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Internet Support For Knowledge Management/ Organizational Memory Systems

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ABSTRACT

Studies of organizational memory/ knowledge management, OM/KM, systems have found that using a common infrastructure to facilitate access to and utilization of knowledge and memory increases the usability and success of these systems. The solution to this is for organizations to have an integrated network. This paper discusses using the Internet as the integrated network. Several systems are described that use the Internet for the OM/KM infrastructure. Theoretical support from case study research for using the Internet as a common knowledge infrastructure is provided through DeLone and McLean's IS Success Model modified and analyzed for knowledge/ memory based systems.

INTRODUCTION

Information systems (IS) developers are building and maintaining systems that manage organizational knowledge and memory. Users of these systems are not always at the same location, in many cases they are distributed across large geographical distances and multiple offices. Key to this task is developing an infrastructure that facilitates distributed access and utilization of the retained knowledge and memory. Connectivity and easy to use interfaces are main concerns. Jennex and Olfman (2002) proposed that using the Internet as a common communications platform and web browsers as an interface is a viable, low cost solution. The purpose of this paper is to illustrate how the Internet can be effectively used as an infrastructure for Knowledge Management/ Organizational Memory Systems, KMS/OMS. This is based on an intensive analysis of a KMS/OMS, an action research study of a KMS, and a literature review of KMS/OMS studies. This paper assumes that knowledge is a subset of Organizational Memory, OM, and the term OMS includes KMS. This relationship will be illustrated later.

BACKGROUND

Organizational Learning

Organizational Learning (OL) can be defined as the process of detection and correction of errors, Malhotra (1996). In this view organizations learn through individuals acting as agents for them with individual learning activities facilitated or inhibited by an ecological system of factors that may be called an organizational learning system. Huber (1991) considers four constructs as integrally linked to OL: knowledge acquisition, information distribution, information interpretation, and OM.

Organizational Memory and Knowledge

Organizational Memory, OM, is variously viewed as abstract or unstructured concepts and information that can be partially represented by concrete/physical memory aids such as databases; and as concrete or structured concepts and information that can be exactly represented by computerized records and files. This paper views OM as a combination of abstract and concrete where the concrete is the history and trend data collected in the memory and the abstract is the experience gained by the organizational member over time. Definitions by Stein and Zwass (1995) and Walsh and Ungson (1991) support this. Additionally, all agree that OM can include everything within the organization that is retrievable including the set of documents and artifacts that forms the corporate record and the collection of shared and stored understandings and beliefs that forms the basis for organizational sense-making and social construction of reality.

OM has two principle goals: to integrate information across organizational boundaries and to control current activities and thus avoid past mistakes. OM functions are perception, acquisition, abstraction, recording, storage, retrieval, interpretation, and transmission of organizational knowledge, Stein and Zwass (1995). OM retention facilities are individuals, transformations, structure, ecology, and culture, Walsh and Ungson (1991).

Davenport and Prusak (1998) view knowledge as an evolving mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information. They found that in organizations knowledge often becomes embedded in documents or repositories and in the organizational routines, processes, practices, and norms. Nonaka (1995) expands this definition by stating that knowledge is about meaning in the sense that it is context-specific.

This paper considers OM and knowledge to be constructs and attributes of organizational learning. Also knowledge is a subset of OM and the acquisition and use of OM includes the acquisition and use of knowledge.

Knowledge Management

Knowledge Management (KM) as a discipline, has not been clearly agreed upon. KM is defined as that process established to capture and use knowledge in an organization for the purpose of improving organizational performance, Malhotra (1998). Organization refers to any acknowledged business group from a small team to the total enterprise. Also, this process is not restricted to the IS/IT organization and is better done in the organizations that create and use the knowledge. Personnel performing these functions are referred to as Knowledge Workers.

Organizational Memory and Knowledge Management Systems

Jennex and Olfman (2002) found that information systems (IS) for knowledge workers are more likely to improve productivity if they integrate OM support functions into the organizational IS. Jennex (2000) applied these findings to the design and implementation of a KMS for a Year 2000 (Y2K) project team. The resulting system enabled the project team to improve their performance from a lagging project to a leading project with respect to the other projects in their industry. The conclusion of these studies is that the basic system structure comes from the OMS and is the portion incorporated into the Information Systems (IS) used by the organizations. The KMS consists of the tools and processes used by knowledge workers to identify and transmit knowledge to the knowledge base contained in the OMS. Jennex and Olfman (2002) presented the KMS-OMS model in Figure 1 as a model illustrating the relationships between OM, KM, and OL.

The basic OMS structure is identified using Stein and Zwass' (1995) proposed framework. Key functions include the mnemonic functions of acquisition, retention, maintenance, search, and retrieval. The OMS repository consists of a combination of three repositories: paper documents, computer repositories, and self-memory.

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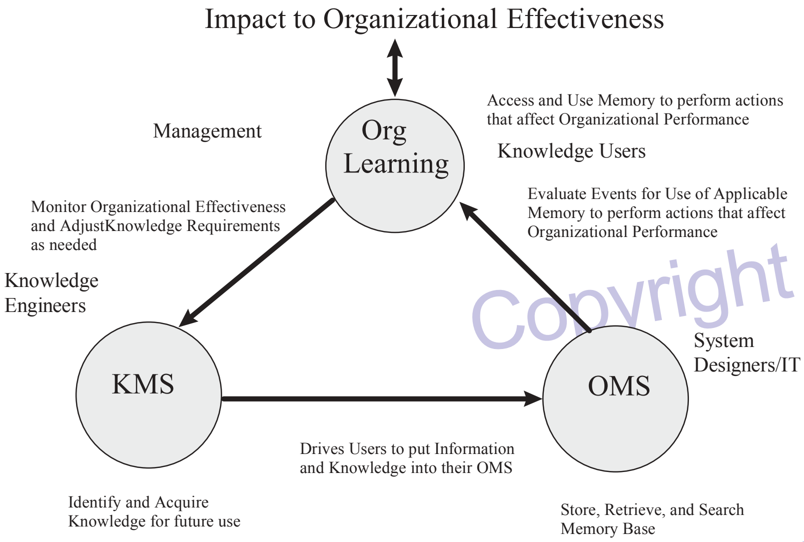
Figure 1: The KMS-OMS model

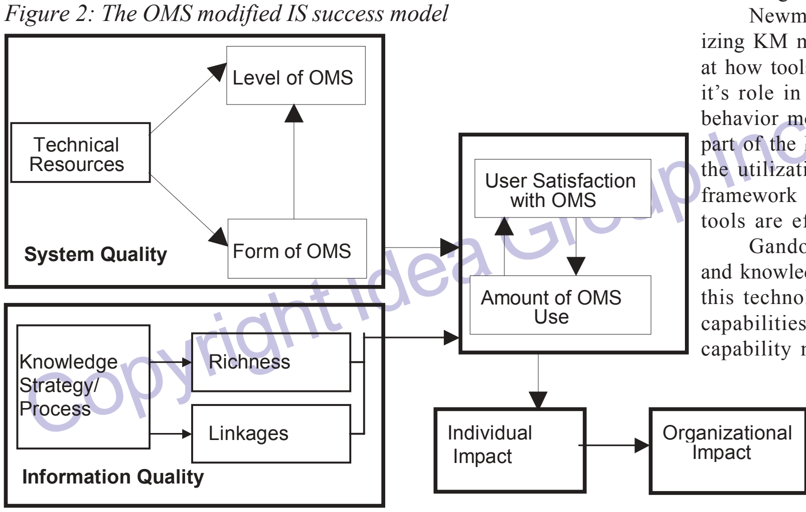


Assessing OMS/KMS Success

Jennex and Olfman (2002) generalized assessment of OMS success by adapting DeLone and McLean's (1992) IS Success Model to OMS. The DeLone and McLean model is based on a review and integration of 180 research studies that used some form of system success as a dependent variable. It identifies six system success constructs and shows how they are related. Figure 2 is the model adapted for OMS. The model is a block-recursive one that includes 5 blocks. Block descriptions are as follows:

System Quality – is defined by the technical characteristics of the OMS as described by three constructs: the technical resources of the organization, the form of the OMS, and the level of the OMS. Technical resources define the capability of an organization to develop and maintain a OMS. The form of OMS refers to the extent to which it is computerized and integrated, explicitly, how much of the accessible information/knowledge is on line and available through a single interface. The level of the OMS refers to its ability to bring past information to bear upon current activities. Given the effectiveness of information technology to provide timely information, it is expected that a more fully computerized system utilizing network and data warehouse technologies will result in the highest levels of system quality.

Figure 2: The OMS modified IS success model



Information Quality - Davenport and Prusak (1998) discuss two primary types of knowledge, links to experts who serve as sources of knowledge and rich, detailed knowledge. Jennex and Olfman (2002) found that OMS users new to an organization utilized knowledge linkages more than any other aspect of the OMS while more experienced members of the organization relied on retrieving detailed, accurate, and timely information. The third construct, KM Strategy and Process, reflects that the knowledge needs of the OMS users changes over time. KM Strategy is needed to determine what information/ knowledge should be in the knowledge base, where it is located, and how it is to be acquired. The KM Process ensures that knowledge requirements are reviewed on an ongoing basis.

Use - Information/knowledge use refers to the utilization of the outputs of the system. This construct is most applicable as a success measure when use is required. User satisfaction measures perceptions of the users. It is considered a good surrogate for measuring system use when use is voluntary. Jennex and Olfman (2002) used a perceived benefit model adapted from Thompson, Higgins, and Howell (1991) to measure user satisfaction and predict continued use of the OMS. This measure was found to work well and is included in the user satisfaction construct.

Individual and Organizational Impact - An individual's use of a system will produce an impact on that person's performance. DeLone and McLean (1992) note that an individual 'impact' could also be an indication that an information system has given the user a better understanding of the decision context, has improved his or her decision-making productivity, has produced a change in user activity, or has changed the decision maker's perception of the importance or usefulness of the information system. Each individual impact will in turn have an effect on the performance of the whole organization. Organizational impacts are typically not the summation of individual impacts, so the association between individual and organizational impacts is often difficult to draw.

Other Tools/Research

Although there is strong support for using the Internet as a Knowledge infrastructure, there are concerns. Chief among these concerns is the difficulty in organizing and searching for knowledge. Another concern is the tendency to not to use the system. Cross (2000) discusses this tendency but comes to the conclusion that repositories are essential. Jennex and Olfman (2002) fount that voluntary use is enhanced if the system provides near and long term job benefits, is not too complex, and the organization's culture supports sharing and using knowledge and the system.

Newman and Conrad (2000) propose a framework for characterizing KM methods, practices, and technologies. This framework looks at how tools can impact the flow of knowledge within an organization, it's role in manipulating knowledge artifacts, and the organizational behavior most likely to be affected. The framework also looks at the part of the KM process the tool works in. The Activity phase looks at the utilization, transfer, retention, and creation of Knowledge. This framework can be used to show that Internet and Browser based KMS tools are effective.

Gandon, et. al. (2000) propose using XML to encode memory and knowledge, and suggest using a multi-agent system that can exploit this technology. The proposed system would have improved search capabilities and would improve the disorganization and poor search capability normally associated with Internet systems.

Dunlop (2000) proposes using clustering techniques to group people around critical knowledge links. As individual links go dead due to people leaving the organization, the clustered links will provide a linkage to people who are familiar with the knowledge of the departed employee. This technique would improve the reliability of the links to knowledge called for in Figure 2.

Te'eni and Feldman (2001) propose using task adapted websites to facilitate searches. This approach requires the site be used specifically for a OMS. Research has shown that some tailored sites, such as ones dedicated to products or communities have been highly effective. This approach is incorporated in the examples in this paper with the exception of the use of dynamic adaptation.

Eppler (2001) discusses the use of knowledge maps to graphically display knowledge architecture. This technique uses an Intranet hypertext clickable map to visually display the architecture of a knowledge domain. Knowledge maps are useful in that they not only create an easy to use standard graphical interface for the Intranet users, they also provide an easily understandable directory to the knowledge.

EXAMPLES OF INTERNET OMS

Jennex (2000) discussed an Intranet based KMS used to manage knowledge for a virtual Y2K project team. This KMS used two different site designs over the life of the project. The purpose of the initial site was to facilitate project formation by generating awareness and providing basic information on issues the project was designed to solve. The design of this site was based on Jennex (1997 and 1999) that suggested a structure providing linkages to expertise and lessons learned were the knowledge needed by knowledge workers. This was accomplished by providing hot links to sites that contained Y2K knowledge, a project team roster that indicated the areas of expertise for each of the project team members and additional entries for individuals with expertise important to the project, and some basic answers to frequently asked questions. This site was accessed from the corporate Intranet site through the special projects section of the IT division page. This made the site hard to find for those who did not know where to look forcing the project team leadership to provide direction to the site through email directions. The site did not contain guidelines and accumulated knowledge as reflected in test plans, test results, inventories of assets referenced to the division who owned them, and general project knowledge such as project performance data, meeting minutes and decisions, presentations, and other project documentation. This information had not been generated at the time the site was implemented. Once generated, this information was stored on network servers with shared access to acknowledged project team members. This was done due to a lack of resources allocated to the initial site. No dedicated personnel or special technologies were allocated for the design or maintenance of the site. This site was in effect from early 1998 through mid 1998.

As the project team formed and began to perform its tasks the requirements for the Intranet site changed from generating awareness to supporting knowledge sharing. The site was redesigned and expanded to include detailed frequently asked questions (FAQs), example documents, templates, meeting minutes, an asset database, guidelines for specific functions that included lessons learned, etc. The knowledge content of the site was distributed into the other components of the site and persons were identified as being responsible for the information and knowledge content of their responsible areas. Additionally, access to the site was enhanced by the addition of a hot link to the Y2K site placed and prominently displayed on the Corporate Intranet home page. The basic layout of the site provided for access to seven specific sub-sites: Major Initiatives, Contacts, Documents, What's New, Hot Links, Issues and Questions, and Y2K MIS.

Access to this site was granted to the all employees; however, several of the sub-sites were password protected for restricted use. Most of the knowledge contained on the site was contained in these protected sub-sites. The knowledge from the initial site was rolled over into the Hot Links and Contacts sub-sites. Additionally, information that had been previously stored on network servers was left on those sites but access was provided through the Intranet site. The network structure was expanded to include more sub-structures for storing more documents, information, and knowledge.

The effectiveness of the two sites was considered good. The first site was successful in generating interest and starting the project. The second site succeeded in taking a project that was performing in the bottom third of projects to being a leading project within six months after its release. Effectiveness of the sites was established using the model in figure 2 and by ensuring the Information Quality was good and the System Quality, especially the search, retrieval, and infrastructure, was good. Use of both sites was established by ensuring the sites met the needs of the project team and the company.

The second example is the Extranet site used by the utility industry for Y2K, Jennex (2000). Its purpose was to facilitate information/knowledge sharing between industry members. It initially provided documents, procedures, and guidelines for getting projects started. It also provided an electronic forum for questions and answers. As projects progressed more test data became available and this information was posted. Finally, this site provided links to other important sites and sources of information.

The effectiveness of the site was limited. A great deal of knowledge was stored on the site but searching was difficult and time consuming, reducing system quality. The consensus of the Nuclear and Non-Nuclear Generation Y2K project personnel was that the site provided little benefit as many companies did not post test results, thus reducing information quality. The Substation Controls Y2K project personnel also found it limited except they did use the knowledge to put together a statistically valid test sample as requested by the North American Electric Reliability Council, NERC. Industry consensus was that the site had limited knowledge value. A redesign of the site with more emphasis on knowledge search and retrieval was not available until after most projects were complete. It was anticipated the new site would be available for the expected onslaught of lawsuits following the roll over to 2000, which of course, did not happen. A further inhibitor to effectiveness was that the member companies did not categorize equipment and system information in the same format. This lack of a shared ontology contributed to the search and retrieval difficulties and made understanding the posted information and knowledge more difficult to users from other companies.

The third example, from Cross (2000) is an Intranet site built by Andersen Consulting. Consulting firms have had a long tradition of brokering their knowledge into business. In the early 1990s, Andersen Consulting began to produce global best practices CDs for distribution to project personnel. This evolved into the development of a Intranet site called KnowledgeSpace that provided consultants with various forms of knowledge including methodologies and tools, best practices, reports from previous like engagements, and marketing presentations. Support was also provided for online communications for online communities of practice and virtual project teams. The site was effective for personnel with access to the Internet and adequate bandwidth. It should be noted that current modem technology and improved dial in access, as well as the proliferation of cable modems and digital subscriber lines, DSL, have made sites such as this much more effective for field or remote personnel.

The last examples come from Eppler (2001). There are five types of knowledge maps: source, asset, structure, application, and development. A multimedia company Intranet site is used to illustrate a knowledge source map. This site provides graphical buttons representing individuals with specific expertise color coded to indicate the expert's office location. The Knowledge Asset map provides a visual balance sheet of an organization's capabilities of a skills directory or core competency tree. Colors are used to indicate knowledge domains while the size of symbols indicates level of expertise. Knowledge Structure maps divide a knowledge domain into logical blocks that are then broken into specific knowledge areas. The Knowledge Application map breaks an organization's value chain into its components parts and then indicates what knowledge, tools, or techniques are needed to implement the component part. The last example is a Knowledge Development map. This map is used to plot the activities needed to be performed to acquire the indicated knowledge competence. Clicking on the displayed competence displays the steps needed to develop the competence. Effectiveness of these maps has only been determined for the Knowledge Asset map. This map, developed for a telecommunications consultant firm, was found to be very useful for the planning of training activities and for identifying experts quickly when required during an emergency. IT should be noted that knowledge maps enhance the linkage aspects of information quality.

LIMITATIONS

The examples used in this paper are limited in number and scope. They may not be indicative of the actual effectiveness of the Internet when used to develop a OMS. Insufficient research has been performed to verify that the Internet is the best approach for a OMS infrastructure. However, sufficient evidence exists to suggest this may be the case. The external validity is limited and is left to the reader to determine if sufficient evidence exists to warrant the claims of this paper.

The examples have limitations as discussed in the references. In general all used reliable methods to reach their conclusions.

CONCLUSIONS

The conclusion is that the Internet is an effective infrastructure for an OMS. There are issues associated with using the Internet. Chief among these are the knowledge representation and search capabilities of the Internet. Several tools such as Knowledge Maps, XML, adaptive websites, clustering, and examples of effective Internet based OMSs were discussed that resolved these issues. The final issue is the tendency of people not to use the computer portion of an OMS. Jennex and Olfman (2002) found that this is a tendency of new members and suggest that this is a matter of context. New members do not understand the context under which the knowledge was created and stored so don't know how to retrieve and use the knowledge. As these members gain experience they gain context and rely more upon the computer and less upon their peers.

Browsers are not discussed in the paper except that the mentioned sites were designed to work with Internet Explorer and Netscape. Use of a browser is mandatory for the Jennex examples with the inference that effectiveness of these sites supports the use of browsers.

REFERENCES

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