Applications of Information Technology for Knowledge Management Implementations

홍순구: 동아대학교 경영정보과학부 전임강사 shong@daunet.donga.ac.kr
홍석기: 건국대학교 경상학부 조교수 skhong01@kku.ac.kr
이상식: 경성대학교 경영학부 조교수 slee@star.kyungsung.ac.kr
김종원: 동의대학교 경영정보학부 조교수 jokim@hyomin.dongeui.ac.kr

Abstract

The borderless global economy has accentuated the importance of knowledge as the most critical source of competitive advantage. Thus, knowledge management has become a strategic mandate for most world-class organizations. A key enabler for implementing an effective knowledge management system is advanced information technology. Strategies for developing an enterprise-wide knowledge management system infrastructure with embedded information technology are discussed. In particular, this paper discusses the concept of a knowledge management life cycle--knowledge capture, knowledge development, knowledge sharing, and knowledge utilization, and how applications of new information technology support each step of the knowledge management practices within and between organizations is suggested.

Introduction

Today's organizations have to deal with complex, rapidly changing business environments in order to survive in the global economy. Accordingly, the structure of economy has shifted from products-based strategy to knowledge-focused business. Without adapting to new rules such as using flexible knowledge workers and advanced information technology for competitive advantage, organizations simply cannot exist for the long term in the global market.

After Nonaka's article, The Knowledge-Creating Company, was published in 1991, the strategic value of knowledge has been recognized by world-class organizations. In a later study, Drucker (1995) claims that knowledge is the only meaningful economic resource. Due to the importance of knowledge relative to competitive advantage and advances in information technology which allow organizations to utilize such advantage, knowledge management (KM) has become part of today's new management terminology. In fact, many leading world-class organizations are implementing KM. According to research reported in Fortune, a survey of 200 firms by CAP Ventures in 1997 found that 63 percent had employed a knowledge management strategy (Dykeman, 1998).

World class organizations view information technology as a key enabler for

implementing a new management paradigm that mostly focuses on endless improvement in organizations. Organizations recognize that without applying information technology, it is almost impossible for them to employ new management ideas in the global market. A wide range of information technologies, such as the Internet, data warehousing, data mining, and database systems have been employed to implement KM.

The objectives of this study are: (1) to review how application systems of information technology support each step of a KM life cycle, and (2) to suggest the future role of information technology in KM practices.

Applications of IT and Knowledge Management Life Cycle

There are many ways to describe the process of KM. Huber (1991) defined the scope of knowledge management, which includes knowledge acquisition, information dissemination, information interpretation, and organizational memory. Nevis et al. (1995) categorized organizational memory into knowledge acquisition, knowledge sharing, and knowledge distribution. While each author employs different terminology, the processes characterized are similar. Based on the literature review, the life cycle of KM can be outlined in four basic steps: knowledge capture, knowledge development, knowledge sharing, and knowledge utilization. Until now, no single information system could provide clear-cut support to all four processes of KM. Typically, several individual information systems support each step in the KM process.

Information technology can be employed in every step of the KM life cycle. In other words, the applications of information technology can support the creation, storage and dissemination of knowledge in the organization. In this section, each step of knowledge management processes will be defined and how information technology supports each process in KM will be explained

(1) Applications of IT in Knowledge Capture

Knowledge capture is the process by which knowledge is obtained and stored. Knowledge resources vary from organization to organization. Examples relate to customer information, human resources data, competitor products data, and government regulation. Knowledge or information can be obtained from the internal or external environment, and be stored in information systems. In this stage, tacit knowledge generated from internal or external sources should be converted into explicit knowledge so that individual knowledge levels can be moved to group or organizational levels. The role of knowledge engineers in developing information systems is to manage a knowledge transfer from domain expertise in certain tasks into explicit knowledge in a digital form for accessibility.

Relevant information technologies for capturing knowledge include traditional database systems, and data warehouses. Those information applications provide centralized repositories of knowledge, operational processes, expertise, or know-how generated by individuals or groups. Since the time that conventional database systems were designed for dealing with structured numbers and characters, the database technology has been improved to store and retrieve data with various formats that include images, graphs,

motion videos and voice (e.g., object-oriented database and hypermedia database). Many applications today and in the near future will require these new functions.

Unlike the conventional database that is mainly designed for operations in business, a data warehouse - a centralized read only database, often remote, containing recent snapshots of corporate data - is one of the essential IT applications supporting knowledge capture in organizations. For example, retailers have been introducing new marketing paradigms such as relational marketing, one-to-one marketing, enterprises marketing automation, and database marketing to survive in hyper-competitive market environments. These marketing concepts can hardly be implemented without using a data warehouse containing various customer data.

(2) Applications of IT in Knowledge Development

Once knowledge is captured, it needs to be organized and analyzed for strategic or tactical decision making. Relevant information technologies for knowledge development include data mining (also known as knowledge discovery), OLAP (On Line Analytical Process), and competitive intelligence systems. Such applications are a means to gather meaningful knowledge from existing data stored in databases, data warehouses, and digital libraries. Data mining that uses tools adopted from artificial intelligence and statistics assists end users intelligently and automatically through data-driven extraction of information from large databases. It also enhances the use of a query, multidimensional analysis, and visualization tools to gain a better understanding of the data. For example, after the Sentara Health System in Norfolk implemented a data mining system, the mortality rate in this hospital was reduced from 12 percent to 9 percent due to the precise analysis of pneumonia patients data.

OLAP is a supporting tool for end users to extract information from the single large database for strategic and/or tactical decision making.

Competitive intelligence systems provide accurate and recent competitor information for supporting strategic planning by filtering and synthesizing raw data gathered from external environment based on a business model. For example, GrapeVINE, a tool for competitive intelligence systems in the automobile industry, provides the interpretation of raw data and classification of different topics into a certain subjects for managers (Davenport et al., 1998).

(3) Applications for Knowledge Sharing

Once knowledge is analyzed, distribution is the next necessary step in the process of KM. Knowledge sharing is viewed by Huber (1991) as the process by which information from different sources is shared and thereby leads to new information or understanding. While database technologies are commonly used for knowledge creation and storage, group support systems and computer-assisted communications technologies including the Internet, EDI (Electronic Data Interchange), e-mail, voice mail, video conferencing, and electronic bulletin boards can be employed for organizational knowledge sharing. Information technology enables new forms of organization such as the network-based organization, business-web, global team, virtual firm, or the agile firm. Nearly 60 percent of organizations are implementing global teams (Boudreau et al., 1998). Given that

organizations are becoming more complex and diverse in the global world, it is almost impossible for organizations to implement those global business concepts without the help of telecommunication technology and group support systems.

Groups are increasingly sharing knowledge and the role of information systems in the group decision making process is becoming more important. Group support systems enable sharing of ideas among group members, dealing with parallel tasks (Boudreau et al., 1998), and facilitating user participation in decision-making processes (Williams and Wilson, 1997). For example, SIGNA International is using a group support system through 55 global units for sharing knowledge and organizational learning across countries (Boudreau et al., 1998).

(4) Applications for Knowledge Utilization

The last step in KM is to effectively enforce employees to use knowledge without computer knowledge. It requires tremendous financial resources and time commitment for organizations to build knowledge-based systems. If organizations do not use information systems, they waste their capital as well as fail to develop competitive advantages. Accordingly, information systems should be developed for end-user convenience.

The development of advanced information technology, graphical user interface (GUI), and multimedia technology help users make better presentations of available information. It is generally agreed that GUI makes it easy for end-users to learn and use systems. This is due to the encapsulation of complicated commands which has changed the human-computer interface. Almost all computer software in the market today is or will be adopting advanced GUI facilities including animation. Gonzales and Kasper (1997) investigated the effect of animation on decision quality by using a laboratory experiment that compared different animation designs in DSS interfaces. Their research results show that more realistic images enable end-users in DSS to make better decisions. Along with GUI, animation is expected to be more prevalent in the near future as the capacity of computers becomes greater with lower cost to the organization.

Given that organizations are networked, multimedia technology facilitates the transportation of non-traditional data including voice, video and animation. The pioneers of such field were the game industry and some art departments (Rowe and Davis, 1996). The result of a study indicates that people with supporting multimedia systems learn faster and understand easier than those without them. The new features in multimedia and GUI will increase greatly for end-users in the near future.

Organizational Knowledge Integration via the Intranet

Organizations are implementing various information systems individually for knowledge creation, diffusion, and utilization. However, global competition forces companies to integrate separated individual systems into an enterprise information system or to have enterprise-wide KM systems to which all levels of employees around the world can access.

With the development of telecommunication technology including local area network, wide area network, and Internet protocols since 1980s, enterprise-wide

computing has been spread throughout organizations. From the knowledge management perspective, the main purpose of such a system is the integration of scattered organizational data via the network.

For systems integration, data integration and communication networks are the critical infrastructure within the organization. For integration, standards such as data definitions, data format, and network protocols are indispensable (Scott, 1998). Data integration allows the organization to implement the concept of KM more effectively and efficiently. Data integration enables an organization to improve business processes through the retrieval of enterprise-wide information. In addition, it also improves organizational learning through knowledge creation and sharing among knowledge workers.

Among the fastest growing communication technologies in the 1990s, the network-based system, in particular the Internet-related technology, is most prevalent. When information systems are used only for handling administrative tasks and numerical decision making, it is not necessary for them to be integrated into one system or shared with others. Since the advent of the Internet, network-based systems have been popular because of its standard protocol. The Internet technology allows organizations to construct knowledge networks with lower costs, ease of use, and high efficiencies and effectiveness without worrying about non-standardized networks.

One of the most active industries implementing systems integration is healthcare. For sharing patients data, healthcare information systems at different locations should be connected so that end-users at different sites access the system. The advance of Internet applications in the early 1990s made possible the integration of individual systems and sharing of knowledge within and between organizations with relatively low costs. As a result, all levels of employees at multiple sites would be able to share their knowledge and communicate with minimal costs.

As a pioneering effort, several medical Intranets connecting different systems have been developed for different purposes. To date, the Intranet application has been widely used as a tool of knowledge diffusion within the medical community. Specialized healthcare Intranets have been activated mostly to enhance knowledge distribution through the Internet. For example, CliniWeb is built for providing particular healthcare related topics and an index of clinical information for healthcare students, providers or researchers (Hersh et al., 1996).

Conclusion

Since Michael Hammer introduced the concept of BPR, it has been a big issue both in industry and in research because of the organizational needs to redesign business processes. Even though the concept of KM was introduced in the early 90s, it only has recently become a substantial topic in industry due to the importance of managing and creating knowledge for organizations to survive in global competition. Drucker (1992) stated that it is safe to assume that anyone with any knowledge will have to acquire new knowledge every four or five years or become obsolete.

Information technology, especially the Intranet and web technology will be the central infrastructure of knowledge-based

organizations. Although technology changes rapidly and tracking new inventions is not simple, organizations should monitor the trend of new technologies in order to recognize new applications which may provide competitive advantage. Unfortunately, most researchers and practitioners agree that there is a gap between the invention of new technology and its practical use. In recognition of importance in researching emerging technologies, this paper discussed the concept of a KM cycle in which organizations capture, develop, share, and utilize knowledge in organizational activities, as well as new trends of information technologies related with a KM practice. Finally, system integration via the Intranet was thoroughly explained to suggest the possible future for knowledge management within and between organizations. Over the next few years, we will undoubtedly hear much more about KM as a competitive tool for the organization and as fertile study areas for the researcher.

References

Boudreau, M., Loch, K., Robey, D., and Straud D., Going Global: Using Information Technology to Advance the Competitiveness of the Virtual Transnational Organization, Academy of Management Executive, Vol. 12, No. 4, 1998, PP. 120-128.

Davenport, T., De Long, D., and Beers, M., "Successful Knowledge Management Projects," Sloan Management Review," Winter 1998, PP. 43-57.

Drucker, P., The New Society of Organizations, Harvard Business Review, September-October 1992, PP. 95-104.

Drucker, P., The Information Executives Truly Need, Harvard Business Review, January-February 1995, PP. 54-62.

Dykeman, J., Knowledge Management Moves from Theory toward Practice, Managing Office technology, May 1998, Vol. 43, No. 4, PP. 12-13.

Gonzalez, C., and Kaspepr, G., Animation in User Interfaces Designed for Decision Support Systems: The Effects of Image Abstraction, Transition, and Interactivity on Decision Quality. Decision Sciences, Vol. 28, No. 4, 1997, PP. 793-823.

Hersh, W., Brown, K., Donohow, L., Campbell, E., and Horacek, A., CliniWeb: Managing Clinical Information on the World Wide Web, Journal of the American Medical Informatics Association, Vol. 3, No. 4, July - August 1996, PP. 273-280.

Huber, G. H., Organizational Learning the Contributing Process and the Literature, Organization Science, Vol. 2, No. 1, February 1991, PP. 88-114.

Other references available upon request