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ABSTRACT

Knowledge Management (KM) has become a key business strategy. KM involves the systematic mapping, harvesting, storing, sharing, maintaining, and refreshing knowledge from many sources. An Electronic Performance Support System (EPSS) can perform an essential role of encapsulating and delivering knowledge at the time needed. Expanding globalization and reliance on distributed knowledge means that the EPSS delivered via networks should have a high priority. We present an argument to show the linkage between components of a KM system and EPSS. The approach involves the creation of software that is designed to assist decision-makers and performers while they accomplish organizational processes.

INTRODUCTION

The concept of knowledge as a critical organizational resource has gained wide-spread recognition in the business world (Sveiby, 1997; Drucker, 1993; Gartner, 1998; Nonaka, 1991; Prahalad & Hamel, 1990). This realization has led to the Knowledge Management (KM) movement. A number of businesses and academic professionals now claim that in order for the organization to have a lasting competitive advantage it will have to be knowledge driven (Holsapple & Joshi, 1997; Ndlela & du Toit, 2001). There are several topical periodicals and many books covering KM concepts. Each year, more conferences and workshops are conducted to further the KM idea. The popularity of KM has contributed to confusion in industry about the difference between knowledge and information (Huang, et al., 1999; Glazer, 1998). Unfortunately, there are several competing concepts. Furthermore, most of the published material is devoid of serious research design and does not report empirical evidence to support conclusions.

A principle value of communication is to establish a way to improve knowledge transfer or sharing (Nonaka & Takeuchi, 1995; Davenport & Prusak, 1998). One of the barriers to sharing knowledge, like data or information, across the organization is finding a common system that promotes dialogue and exchange. Patterns often facilitate the codification and transfer of knowledge; however organizations that depend on social interpretation discover that much of the meaning is lost when it is transferred between contexts (Hinton, 2002). The KM process provides a foundation for an organization to understand its knowledge resources and activities. Corporations around the world have identified the need for KM; however, they have not identified the best method or system, to communicate the knowledge capital of the organization.

We contend that Electronic Performance Support System (EPSS) is the best method of communicating knowledge capital of the organization. This paper provides KM and EPSS definitions and discusses the relationship between these concepts.

KNOWLEDGE MANAGEMENT

There is no consensus about the concept of knowledge management. The lack of effective management of knowledge could be because most organizations are still struggling to comprehend the KM concept (Holsapple and Joshi, 1997). "Knowledge Management (KM) is the discipline that focuses on capturing, organizing, filtering, sharing, and retaining key corporate knowledge as an asset" (McManus & Snyder, 2003, p. 89). Knowledge Management has been further defined as "...the process of capturing a company's collective expertise", (Fearnley, P. & Horder, M. 1997, p. 46). "KM can be considered to be a supportive process comparable to the Management of People...It includes the systematic generation, capture, and transfer of knowledge and learning for the application and benefit of the whole organization" (Toffler, 1990, p. 25). The aim of KM is to create learning organizations that provide equal access to corporate memory.

> To make knowledge work productive will be the greatest management task of this century just as to make manual work productive was the greatest management task of the last century. The gap between knowledge work that is left unmanaged is probably a great deal wider than was the tremendous difference between manual work before and after the introduction of scientific management [Drucker, 1969, p. 272].

Corporate Memory Management (another term for Knowledge Management in an organization) incorporates the extraction of knowledge from both internal and external sources. Corporate Memory Management (CMM) is a systematic methodology for implementing knowledge management tools throughout the organization. It includes methods for thinking better, learning faster, and sharing what is known effectively and as needed among individuals throughout an entire organization (Snyder, Wilson, & McManus, 2000). CMM is fundamentally about consciously eliciting and disseminating the principles of adaptation from and through an entire system, so that an organization can begin to function as an organism. It is an integrated set of processes that allow the often hidden (or tacit) insights of top performers to be captured and converted into specific, actionable know-how that can be transferred to others. Figure 1 illustrates the proprietary process where top performers verbalize some of their tacit know-how and thereby make it explicit (Snyder et al., 2000). With knowledge management in place, key know-how will remain even if employees leave the company (The Facts, 1998).

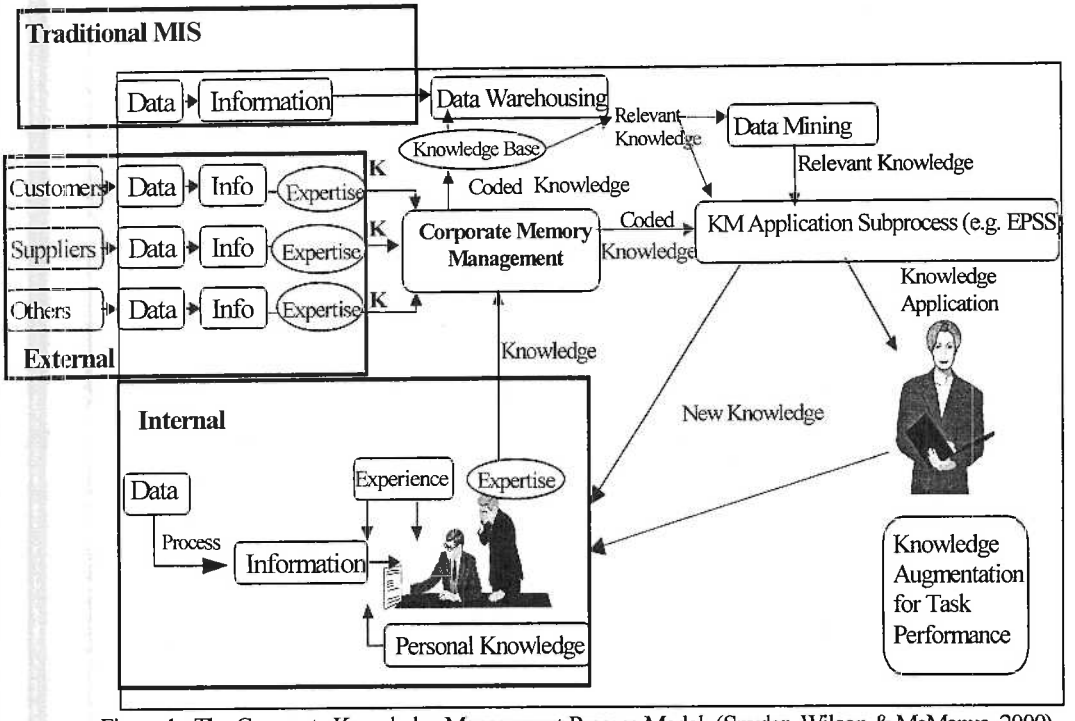

Figure 1 - The Corporate Knowledge Management Process Model (Snyder, Wilson & McManus, 2000).

This model serves as a process framework of CMM in the organization. The framework integrates the traditional MIS components with internal and external components that ultimately flow into the knowledge harvesting process. The model includes such concepts as joining data, information, and knowledge via data warehousing, data mining, and application sub process, such as electronic performance support systems (EPSS) (Snyder et al., 2000). One important aspect of the KM methodology is the requirement for refreshing the knowledge base. Attached to this should be the knowledge base bringing to bear the decision rules of key performers and the accumulated expertise from organizational memory. The EPSS is an outcome of the harvesting process and provides the organization with the basis for knowledge augmentation for task performance. This CMM process model should guide the organizations' knowledge management efforts and contribute directly to improved performance. The model provides a framework for an organization to better understand its knowledge resource and activities. It is directly aimed at improvement of the performance of the organization's key processes.

Individuals throughout the organization can be trained to perform CMM activities. These individuals learn how to successfully elicit, codify, and formalize know-how using the CMM processes. One of the primary outputs of the CMM process is software in the form of an EPSS. The EPSS in this instance allows individuals to simultaneously understand, learn, perform, and record performance in a single action. The EPSS becomes the means of sharing appropriate knowledge on a just-in-time basis, and is described in more detail in the following section.

ELECTRONIC PERFORMANCE SUPPORT SYSTEMS

Gloria Gery is widely recognized as an EPSS expert. Gery (1991, p. 48) defined EPSS as "an integrated electronic environment that is available to and easily accessible by each employee and is structured to provide immediate, individualized on-line access to the full range of information, software, guidance, advice and assistance, data, images, tools, and assessment and monitoring systems to permit job performance with minimal support and intervention by others." An EPSS can provide concise procedural steps and advice for a specific task that an employee is to perform. As a method, the goal of an EPSS is "...to provide whatever is necessary to generate performance and learning at the moment of need. The common denominator that differentiates an EPSS from other types of systems or interactive resources is the degree to which it integrates information, tools, and methodology for the user" (Gery, 1991, p. 60).

An EPSS not only performs an essential part of insuring that the maximum support information may be delivered to the decision-maker or the process performer at the time needed; but also provides previously organized and distilled knowledge via an effective delivery tool. It allows users to begin with simple functions and progress to more complex functions. Miller (1996, p. 1) defines an EPSS as "any computer software program or component that improves employees performance by either reducing the complexity or number of steps required to perform a task; providing the performance information an employee needs to perform a task; or providing a decision support system that enables an employee to identify the action that is appropriate for a particular set of conditions". Summary definitions of EPSS are illustrated in Table 1.

The authors referenced in Table 1 have a general consensus on the major goals of an EPSS. These goals include:

- Provide "whatever is necessary to generate performance and learning at the moment of need" (Gery, 1991, p. 34). Thus, an EPSS is sometime referred to as "Just-in-Time Training" (Geber, 1991).
- Enable "day-one performance" -- the idea that novice users should be productive on the very first day they start using a system (Gery, 1995, p. 72).
- Support higher levels of performance for the work being done today, while helping to build the knowledge infrastructure for work to be done in the future (Winslow & Bramer, 1994, p. 36).

EPSS can help to create a corporate pool of knowledge assets. As stated by Fischer and Horn (1997, p. 31), "the origin of Electronic Performance Support Systems was simply the need to use technology to connect knowledge resources that seemed to complement each other." Hiltz and Kerr (1982) note that most people address a new capability with segmentation, e.g., the ability of the user to learn only the minimum in order to carry out a specific task. They believe the system should contain guidance, which is the degree to which a system allows users to learn as they perform tasks.

With an EPSS, the user starts with a minimum of knowledge, is educated as to global possibilities, and is guided through a learning process to accomplish more complex tasks. A system embodying EPSS is to support learning. Users often want to jump into task performance with a minimum of knowledge. EPSS embodies context sensitive learning in the software. An example of context sensitive help, computer-based training, and suggestions is now seen (crudely) in Microsoft® Software as the Wizard, to enable the user to perform more complex tasks. "Developing an intelligent advisor or coach is perhaps the most difficult aspect in creating a complete EPSS that supports both performance and learning" (Leighton, 1998, p. 3).

EPSS Source	**Definition of Electronic Performance Support Systems (EPSS)**
Gery, 1991; Raybould, 1990	An EPSS is an electronic system that provides integrated, on-demand access to information, advice, learning experiences, and tools to enable a high level of job performance with a minimum of support from other people.
Laffey, 1995, p. 1	Dynamic support systems are characterized by the ability to change with experience, the ability to be updated and adjusted by the performer, and by augmenting other supports found in the performer's community. In this view, much of the content is generated by the users themselves.
McGraw, 1994	Extends the basic EPSS idea by integrating AI concepts, such as design elements of an Intelligent Tutoring System, into the advice and coaching provided by the software. This allows an EPSS to support just-in-time training, on-the-job training with authentic tasks, and user-targeted training that meets the needs of each individual.
Raybould, 1995, p.11.	An EPSS is the electronic infrastructure that captures, stores, and distributes individual and corporate knowledge assets throughout an organization, to enable individuals to achieve required levels of performance in the fastest possible time and with a minimum of support from other people.
Winslow and Bramer, 1994	Integrated Performance Support (IPS). IPS is not just a technology, but a strategy for satisfying the current and future performance needs of an organization.

Table 1- Electronic Performance Support Systems

The process of harvesting the knowledge of the expert and converting it into a form that is available and useful is the ultimate goal of KM. The process is similar to the Knowledge Engineering activity in the Expert System field (Wiig, 1990). Learning support software is the primary output from the process. The resulting software is designed so that an individual can simultaneously understand, learn, perform, and record the performance in a single action. In this sense, it can be classified as an Electronic Performance Support System (EPSS) (Gery, 1991). In the next section, we illustrate the important role of EPSS in KM.

KNOWLEDGE MANAGEMENT AND ELECTRONIC PERFORMANCE SUPPORT SYSTEMS

An important issue for managers is to understand the relationship between the concepts of KM and EPSS. "EPSS are computerized systems designed to support the performance of workers via the provision of on-demand and task specific information. KM, an emerging science is focused upon the critical role that knowledge plays within an organization and aimed at developing strategies for its capture and transfer" (Lawton, 1999). In a rush to embrace KM, many companies select software systems that profess to be KM systems but actually fall far short. To be of true value, KM systems should incorporate software that augments the knowledge of persons who are performing organizations key processes. This software takes the form of an EPSS. EPSS will impact the processes of the work environment. It will redesign jobs, while improving quality, efficiency and effectiveness within the organization.

The value of knowledge is tied to the organization of knowledge. Taxonomies are ways to organize corporate knowledge so it can be located, accessed and maintained more easily. Corporate knowledge should be classified into different categories as a means of locating, accessing and maintaining the knowledge. Since one of the most valuable assets of the company is the tacit knowledge of its employees, a key goal of any KM program is to enable the company to make effective use of those assets, by making this knowledge explicit. The knowledge harvesting process aims to make relevant tacit knowledge explicit and is well-suited for eliciting information for a clearly defined purpose. It can be used to capture the knowledge of departing employees or facilitate project development by rapidly generating a body of specialized information from in-house experts and making it available to colleagues across the company. Valuable knowledge about a task or process can be made available to anyone in the organization who needs it on a just-in-time basis via an EPSS. Since CMM can be applied to nearly any kind of human knowledge that is procedurally actionable, the organization's resident expertise or know-how can be captured and formalized into EPSS software so that the organization can leverage it, preserve it and refresh it to keep it current. The ultimate goal of knowledge harvesting is to capture an individual's decision-making process with enough clarity that someone else guided by it could repeat the steps of the process and achieve the same result. The encapsulation of knowledge in an EPSS should be that of the best performers so that their expertise can help all users perform to a higher standard. Thus, this model provides a framework for an organization to better understand the company's knowledge resource and activities. It is directly aimed at improvement of the performance of the organizations' key processes.

The task of codifying the knowledge needed for a complex job is made easier by the object-oriented aspect of an EPSS. An EPSS and CMM, create coded knowledge that is stored in knowledge databases, often labeled as knowledgebases. They facilitate the joining of data, information, and knowledge. The purpose is to capture and express expertise in a form than can be easily accessed and used by others. By presenting expertise in the form of an EPSS, successful thinking is made visible, manageable, and useful to more than one person. In an EPSS, knowledge is broken into its smallest parts while preserving its unique structure, characteristics and relationships.

Each organization needs to have a continuous process of updating the captured knowledge. It is important to note that users continue to learn and they should be able to contribute knowledge. It is the responsibility of the knowledge harvester to navigate through this process to enrich and capture the organization's most valuable resource, its knowledge. Since harvesting can be applied to nearly any kind of human knowledge that is procedurally actionable, the firm's critical expertise or know-how can be captured and formalized into software so that the organization can leverage it, share it, preserve it, and refresh it. To maintain this core knowledge asset, software is designed to record the knowledge and activities of the user. By instantly recording all input information generated during the learning sessions, it is possible to increase the organization's ability to make effective use of all harvested know-how and keep the EPSS software continuously updated. Therefore, the organization's knowledge should be constantly refreshed and will continue to grow and can be shared with others.

Company Name	Company Case Study
Shell Oil	Shell Oil used an EPSS to teach new customer service employees about statistical process control. Estimates of the normal cost were approximately $3 million; however, by using computer-based training involving interactive video, they reduced the cost 60 percent to $100,000 (Case Studies, 1996).
Storage Technology, Inc.	This company used EPSS to replace the traditional method of using lecture/lab training. The company saved $2,000,000 over 3 years (Case Studies, 1996).
Price Waterhouse Coopers	Price Waterhouse Coopers replaced their traditional training method with computer-based training, according to some, a component of EPSS, and they achieved the same learning levels in 50 percent less time. With computer-based training, Price Waterhouse Coopers reduced the amount of money spent on training classes from $760 per employee to $106 per employee (Case Studies, 1996).
Payless Shoes	Payless ShoeSource, Inc. is the largest retailer of family footwear in North America, with about 4,500 stores. Payless developed a Retail Performance Support System (RPSS), an EPSS designed to improve training and help employees internalize firm values. The system includes applications, job aids, references, and computer-based training components. Reported benefits include a reduction in training time of about 30 percent, increased profits from sales of three percent annually. The firm expects to recover costs of the EPSS in less than a year.
Buckman Laboratories	Buckman is a specialty chemical company with operations all over the world. Buckman built an application employing the expertise of its top human resources talent. The application was used to have every employee build their own job descriptions. For the first time, all job descriptions were aligned with the firm's strategy.

First Union Mortgage Corporation	First Union is one of the top 20 mortgage lenders. The firm developed an EPSS to reduce the number of resources needed and time wasted during sales contacts. An expandable help system was made available on-line and was perceived as very helpful. The system allowed employees to find needed information without customers noting any delay.

Table 2 – EPSS and KM Case Studies (Snyder, McManus & Bradley, 2003).

The EPSS is a form of software that can be used to share relevant knowledge across an organization. Some organizations have used their intranets in order to share important knowledge amongst their global locations. Buckman Laboratories, a well-known KM practitioner, employs its intranet to share knowledge in the form of EPSS software amongst its worldwide locations. Expanding globalization and reliance on distributed knowledge means that the EPSS delivered via networks should have a high priority. Several companies have reported positive results from using the components of an EPSS and KM system, as depicted in Table 2.

The knowledge base contains relevant knowledge that can go through the KM applications process to encapsulate knowledge in the form of an EPSS. As illustrated in Figure 1, the KM applications sub-process makes the encapsulated knowledge actionable know-how. New knowledge moves back to the expert to increase or refresh personal knowledge. Since knowledge is not static, to avoid decay it must be renewed. The harvesting process is designed to be a complete process.

FUTURE RESEARCH

The most important research area is the empirical testing of the efficacy of KM and EPSS in organizational settings. An established pre-measurement baseline, intervention, post-measurement methodology in organizational behavioral research employs the use of baseline data and contrasting results of the post intervention data (Baer & Wolf, 1968; Kazdin, 1973; Komaki, 1977). One powerful advantage of this method is the fact that visual examination of the data, when stable baselines are obtained and the effects of the intervention are immediate and marked, obviates the requirement for further statistical analysis (Hersen & Barlow, 1976). We are presently developing a measurement model that can be tested in organizational implementations. Several other fruitful research areas exist, (see, e.g., Gottschalk, 2000; Grover & Davenport, 2001; McManus & Snyder, 2003; Stamoulis, Kanellis, & Martakos, 2002). The elicitation process needs to be elaborated and the relation of reward systems to willingness to share what was once a hoarded asset should be investigated.

CONCLUSION

The KM process and incorporation of EPSS we have discussed provides a meaningful approach to a practical organizational problem. Our model incorporates the full gamut of KM activities necessary to build an effective KM function for the organization. The concept of sharing knowledge across the organization allows for evaluation and process improvement, ultimately, providing an effective and efficient strategy without duplication of efforts. The coupling of the knowledge harvesting concepts with EPSS provides a process that is able to deliver, with a focus of improving the key processes of the organization. As organizations develop computer-based applications that support learning from a user perspective, the EPSS construct will evolve. The further development of the EPSS should provide a practical means of sharing the knowledge of best performers or experts wherever and whenever needed by those who are charged with getting a process accomplished; thus, significantly reducing time and resulting in improved thinking and decision making. The active management of knowledge should underpin the competitive advantage of an organization because this is the wellspring of the basis of advantage. We have shown that knowledge management can augment organizational decision making and learning through the deployment of EPSS.

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