) on-line bank transaction receipts, b) records via payroll software, c) reports from the accounting software and d) an extended backup summary in a text document. Salaries were fortnightly and the process was soon generating many reports.

Confidence in the system grew until, some months on, a significant error was detected. Correction led to discussion on ways to prevent its re-occurrence. Initially, these focused on designing an additional report. A new insight emerged when one owner identified that the system produced large quantity of paper reports while all significant steps were conducted electronically. Analysis proved that the reports duplicated data available in other forms, took time to print and file, and were rarely re-visited. It was time to simplify the records.

And then a fundamental question emerged: "Exactly '*what information*' do we need to '*move*' to '*where*' in order to *achieve* the '*desired result*'?" And they realised they were trying to "create a system", rather than efficiently using available software. Answers to this fundamental question led to further questions, and drastically re-ordered their processes:

- What is "essential information"?
- Where is it first created?
- Does it need to be accessed elsewhere in the business? If so, how is it 'moved'?
- How can audit trails of data created in one system (e.g. bank transaction numbers) be linked to others (e.g. in-house software) without additional printing?
- How can a relevant summary be created and accessed?

These questions will be familiar to records/information managers in much larger organisations.

Observations

The owners were "*doing work*" and "*creating a system*" - a familiar experience for many. They corrected an 'error' in their system by adding an additional step. Much like Harrison in his clock making, they did not go back to errors 'at source' and correct them. Indeed several steps in their process were there simply to assure that errors had been corrected, without adding value.

Design of new systems and procedures is often "made up as we go along" with workers defining "making a record" as a sub-task within a process and an addition to "doing the task". This ignores the reality that information-based tasks create records *as* the task is done. The owners were initially unaware that the task of "getting a job done" *was the same as* "moving information" until they realised that entering data also created a record. If the data entry was correct their software provided the necessary audit trails. Once they re-defined the process as "managing the *movement* of information" their system could provide a stable up-to-date record with little paper.

This is an example of a problem frequently encountered elsewhere. The effort to recognize that there was a need to "start over again" was substantial and did not come without a struggle. Reliance on routine procedures, in this small business, mirrors the habits sustaining established systems however poorly suited to current needs. This will continue while ever managers consider managing information is "an addition to the work" rather than an integral "work activity".

Conclusions and Further Actions

This redefinition of the situation is one of several possible results arising when inappropriate conventions for information management are discarded. In order to move beyond inappropriate conventions, it is essential that information operators become skilled in responding to the reality of the integrated nature of information creation and its management within the work activity.

Information is no longer being managed 'on behalf of others.' Information operators create and use information as an inseparable part of their activity and must therefore *be* information managers at source. However, the skills for such management are little understood, outside 'conventions without logic', which we have demonstrated to have severe deficiencies.

There is no point in trying to add in more quick fixes - or leave in the redundancies, as Harrison did in his first clock. What is needed is use different mental models in which

information creators understand the underlying principles of managing information and are capable of using information in ways that are needed by them, rather than relying on conventions which can no longer sustain a pretence to being logical.

Use of these skills will contribute directly to the knowledge environment. Tacit-explicit understandings of knowledge need to be seen as a circle, or cycle, rather than a dichotomy or continuum. Just as tacit knowledge can become explicit information, explicit information can become the prompt or starting point for the development of new tacit knowledge. However, without appropriate and useful information management skills at the 'desktop', explicit knowledge can be lost unless it is adequately labelled.

Table 1: A model of skills for information operators in a Knowledge Environment

Capability	Description
Making decisions around organising information	<ul style="list-style-type: none"> • <i>Distinguish</i> between levels and types of information content • <i>Recognise</i> the range of possible options for organising information • <i>Choose</i> from range of options based on known priorities
Valuing information	<ul style="list-style-type: none"> • Involves thinking capabilities <i>and</i> awareness of the nature of information • Ability to think beyond own or original use of the information
Describing the work being done	<ul style="list-style-type: none"> • Consistent Mental models • Discriminating among process options • eg decision making process to produce action • vs decision making process to contextualise
Communications	<ul style="list-style-type: none"> • Collaboration to develop, revise, stabilise, amend the schema used
Trust	<ul style="list-style-type: none"> • Vital to good info organising. However it is not a skill but rather a product an environment. This will be dealt with in another forum.

Our current model of the required information skills is presented in Table 1. Our intention at the conference is to provide an opportunity for knowledge workers – conference participants – to explore some of these and to take away a greater understanding of their own needs for information management at their desktops and within their own local working environments.

References

- Australian Standards Association. *AS 4390: Records Management*, 1996. (This standard formed the basis of international standard ISO 15489 launched in October 2001 for comment)
- CIO*. (Chief Information Officer magazine) Various Case studies covering a range of projects are documented at <http://www.cio.com/research/knowledge/case.html>
- Davenport, Thomas H & Prusak, Laurence *Working knowledge: how organisations manage what they know*. Boston, Harvard Business School Press, 2000
- Malhotra, Yoghesh "*Knowledge Management in Inquiring Organisations*" in the Proceedings of 3rd American conference in Information Systems (Philosophy of Information systems Mini-track) Indianapolis, August 15-17, 1997 pp. 293-295
- Milton, Nick, Shadbolt Nigel, Cottam, Hugh Hammersley, Mark "*Towards a Knowledge Technology for Knowledge Management*" @ http://www.psychology.nottingham.ac.uk/research/ktc/publics/ijhcs_web2.htm accessed 8/2/01
- Morrisey, Judith "If not Hamurabi's Scribe or Victoria's Librarian, then who? New frameworks for managing information." in Proceedings 1996 Annual Conference AEPP and American Management Foundation pp136-140
- Records Management Association of Australia listserv discussion - December 2001
- Sobel, Dava (1995) "*Longitude - the true story of a lone genius who solved the greatest scientific problem of his time*", Fourth Estate, London.
- Thomas H. Davenport, *Working Knowledge* Laurence Prusak. Harvard Business School Press Mass 2000

("A temporary piece of absolute logic")

Sixth International Research Conference on Quality Innovation
and Knowledge Management

Convergence in the Digital Economy

Copyright by the Department of Management,
Faculty of Business and Economics, Monash University.
All rights reserved.

Except under the conditions described in the Copyright Act 1968 of Australia and subsequent amendments. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright owner.

First published in 2002 by
MONASH UNIVERSITY
CONFERENCE MANAGEMENT OFFICE
PO Box 70 Clayton, AUSTRALIA 3800
(+ 61 3 9905 1343)

National Library of Australia
Cataloguing in publication data
Convergence in the Digital Economy
ISBN 0-7326-2198-4

Edited by Professor Amrik Sohal and Dr Richard Cooney

Instructions for using this CD-ROM

Windows (all)

If your CD-ROM drive has Autoload enabled the CD will open automatically when placed in the CD drive. If your computer has this feature disabled you must have Adobe Acrobat Reader Search installed. This can be done from the CD by using Explorer to open the CD, click on the contents, click on the folder named RdSrch then click on the blue file named Setup.exe. This will install the reader/search which allows use of the advanced search facilities available on this CD.

Macintosh Users

The Reader/Search program is available from the Adobe web site at www.adobe.com. When downloading remember to tick the search option.

After Installation

Start the Acrobat reader program, go to File and choose Open select your CD-ROM drive, double click on the CD-ROM and then click on the QIK.PDF File to launch the conference proceedings on CD-ROM.

The Toolbar has many features, a hand to grab and scroll up or down the pages, arrow buttons to navigate forward or back and the binocular Tool will search the document. An advanced search facility is available by clicking on Tools and going to Search, from here take the Query option and make your query.

Difference views of the proceedings are available by clicking either of the three boxes on the top left side of the toolbar, one of these features thumbnail views for rapid scrolling through the proceedings. The Magnifying tool also can be used to enlarge the page for easy viewing.

Acrobat Reader

Copyright 1987-1997 Adobe Systems incorporated. All rights reserved Adobe and Acrobat are trademarks of Adobe Systems Incorporated.

Preface

The conference aim is to provide the opportunity to share new ideas relating to quality, innovation and knowledge management and the associated challenges in the rapidly developing digital economy of the 21st century.

This publication brings together papers from educators, researchers, students and practitioners from all parts of the globe.

Abstracts were reviewed and papers selected for publication in either the refereed section or non-refereed section of the proceedings. Over 180 papers were received and all refereed papers were double-blind reviewed. The organising committee takes this opportunity to thank all reviewers for their timely support.

On behalf of the organising committee, we thank you for your participation in the Sixth International Research Conference on Quality, Innovation and Knowledge Management held in Malaysia in February 2002.

Professor Amrik Sohal

Dr Richard Cooney

Conference Convenors