IT-Track KM and Technologies for Knowledge Management in Government Organizations

As we have asserted many times in this material knowledge management is much more than technology, but clearly efficient and effective utilization of relevant technology is an integral part of the knowledge management scheme. Indeed, the availability of certain new Information and Communication Technologies (ICTs) such as Database technology and the World Wide Web has been instrumental in catalyzing the knowledge management movement. In this part we are going to briefly discuss the “technology side” of knowledge management and how knowledge management technologies might help with the KM movement within government organizations.

1. Knowledge Management Technologies

In his *Strategic Knowledge Management Technology*¹ Petter Gottschalk pointed out that, as we trace the evolution of computing technologies in business, we can observe their changing level of organizational impact. The first level of impact was at the point where work got done and transactions (e.g., orders, deposits, reservations) took place. The inflexible, centralized mainframe allowed for little more than massive number crunching, commonly known as electronic data processing. Organizations became data heavy at the bottom and data management systems were used to keep the data in check. Later, the management information systems were used to aggregate data into useful information reports, often prescheduled, for the control level of the organization – people who were making sure that organizational resources like personnel, money, and physical goods were being deployed efficiently. As information technology (IT) and information systems (IS) started to facilitate data and information overflow, and corporate attention became a scarce resource, the concept of knowledge emerged as a particularly high-value form of information².

Information and telecommunication technologies can indeed play an important role in successful knowledge management initiatives. As a matter of fact, since knowledge and the value of harnessing it have always been with us, it might be safe to say that it is indeed the availability of these new ICTs that has stoked the knowledge fire. However, the concept of coding and transmitting knowledge in organizations is not new: training and employee development programs, organizational policies, routines, procedures, reports, and manuals have served this function for many years. What is new and exciting in the current knowledge management area is the potential for using modern ICTs to support knowledge creation, sharing and exchange in an organization and between organizations. Modern information technology can collect, systematize, structure, store, combine, distribute and present information of value to knowledge workers³.

¹ Petter Gottschalk (2005), *Strategic Knowledge Management Technology*, Idea Group Inc.
Identifying, nurturing and harvesting knowledge is a principal concern in this knowledge age. Effective use of knowledge-facilitating tools and techniques is critical, and a number of computational tools have been developed. While numerous techniques are available, it remains difficult to analyze or compare the specific tools. In part, this is because knowledge management is a young discipline. The arena is evolving rapidly as more people enter the fray and encounter new problems\(^4\).

Alavi and Leidner\(^5\) have developed a systematic framework that could be used to analyze and discuss the potential role of ICTs in knowledge management. To them organizations consist of four sets of socially enacted knowledge processes: (1) creation, (2) storage and retrieval, (3) transfer, and (4) application. These processes do not represent a monolithic set of activities, but an interconnected and intertwined set of activities. The utilization of relevant ICTs during these four individual knowledge management processes is elaborated in some detail in the following.

1.1 Knowledge Creation Process

As the SECI Model developed by Nonaka suggests, organizational knowledge creation involves developing new content or replacing existing content within the organization’s tacit and explicit knowledge. Through social and collaborative processes as well as individuals’ cognitive processes, knowledge is created. It views organizational knowledge creation as involving a continual interplay between the tacit and explicit dimensions of knowledge and a growing spiral flow as knowledge moves through individual, group, and organizational levels. Four modes of knowledge creation have been identified: socialization, externalization, internalization and combination.

We believe during this process organizations can utilize Intranets (which includes electronic mail and group support systems) to enable organizational-wide exposure to greater amounts of online organizational information, both horizontally and vertically, so as to accelerate the growth of knowledge creation. As the level of information exposure increases, the internalization mode of knowledge creation, wherein individuals make observations and interpretations of information that result in new individual tacit knowledge, may increase. In this role, an intranet can thus support individual learning (conversion of explicit knowledge to personal tacit knowledge) through provision of capabilities such as computer simulation (to support learning-by-doing) and smart software tutors.

For knowledge creation, there is currently emerging idea-generation software. Idea-generation software is designed to help stimulate a single user or a group to produce new ideas, options, and choices. The user does all the work, but the software encourages and pushes, something like a personal trainer. Although idea-generation software is relatively new, there are several packages on the market. IdeaFisher, for example, has an associative lexicon of the English language that cross-references words and phrases. These associative links, based on analogies and metaphors, make it easy for the user to be fed words related to a given theme. Some software packages use questions to prompt the user toward new, unexplored patterns of thought. This helps users to break out of cyclical thinking patterns and conquer mental blocks.

1.2 Knowledge Storage and Retrieval Process

According to Alavi and Leidner\(^6\), empirical studies have shown that while organizations create knowledge and learn, they also forget (i.e., do not remember or lose track of the acquired knowledge). Thus, the storage, organization, and retrieval of organizational knowledge constitute an important aspect of effective organizational knowledge management. Advanced computer storage technology and sophisticated retrieval techniques, such as query languages, multimedia databases, and database management systems, can be effective tools in enhancing organizational knowledge. These tools increase the speed at which organizational knowledge can be accessed. For instance:

Groupware enables organizations to create intra-organizational knowledge in the form of both structured and unstructured information and to share this kind of knowledge across time and space. Document management technology allows knowledge of an organization’s past, often dispersed among a variety of retention facilities, to be effectively stored and made accessible. Common repository technologies (which include Lotus Notes, Web-based intranets, and Microsoft’s Exchange), supplemented by search engines, document management tools, and other tools that allow editing and access, help to capture knowledge for later and broader access by others within the same organization. Knowledge retrieval can find support in content management and information extraction technology, which represent a group of techniques for managing and extracting information from documents, ultimately delivering a semantic meaning for decision makers or learners alike.

1.3 Knowledge Transfer Process

Knowledge transfer occurs at various levels in an organization: transfer of knowledge between individuals, from individuals to explicit sources, from individuals to groups, between groups, across groups, and from the group to the organization. Considering the distributed nature of organizational cognition, an important process of knowledge management in organizational settings is the transfer of knowledge to locations where it is needed and can be used. However, this is not a simple process in that organizations often do not know what they know and have weak systems for locating and retrieving knowledge that resides in them. Communication processes and information flows drive knowledge transfer in organizations.

Knowledge transfer channels can be informal or formal, personal or impersonal. ICTs can support all four above-mentioned forms of knowledge transfer, but has mostly been applied to informal, impersonal means (such as discussion databases) and formal, impersonal means (such as organization directories). An innovative use of technology for transfer is use of intelligent agent software to develop interest profiles of organizational members in order to determine which members might be interested recipients of point-to-point electronic messages exchanged among other members. Employing video technologies can also enhance transfer.

ICTs can increase knowledge transfer by extending the individual’s reach beyond the formal communication lines. The search for knowledge sources is usually limited to immediate coworkers in regular and routine contact with the individual. However, individuals are unlikely to encounter new knowledge through their close-knit work networks because individuals in the same clique tend

\(^6\) Ibid.
to possess similar information. Moreover, individuals are often unaware of what their cohorts are doing. Thus, expanding the individual’s network to more extended, although perhaps weaker, connection is central to the knowledge diffusion process because such networks expose individuals to more new ideas.

Computer networks and electronic bulletin boards and discussion groups create a forum that facilitates contact between the person seeking knowledge and those who may have access to the knowledge. Organizational directories (i.e. knowledge mapping) may enable individuals to rapidly locate the individual who has the knowledge that might help them solve a current problem. For example, the primary content of such a system can be a set of expert profiles containing information about the backgrounds, skills and expertise of individuals who are knowledgeable on various topics. Often such metadata (knowledge about where knowledge resides) prove to be as important as the original knowledge itself. Providing taxonomies or organizational knowledge maps enables individuals to rapidly locate either the knowledge or the individual who has the needed knowledge, more rapidly than would be possible without such ICT-based support.

1.4 Knowledge Application Process

An important aspect of the knowledge-based view of the organization is that the source of competitive advantage resides in the application of the knowledge rather than in the knowledge itself. Information and communication technology can support knowledge application by embedding knowledge into organizational routines. Procedures that are culture-bound can be embedded into ICTs so that the systems themselves become examples of organizational norms.

For instance, ICTs can help enhance knowledge integration and application by facilitating the capture, updating, and accessibility of organizational directives. For example, many organizations are enhancing the ease of access and maintenance of their directives (repair manuals, policies, and standards) by making them available on corporate intranets. This increases the speed at which changes can be applied. Also, organizational units can follow a faster learning curve by accessing the knowledge of other units having gone through similar experiences. Moreover, by increasing the size of individuals’ internal social networks and by increasing the amount of organizational knowledge available, ICTs allow for organizational knowledge to be applied across time and space.

ICTs can also enhance the speed of knowledge integration and application by codifying and automating organizational routines. Workflow automation systems are examples of ICT applications that reduce the need for communication and coordination and enable more efficient use of organizational routines through timely and automatic routing of work-related documents, information, rules, and activities. Rule-based expert systems are another means of capturing and enforcing well-specified organizational procedures.

To summarize, we think, each of the four knowledge processes of creation, storage and retrieval, transfer, and application might be facilitated by ICTs:
• **Knowledge creation:** Examples of supporting information technologies are data mining and learning tools, which enable combining new sources of knowledge and just in time learning.

• **Knowledge storage and retrieval:** Examples of supporting information technologies are electronic bulletin boards, knowledge repositories, and databases, which provide support of individual and organizational memory as well as inter-group knowledge access.

• **Knowledge transfer:** Examples of supporting information technologies are electronic bulletin boards, discussion forums, and knowledge directories, which enable more extensive internal networks, more available communication channels, and faster access to knowledge sources.

• **Knowledge application:** Examples of supporting information technologies are expert systems and workflow systems, which enable knowledge application in many locations and more rapid application of new knowledge through workflow automation.

2. Major Technology Categories for Knowledge Management in Government Organizations

ICTs enable the knowledge of an individual or group to be extracted and structured, and then used by other members of the organization or its trading partners worldwide. Technology also helps in the codification of knowledge and occasionally even in its generation. Although knowledge management is a relatively recent field of practice, attempts to use technology to capture and manipulate knowledge have been underway for decades. Generally speaking the various new technologies that have been developed and are most relevant to knowledge management within government organizations might be categorized into the following groups: database technologies, decision support technologies and networking technologies.

2.1 Database Technologies

A database is a collection of data organized to efficiently serve many applications by centralizing the data and minimizing redundant data. A database management system (DBMS) is the software that permits an organization to centralize data, manage them efficiently, and provide access to the stored data by application programs.

Database technologies are mainly applied in three basic forms of information systems during the process of government knowledge management:

1. **Object registration systems** hold a general purpose registration of the population, legal entities such as institutions, immovables, enterprises etc. Object registration systems make (legally) reliable societal exchanges possible. They function as a general purpose registration. Although no concrete transactions are performed by the object registration systems, they are of great interest for exchanges between bureaucracies and citizens. Exclusive data-mining results generated from these systems will be highly valuable to guide government operations. Administrative identity of the citizen can also be certified by these types of authentic registrations.
2. **Sectoral systems** assist in the basic transactions in a specific sector of public administration such as social security, health care, police, traffic and transport etc. More and more architectures are being developed for entire sectors of society which make free exchange of data and data-linking throughout the whole sector possible. For instance, in the health-care sector, electronic patient dossiers are becoming the knowledge base for transactions linking the different care providers: hospitals, pharmacies, general physicians, homes for the elderly, nursing homes, medical insurance companies etc.. As a result, during the design and implementation stage of various government policies, supports from these kind of systems are required. Sectoral systems can also be useful in the construction of simulation models. In the judicial and social security sectors sectoral systems are linked to each other.

3. **Control systems** perform and monitor the expenditure of financial, human and physical (building and equipment) resources within ministries, other government bodies and subsidized organizations. Control systems are playing an ever increasing role in the transparency and accountability of governmental institutions and private bodies, such as schools, hospitals, social security organizations and as partners in civic society (non-governmental organizations) through performance indicators and benchmarking.

However, it should be noted that some large databases make knowledge discovery computationally expensive because some domains or background knowledge, hidden in the database may guide and restrict the search for important knowledge. Therefore, modern database technologies need to process large volumes, multiple hierarchies, and different data formats to discover in-depth knowledge from large databases. For example, multi-dimensional data analysis, on-line analytical processing, data warehouses, web and hypermedia databases.

### 2.2 Decision Support Technologies

Decision support technologies used in knowledge management system serve as an aid to decision-making processes, by applying specific rules to individually, or collectively, data and knowledge. Decision support systems can range from fairly simple processing (case-handling) systems, based on a few production rules (best practice), to complex advisory systems and expert systems as knowledge-based systems. Expert systems, essentially an artificial intelligence method for capturing knowledge, are knowledge-intensive computer programs that capture the human expertise in limited domains of knowledge. For this, human knowledge must be modeled or presented in a way that a computer can process. Usually, expert systems capture the human knowledge in the form of a set of rules. The set of rules in the expert systems adds to the organizational memory, or stored learning of the organization. An expert system can assist decision making by asking relevant questions and explaining the reasons for adopting certain actions. Expert systems of representing knowledge include knowledge base, rule-based systems, knowledge frames, expert system shell, inference engine, and case-based reasoning. Sometimes, expert systems are integrated with other AI methods, such as neural networks, fuzzy logic, genetic algorithms, and intelligent agent, using their functions of automated reasoning and machine learning.
Increasingly, with the establishment of knowledge management system in all government organizations, databases from different government departments will be automatically linked to decision-processing systems in other domains. Aggregates, abstracted from databases containing the outcomes of decisions, may, as Management Information Systems (MIS) and Executive Information Systems (EIS), also belong to the category of decision support systems.

### 2.3 Networking Technologies

Networking technologies, of which various Groupware could be regarded as an integral component, are rapidly mushrooming and have added a very important communication dimension to itself. It has a general data-communication purpose and is therefore utilized in every knowledge management systems. In today's knowledge economy, rapid access to knowledge is critical to the success of many organizations. With the emergence of the concept of ‘sharing knowledge is power’ networking technologies enable knowledge management activities for collaborative decision support, information sharing and organizational learning. An information and communication technology (ICT) infrastructure provides a broad platform for exchanging data, coordinating activities, sharing information, emerging private and public sectors, and supporting globalization commerce, all based on powerful computing and networking technology. In today's world information computing offers powerful information processing abilities and the network provides standards and connectivity for digital integration.

As a result of this, time and place are losing their significance and all kinds of virtuality are thereby introduced. Examples of these technologies are file-sharing, email, websites, navigating, chatting, targeting messages, video-conferencing and the like. Networking started with local and wide area networks, and Groupware. More recently intranets and extranets — using internet technology — have been widely introduced into and become the standard of every aspect of social lives so as to construct a digital environment to consistently create new knowledge, quickly disseminate it, and embody it in organizations.

### 3. Some Techniques and Utilization Regarding the Use of Web for Knowledge Management

Apparently the use of Intranet, Internet or World Wide Web for storing, retrieving and dissemination is the singly most widely used technology in today’s IT-track knowledge management system, especially knowledge repositories based on the World Wide Web are rapidly picking up steam. The Web is a very intuitive technology; and deals easily with audio, graphic, and video representations of knowledge. Knowledge in a particular domain is often related to other knowledge, and the hypertext structure of the Web makes it very easy to move from one piece of knowledge to another. Most Web-based repositories are smaller and easier to negotiate than those built in other environments. Intranet Webs are therefore the easiest way to get into knowledge management.

However, if one plans to use Web technology for knowledge management (particularly the search-and-retrieval of structured, document-based knowledge), don't think that a Web browser and server software is all that one needs. A complex suite of tools is normally necessary to capture information, store it, and allow broad access. The usual requirements include Hypertext Markup
Language (HTML) publishing tools for producing Web documents, a relational database system for storing them, text search-and-retrieval engines, and some approach to managing the "metaknowledge" that describes and facilitates access to the knowledge one has got on hand.

It is also crucial to develop an on-line thesaurus for the search-and-retrieval knowledge management. Knowledge is unwieldy to structure. One will find that searchers will be looking for knowledge using terms that one can't always anticipate. The idea behind a thesaurus is to connect the terms by which one has structured the knowledge with the terms employed by the searcher. This isn't that tough technically if one has bought a search engine. It is more difficult to compile a set of meaningful terms by which the knowledge repository can be searched.

The underlying technique for the Web-based knowledge repositories is text search-and-retrieval. While this technology has been around for decades, it has both strengths and shortcomings for knowledge management. On the positive side, the knowledge itself typically has plenty of meaningful context that was created by the original author of the article, legal brief, or biography. However, the knowledge in textual databases is indexed on the basis of keywords and their proximity in the text. These are relatively shallow aspects of knowledge and it can be difficult to extract knowledge in search queries on this basis. If the information about a problem is not already in text form, putting it in that form requires significant time and human labor.

Besides knowledge repositories the Web can also be used for other knowledge management applications as well. One popular application, for example, is the expert locator, which allows users to search through a set of biographies for an expert on a particular knowledge domain. Although this is still a form of repository, the objective is to locate people rather than documents. Intranet-based Webs combined with database-management software are usually the most popular technology for this type of application. The data on the expert may include educational background, jobs held within and outside the company; current projects or responsibilities, and particular skills, including languages spoken or computer proficiency; Most importantly; the expert locator should include a keyword-based guide to the domains of expertise in the company. If someone seeks an expert on the topic of "database marketing," for example, it should be easy to connect with experts having that expertise by searching on that keyword.

The technology associated with expert locators is relatively straightforward. In addition to a Web browser and server software, the application will typically require some system of database management and a search engine. As with repositories, the search engine should work with a thesaurus, since the terminology in which expertise is sought may not always match the terms the expert uses to classify that expertise. "Database marketing" searches, for example, should also turn up experts in "interactive marketing", "response management" and "fulfillment".

4. Reminder for the Shortcomings of Technology in Knowledge Management

As we have mentioned before knowledge management is not just about technology. It should be made clear that technology's most valuable role in knowledge management is extending the reach and enhancing the speed of knowledge transfer. ICTs enable the knowledge of an individual or group to be extracted and structured, and then used by other members of the organization or its trading partners worldwide. However it rarely enhances the process of knowledge use and is also relatively less helpful when it comes to knowledge creation.
Because it is the value added by people---context, experience, and interpretation---that transforms data and information into knowledge, it is essentially only the ability to capture and manage those human additions that make ICTs particularly suited to dealing with knowledge. While technologies designed for managing data are structured, typically numerically oriented and address large volumes of observations, knowledge technologies deal most frequently with text rather than numbers, and text in relatively unstructured forms, such as clauses, sentences, paragraphs, and even stories. Volume may be the friend of data management, but it is the enemy of knowledge management---simply because humans have to sift through the volume to find the desired knowledge. Vast amount of computerized processing may take place on data without substantial human intervention. Knowledge technologies, however, are more likely to be employed in an interactive and iterative manner by their users. Therefore, the roles of people in knowledge technologies are more important to their success.

All in all, while knowledge is an ongoing process, technology is a means or vehicle for processing data and producing and disseminating information. ICT in itself hardly creates knowledge or guarantees the generation of knowledge. The assumption that technology can replace human knowledge or create its equivalent has been proven false time and again. As Sydney J. Harris has once sharply pointed out, “The real danger is not that computers will begin to think like men, but that men will begin to think like computers.” Knowledge management practitioners should therefore avoid the information-processing mentality and blindly relied on technologies. For any successful KM implementation, one must look at the human side as well as the technology side of the equation.