KNOWLEDGE MANAGEMENT SOLUTIONS-THE IT CONTRIBUTION

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The Knowledge Agenda

Managing an organization's knowledge more effectively and exploiting it in the marketplace is the latest pursuit of those seeking competitive advantage. The interest in knowledge management has surged during the last few years, with a growing number of publications, conferences and investment in knowledge management initiatives.

In a year long study of international best practice (Skyrme and Amidon 1997), two main thrusts were identified. The first is that of making better use of the knowledge that already exists within the firm, for example by sharing best practices. This addresses the often heard lament of "if only we knew what we knew". Too frequently people in one part of the organization reinvent the wheel or fail to solve customer's problems quickly because the knowledge they need is elsewhere in the company but not known or accessible to them. Hence, the initiative of many knowledge management programs (between a third and a half according to surveys) is that of installing or improving an Intranet, and adding best practice or 'expert' databases.

The second major thrust of knowledge focused strategies is that of innovation, the creation of new knowledge and its conversion into valuable products and services. This is sometimes referred to as knowledge innovation (Amidon 1997). This requires an environment where creativity and learning flourishes and knowledge is encapsulated in a form where it can be applied. One new way is to embed knowledge into products, where it is more easily disseminated. Products from tractors to domestic appliances are getting 'smarter', while other products, such as software, represent packaged knowledge.

The range of knowledge management activities is broad, and touches many aspects of business operations, for example:

- Creation of knowledge databases - best practices, expert directories, market intelligence etc.
- Effective information management, gathering, classifying, storing etc.
- Incorporation of knowledge into business processes e.g. through the use of help screens in computer procedures or access to experts from icons
- Development of knowledge centres focal points for knowledge skills and facilitating knowledge flow
- Reuse of knowledge at customer support centres e.g. via case-based reasoning

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- Introduction of collaborative technologies, especially Intranets or groupware, for rapid information access

- Knowledge webs - networks of experts who collaborate across and beyond an organization's functional and geographic boundaries
- Augmentation of decision support processes, such as through expert systems or group decision support systems.

In fact, any activity that uses and applies knowledge can benefit from the disciplines of knowledge management, and that covers most managerial and professional activities. Therefore, like other management fads before, many existing business practices (such as information management and intelligence gathering) are coming under the knowledge management umbrella. Similarly, information systems solutions, such as document management and data warehousing are being similarly relabelled.

Such relabelling raises the question as to whether the current knowledge focus is merely a passing fad. The importance of knowledge as a strategic lever can in fact be traced back many years to writers like Peter Drucker, who is credited with coining the term 'knowledge worker' (see explanation in Drucker 1993). More recently, writers such as Quinn (1992), Wiig (1994), Nonaka and Takeuchi (1995) and Stewart (1997) have given important insights into the contribution of knowledge to corporate success.

What is new, and therefore makes knowledge management more fundamental than simply a passing fad are the following factors:

- The value of an organization's wealth is increasingly in its intangible assets - its people, know-how, brands, patents, licenses, customer relationships etc.
- Knowledge can command a premium price in the market - Applied know-how can enhance the value (and hence the price) of products and services. Examples are the 'smart drill' that learns how to extract more oil from an oilfield, and the hotel chain that knows your personal preferences and so can give you a more personalized service.
- As suppliers and consumers get more globally connected (e.g. through the Internet) access to vital knowledge becomes easier and more cost effective.
- As organizations become more efficient at what they do, they need to apply new learning and ideas to help them differentiate themselves in the marketplace.
- By retaining knowledge as organizations downsize or restructure, organizations can save costly mistakes and prevent 're-inventing the wheel'.

The significant change as companies respond to these factors is that their knowledge processes become more explicit, more systematized, more cross-organizational and more geographically dispersed. As a consequence they more readily lend themselves to the application of information and communications technologies (ICT). Thus, surveys (e.g. Murray and Myers 1997, Chase 1997) have shown e-mail, intranets, Internet as effective knowledge management tools. Also video conferencing, document management, other information sources and decision support tools are quite widely used as such, although views diverge as to their effectiveness.

The First Generation: What Went Wrong?

Computer support of knowledge activities is far from new. In the 1970s there was a proliferation of expert systems, and heightened interest in artificial intelligence. It was suggested that they might radically transform knowledge activities within firms. The reality, as we know in hindsight, is that they fell far short of expectations. They could handle only a narrow range of problems, they required extensive knowledge elicitation, and they failed to grasp the fundamental nature of human thought processes. This era is best characterized as one where we tried to make computers think, rather than using computers to help humans think.

Today, after years of steady progress, artificial intelligence has evolved new techniques, such as neural networks and intelligent agents, and is being widely applied in a growing number of applications. Our research also found a significant proportion of the world-class knowledge management programs we investigated. The main hurdle affecting all applications of ICT to knowledge management is coping with the fundamental difference between explicit and tacit knowledge (Figure 1).

Whereas explicit knowledge is that which can be codified into documents, databases and other tangible forms, tacit knowledge is that in the heads of individuals.

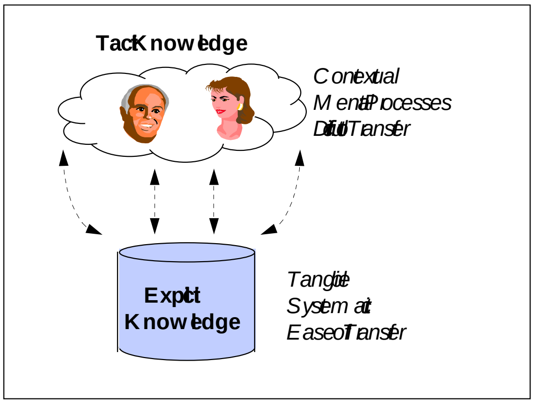

Figure 1 Two Types of Knowledge

Asking a person to describe explicitly how to ride a bicycle and they cannot, yet they know how to. This is tacit knowledge, and the processes by which tacit knowledge is converted into explicit knowledge and vice versa is one of the central planks of Nonaka and Takeuchi (1995). Our research found it one of the most widely quoted concepts by knowledge management practitioners, yet one that is often ignored by information systems professionals. There seems to be a Western tendency to capture knowledge by "getting it into a database". Yet some of the most successful applications of ICT in knowledge management include those that help human-to-human communications, most notably groupware and especially Lotus Notes.

Frameworks for Thinking and Action

From the perspective of knowledge architecture, frameworks provide a convenient way of thinking about the role of ICT in supporting knowledge processes. Most

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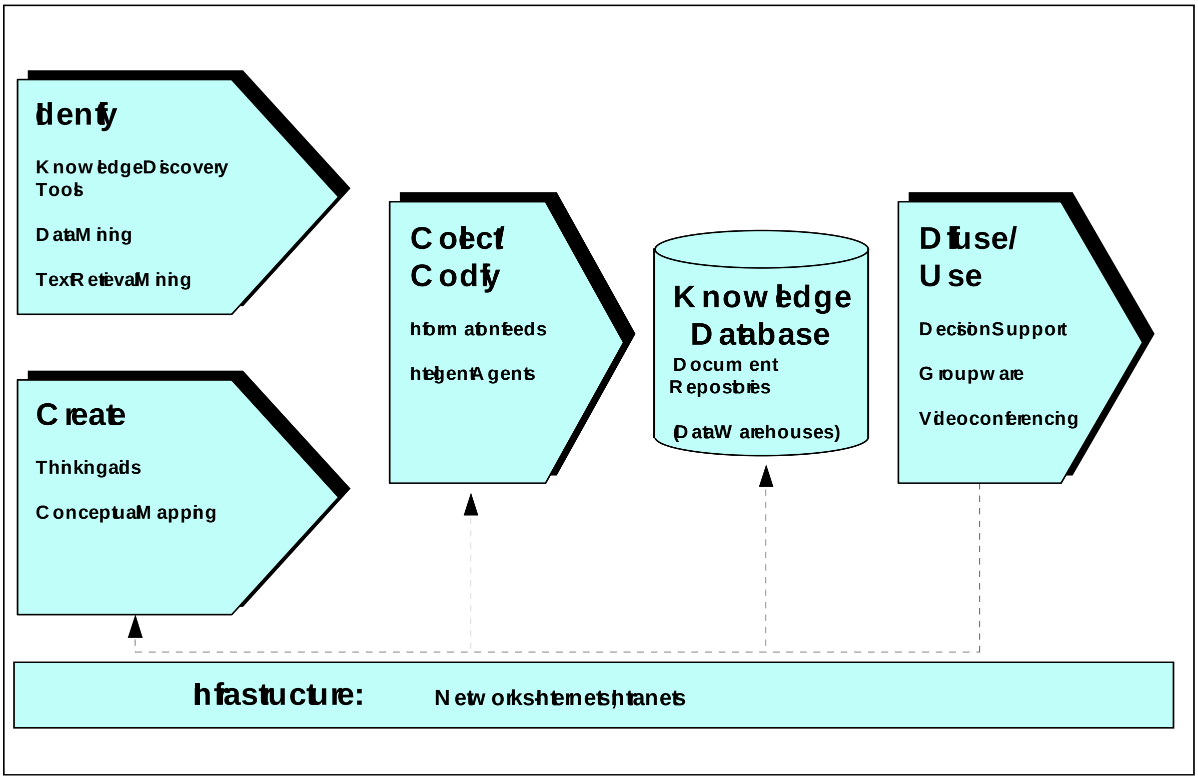

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From an analysis of a wide range of tools and classifications, Ian Wyly of Trend Monitor International has developed the functional schema shown below:

A MIND: Assimilation and Interpretation
- Mapping, Summarization, Significant pattern discovery, Decision support

B COLLABORATION: Network and Communication
- Conversing, Workflow, Information sharing, Resource sharing, Groupware

C CONTENT: Gathering and Retrieval
- Preparation, Classifying, Searching, Filtering, Indexing

D MEDIA: Storage and Form
- Numeric databases, Text bases, Image bases, Multimedia

A framework that most managers can easily relate to is that which maps various ICT tools according to the knowledge processes they enhance. Having learnt about Business Process Reengineering many are now well oriented to the process view of the firm. Figure 2 shows a schematic of knowledge processes (similar to a value chain) whose left hand categories distinguish the two strands of knowledge management – identifying existing knowledge and creating new knowledge. A representative selection of ICT tools are mapped onto different knowledge processes.

Some Key Technologies

The impact of each technology varies enormously from situation to situation. Several technologies recur in many knowledge management programs, partly because they are generic and pervade many core activities and processes. The main ones are now briefly reviewed.

Intranets/Internet

The ubiquitous Internet protocols make it easy for users to access "any information, anywhere, at any time". Further, browsers and client software can act as front ends to information in many formats and many of the other knowledge tools such as document management or decision support. Remember too, that the basic functions of email, discussion lists and private newsgroups often have the biggest short term impact.

Booz Allen & Hamilton's *Knowledge On-line* is an Intranet that provides a wealth of information (e.g. best practice, industry trends), a database of experts, to their consultants world-wide. Through active information management by knowledge editors (subject experts and librarians), the information remains well structured and relevant.

Groupware/Lotus Notes

What groupware products like Lotus Notes add over and above Intranets are discussion databases. Users such as Thomas Miller, London based manager of insurance mutuals, access their organizational memory, as well as discuss current news feeds in areas of interest.

through one of Lotus's key features; multiple 'views'. When writing new insurance proposals, existing explicit knowledge can be assembled from the archive, guided by an expert system front end, while tacit knowledge is added through discussion databases.

Intelligent Agents

The problem of information overload is becoming acute for many professionals. Intelligent agents can be trained to roam networks to select and alert users of new relevant information. Additionally, they can be used to filter out irrelevant information from information feeds. However, in practice the forms that we call knowledge centers, such as those at Price Waterhouse, the best intelligent agent is the human being!

A related technology is that of text summarizing, which British Telecom have found can summarize large documents, retaining over 90 percent of the relevant meaning while less than a quarter of the original text.

Mapping Tools

There are an increasing number of tools, such as COPE and DONS, that help individuals and teams develop cognitive maps of shared mental models. These have been used by companies such as Shell to develop future scenarios and resolve conflicting stakeholder requirements. In addition, the mapping tools, such as those found in KnowledgeX, can represent conceptual linkages between different source documents.

Document Management

Documents, and especially structured documents, are the form in which much explicit knowledge is shared. With annotation and red-lining facilities, they can become active knowledge repositories, where the latest version and thinking is readily shared amongst project teams.

By using a document management system for the construction of the Thelma North Sea oil platform, AGIP reduced construction time by 9 months and reduced document handling costs by 60 percent. Suppliers like Dataware are repositioning their products as knowledge management products and are also adding 'knowledge enriching' functionality.

Knowledge Enriched Solutions

With a burgeoning and lucrative market for knowledge management solutions, many companies are simply re-labeling their products and approaches e.g. information management as knowledge management, databases as knowledge bases, data warehouses as knowledge repositories. True knowledge management solutions are not simply new labels, but add knowledge enriching features. These include:

- Adding contextual information to data - where was this information used? What factors need to be considered when using it?
- Using multimedia e.g. adding video clips or voice to databases of best practice or problem solution databases

- Providing annotation - adding information notes to individual items using MAPI enabled software where a document or file can be sent with a forwarding note by email
- Qualifying information e.g. giving details of originators, users adding comments about the quality of information
- Providing links to experts (click button to contact an expert either by email or phone). GIGA, for example, provides its clients access to global experts through its website (http://www.gigaweb.com)

These all help the transfer of tacit knowledge, and any tool should increasingly provide hooks that add new levels of interaction, not just person-to-computer but person-to-person.

Knowledge Collaboration Architecture

Over time, the boundaries of individual tools blur (e.g. groupware and Internet, document management and information retrieval) and effective usage requires seamless interoperability and fluidity of information and knowledge flow.

Therefore organizations using ICT to support knowledge activities need to think about an overall architecture. Some companies, such as Glaxo Wellcome are recognizing that knowledge management requires changes in established technical architectures. Our analysis of several companies who have developed architectures that support knowledge management indicates that tools and supporting processes are needed at several levels (Figure 3).

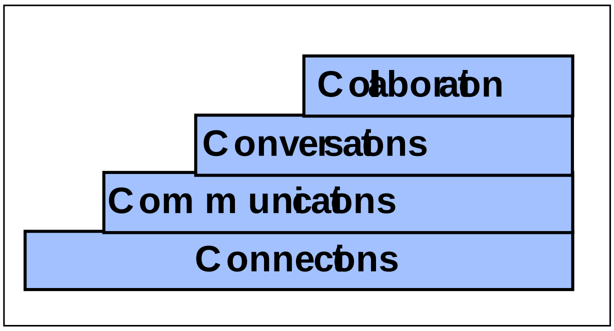

Figure 3. Levels of an IT Knowledge Infrastructure

At the base level, the requirement is that people should be able to connect into knowledge whenever and wherever they are (the office, at home, or even on the move). At higher levels, there must be mechanisms for threaded conversations and structured collaborative work.

As you move up through each architectural layer (each of which depends on the one below), more of the challenges are people and organization related than technology. In our experience, most large organizations are taking the opportunity to move forward rapidly at the bottom two levels.

Achieving the Benefits

As many managers of change or implementers of ICT infrastructure know, it is the human, organizational and cultural factors that are the ultimate determinants of success. ICT solutions for Knowledge Management are, in essence, social computing and therefore need such an approach. Implementations that are successful are typically found to share the following characteristics:

- Clear vision and leadership, as well as appreciation of the contribution of knowledge to business success and how IT can help.
- Multidisciplinary teams - including information managers (librarians), facilitators, business experts as well as technologists.
- User and business centred. Users are actively engaged in developing solutions that enhance knowledge activities.
- Well designed processes that engage humans where they are best, and allow them to interact with computers where computers perform best. A business process that does not consider applying the knowledge (and updating it) is an incomplete process.
- Active learning and experimentation. There is no such thing as a finished requirement specification. Solutions evolve and adapt.
- A knowledge sharing culture. People want to share information and their experience and are rewarded for doing so.

Conclusion

Information and communications technologies are an important ingredient of virtually every successful knowledge management program. An ever widening range of highly effective solutions are coming to market, including a new generation of artificial intelligence solutions, new flavors of document management systems and various collaborative technologies such as the Internet.

Successful implementation depends, as always, on giving appropriate focus to the non-technical factors such as human factors, organizational processes and culture, the multidisciplinary skills of hybrid teams and managers, and the already existing knowledge repository of prior learning - providing, of course that it is well structured, accessible and gives you access to local expertise!

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