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# The Role of Information Technology in Knowledge Management

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## Abstract

Effective knowledge management is becoming crucial for the survival of business organizations due to their increasing reliance on knowledge work. Information technology (IT) plays a key role in enabling knowledge management. The objective of this research is to understand the role of IT in managing organizational knowledge. The results of the study will enhance our understanding of the organizational knowledge management process and provide guidelines for designing IT infrastructure for effective knowledge management.

## Introduction

Knowledge is considered to be an important resource to maintain the competitiveness of an organization. Drucker (1993) contends that knowledge is a key resource, more important than land, capital and labor, in the post-capitalist society. While inquiry about knowledge has been a topic of debate and discussion since the time of ancient Greek philosophers, recently there is a strong surge of interest among both academics and practitioners in issues related to management of knowledge within organizations (Garvin, 1993; Pan and Scarbrough, 1998; Martiny, 1998). Several factors have contributed to this rising popularity of knowledge management. Intense global competition is challenging organizations to enhance productivity and quality while reducing cost. The half-life of new products and services is diminishing rapidly. With the growth of knowledge work, especially in the developed economies, the proportion of knowledge workers in the workforce is increasing, thus making the productivity of knowledge workers an important factor affecting economic growth (Drucker, 1993). Organizational knowledge management is expected to facilitate the transition of a predominantly production and information based economy to a knowledge based economy.

Effective knowledge management (KM) requires appropriate use of organizational strategies as well as information technology (IT). Our definition of IT includes computers and communications technologies. The KM strategy must be congruent with the competitive strategy of the organization (Hansen et al., 1999), and the organization must have the appropriate IT infrastructure for implementing the KM strategy (Alavi and Leidner, 1999). We consider IT to be an essential enabler of organizational KM. While the degree of reliance of a KM

initiative on IT is contingent on the KM strategy adopted by the organization, IT is likely to play a crucial role in implementing most KM initiatives. It is, therefore, critical to understand the role of IT in KM. Our objective in this research is to explore the role of IT in KM. The remainder of the paper is divided into 4 sections. Section 2 explains the concept of knowledge and knowledge management. Section 3 discusses the role of IT in various phases of knowledge creation and management. Section 4 presents the research questions and the research method. The discussion is concluded in section 5.

## Knowledge Management

In order to understand knowledge management we must first understand what knowledge is. Different authors have proposed different definitions of knowledge. We will quote two sources and develop a common ground for our discussion. According to Liebowitz and Beckman (1998), "Knowledge is applied information that actively guides task execution, problem solving and decision making." Nonaka and Takeuchi (1995) has defined knowledge by comparing it with information. According to this definition, "Knowledge, unlike information, is about *beliefs* and *commitment*. Knowledge is a function of a particular stance, perspective, or intention. Knowledge, unlike information, is about *action*. It is always knowledge "to some end." Knowledge, like information, is about *meaning*. It is context specific and relational." Both definitions emphasize the applied nature of knowledge, i.e., it must serve some organizational goal. Both suggest that knowledge is created out of information. Nonaka and Takeuchi (1995) emphasizes the person specificity of knowledge by linking it with the beliefs and commitment of its holder. Thus, what is knowledge for one person may not be knowledge for another person. A similar viewpoint has been expressed in Alavi and Leidner (1999).

Figure 1. The Knowledge Triangle

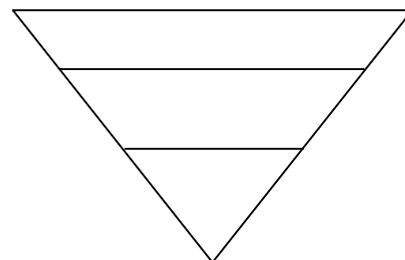


Figure 1 depicts the data, information and knowledge hierarchy. The inverted knowledge triangle represents the fact that information carries more meaning compared to data, and knowledge carries most meaning. Data is converted into information by adding context to it. Information is converted into knowledge when a person interprets it based on his/her existing knowledge. Knowledge, therefore, is not only context sensitive but also person specific. To summarize, information is meaningful data, and knowledge is information interpreted and/or assimilated by a person using his/her prior knowledge.

Knowledge may be categorized into two types: tacit and explicit (Nonaka and Takeuchi, 1995). Tacit knowledge resides in the head of individuals. It is difficult to formalize and communicate such knowledge to others. Explicit knowledge is codifiable. It can be expressed using a formal language. Examples of such knowledge are process descriptions, office procedures, best practices, etc. Knowledge management deals with the creation, distribution, and sharing of knowledge within the organization. Personalization and codification are two dominant knowledge management strategies (Hansen et al., 1999). A personalization strategy puts emphasis on transfer of tacit knowledge from one person to another, whereas a codification strategy relies on reuse of explicit knowledge.

may be gained from operational data through the use of data mining technology. Internalization is the process by which a person absorbs external knowledge by forming his/her own mental model or technical know-how. An example of this process is when you study a concept from a book and learn it by understanding it yourself.

While knowledge creation is an important activity in an organization, distribution and sharing of explicit knowledge is also a critical knowledge management task. It enhances the productivity of knowledge workers through knowledge reuse. Effective management of explicit knowledge requires such knowledge to be extracted, codified and stored in the organizational knowledge base. Search and retrieval functions are provided to access the right knowledge at the right time. As we will see in the following section, IT plays a key role in facilitating knowledge creation as well as distribution and sharing.

## Information Technology and Knowledge Management

IT provides a number of functionalities that may enable knowledge management. Table 1 provides a list of such functions and the IT that supports each function.

Figure 2. Knowledge Creation Process (Nonaka and Takeuchi 1995, pp. 62)

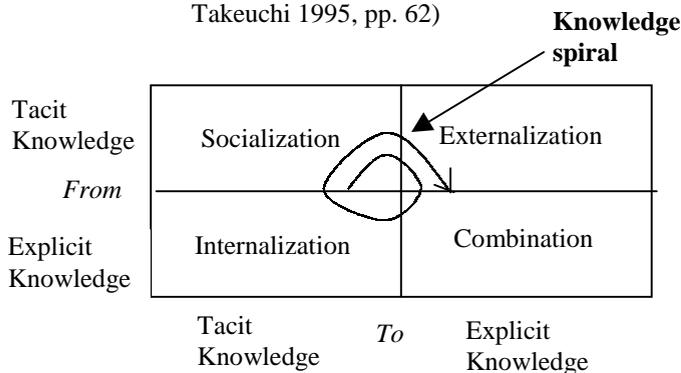


Table 1: IT Functions

Functionality	Technology
Communication	Email, Video conferencing
Coordination	Email, Scheduling software
Group process support	Groupware
Storage and Retrieval	Database management Information Retrieval, Hypertext, Internet and Intranet
Browsing	GUI, Web Browser
Presentation	Presentation software
Numerical Computation	Statistical analysis packages, Computational algorithms
Location, filtering	Intelligent agents
Symbolic processing and reasoning	AI, Expert Systems

Knowledge creation takes place through the transformation of tacit knowledge to explicit knowledge and back to tacit knowledge through the four processes described in Figure 2, thus creating the knowledge spiral (Nonaka and Takeuchi, 1995). Tacit knowledge may be transferred from one individual to others through socialization. Examples of such knowledge transfer are apprenticeship and on-the-job training. Tacit knowledge is transformed into explicit knowledge through externalization. Examples of this process are writing, oral communication, knowledge acquisition processes used in expert system development, etc. Combination involves creating new explicit knowledge by combining different bodies of explicit knowledge. For example, new insights

Let us first consider the role of IT in supporting the knowledge creation spiral proposed by Nonaka and Takeuchi. Socialization requires interaction between two or more persons with similar and/or overlapping interests. Communication, coordination, and group process support functions offered by IT are useful in facilitating the socialization process. Many organizations set up yellow pages that list experts and their field of expertise. Such yellow pages facilitate socialization by pointing to the source of tacit knowledge. The yellow pages use the storage and retrieval function. The search process associated with these pages may be enhanced through information location function.

Externalization converts tacit knowledge into explicit knowledge. Knowledge acquisition techniques and tools can facilitate this process to some extent. Combination process creates explicit knowledge through transformation, analysis, and integration of available explicit knowledge. All IT functions with the exceptions of communication, coordination, and group process support are useful in facilitating combination. Internalization converts explicit knowledge into tacit knowledge. Knowledge location, browsing, filtering and retrieval functions are useful in finding appropriate knowledge, while analysis and presentation functions are useful in assimilating knowledge from its explicit form into tacit form.

Managing explicit knowledge requires significant investment in IT (Hansen et al., 1999). Knowledge extracted from experts, organizational policies and procedures, problem solving episodes, etc. are captured in the organizational knowledge base. Browsing, presentation, location, and filtering functions are deployed to provide knowledge workers access to this knowledge. An expert system may also be used as a vehicle for knowledge reuse (Liebowitz and Beckman, 1998). IT, thus, plays a key role in facilitating knowledge creation and management.

## Research Questions and Method

Our goal in this research is to understand the role of IT in the organizational knowledge creation and management process. We are specifically interested in exploring the following research questions:

1. What are the different kinds of knowledge that organizations consider useful? Our objective is to create a richer taxonomy of knowledge categories by going beyond the binary classification of tacit and explicit.
2. How is IT used in managing each knowledge category?
3. What technical and management issues need to be addressed to effectively deploy IT in organizational knowledge management?
4. What lessons can be learnt from the experience of early adopters of organizational knowledge management?

We have adopted a two-stage research method. In the first stage we are using a multi-site case study (Yin 1989) approach to develop a deeper understanding of the knowledge management process in organizations and the role of IT in this process. The case study approach allows the researcher to examine a phenomenon in its natural setting. It is especially useful during exploratory phase of a research project. Since knowledge management is a relatively new phenomenon and there is a lack of established theories in this area we considered it an

appropriate research method for the exploratory phase of our research. We have adopted a multi-site case study approach to enhance the generalizability of the results from the first phase of our research. The result of the case study will be used to formulate a model of the role of IT in knowledge management (Eisenhardt 1989). This model will be validated using an empirical field study in the second phase of the research. We plan to accomplish this through a questionnaire survey of companies that have implemented KM projects.

## Conclusion

Our study focuses on IT related issues that are significant in facilitating KM. We have selected this topic because very little research has been conducted to study this aspect of KM. We acknowledge that organizational issues are no less important in managing knowledge. We are currently conducting the first phase of our research. We expect to present our findings at the conference.

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