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A Knowledge Management Success Model: An Extension of DeLone and McLean's IS Success Model

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A KNOWLEDGE MANAGEMENT SUCCESS MODEL: AN EXTENSION OF DELONE AND MCLEAN'S IS SUCCESS MODEL

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Abstract

This paper describes a knowledge management system, KMS, Success Model that is based on the IS Success Model proposed by DeLone and McLean (1992) and modified by DeLone and McLean (2002). The KMS Success Model is derived through the identification of knowledge management, KM, constructs within the System Quality and Information Quality dimensions of the original success model. Additionally, the Perceived Benefit model from Thompson, Higgins, and Howell (1991) is added to the Intent to Use dimension to help predict voluntary usage of the KMS. The KM constructs were identified though a longitudinal study of a knowledge using organization. Additional studies looking at the use of knowledge management in projects were used for additional support for the constructs. Methods of operationalizing the constructs and implications for the design and implementation of KMS are also discussed.

Keywords: Knowledge management, knowledge management systems, knowledge management success

Introduction

Knowledge Management, KM, is currently a popular topic as evidenced by the large numbers of articles and papers appearing in conferences and journals. As an example the Knowledge Management, Organizational Memory, and Organizational Learning mini-track at the Hawaii International Conference on System Sciences, HICSS, went from 22 submittals with 12 papers accepted in 2002 to 47 submittals with 23 papers accepted for 2003. Additionally, a search of the Association for Information Systems, AIS, eLibrary for the term "Knowledge Management" generated 300 hits and a Google search for the same term generated over a million hits (searches conducted on November 26, 2002). The surge in academic interest in KM is reflective of the KM interest in the practitioner world. Commercial products and services are being marketed to assist organizations in the building and implementation of Knowledge Management Systems, KMS. The measurement of the effectiveness or success of these KM initiatives and/or KMS' is crucial to understanding how these systems should be built and implemented. It is the purpose of this paper is to develop a model for assessing the effectiveness and/or success of a KMS.

The proposed KMS Success Model is based on the widely accepted DeLone and McLean IS Success Model. This was done not because the DeLone and McLean IS Success Model is widely accepted, but because it was found to be able to be modified to fit the data collected in a longitudinal study of Organizational Memory and Knowledge Management and because the generated KMS Success Model was useful in predicting success when applied to the construction and implementation of a KMS.

Before presenting the KMS Success Model we will discuss the concepts of knowledge, knowledge management, and knowledge management systems so that we can establish the differences between a KMS and a regular IS as used in the D&M IS Success Model. We will then briefly discuss the D&M IS Success Model, present the KMS Success Model, and discuss the differences. We will conclude by summarizing studies that support the KMS Success Model and present measures that can be used to evaluate the constructs used to define the KMS Success Model dimensions.

Knowledge Management, Organizational Memory, and Organizational Learning

Alavi and Leidner (2001) summarize and extend the significant literature relating to knowledge, knowledge management, and knowledge management systems. They view organizational knowledge and organizational memory, OM, as synonymous labels as do Jennex and Olfman (2003). This is useful as it allows us to combine research results from OM and knowledge management. It is also born out in the literature. Huber, Davenport, and King (1998) summarize OM as the set of repositories of information and knowledge that the organization has acquired and retains. Stein and Zwass (1995) define OM as the means by which knowledge from the past is brought to bear on present activities resulting in higher or lower levels of organizational effectiveness, and Walsh and Ungson (1991) define OM as stored information from an organization's history that can be brought to bear on present decisions.

There is some confusion as to the difference between knowledge and information. Davenport and Prusak (1998) define knowledge is an evolving mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information. Knowledge often becomes embedded in documents or repositories and in organizational routines, processes, practices, and norms. Knowledge is also about meaning in the sense that it is context-specific (Huber, Davenport, and King, 1998). Ultimately we conclude that knowledge contains information, but information is not necessarily knowledge.

Various knowledge taxonomies exist. Alavi and Leidner (2001) and Croasdell et.al. (2003) found that the most commonly used taxonomy is Polyani's (1962 and 1967) and Nonaka's (1994) dimensions of tacit and explicit knowledge. This paper uses this taxonomy for knowledge. Tacit knowledge is that which is understood within a knower's mind. It consists of cognitive and technical components. Cognitive components are the mental models used by the knower and which cannot be directly expressed by data or knowledge representations. Technical components are concrete concepts that can be readily expressed. Explicit knowledge also consists of these technical components that can be directly expressed by knowledge representations. Knowledge management, KM, in an organization occurs when members of an organization pass tacit and explicit knowledge to each other. Information Technology, IT, assists KM by providing knowledge repositories and methods for capturing and retrieving knowledge. The dimension of the knowledge being captured limits the effectiveness of IT in assisting KM. IT works best with explicit knowledge. Tacit knowledge requires that more context be captured with the knowledge where context is the information used to explain what the knowledge means and how it is used.

Knowledge Management Systems

Knowledge Management Systems, KMS, are systems designed to manage organizational knowledge (previously defined as OM). Alavi and Leidner (2001) clarify the KMS as IT-based systems developed to support/enhance the processes of knowledge creation, storage/retrieval, transfer, and application. While explicit knowledge is easier to manage, support for tacit knowledge can be provided through knowledge and/or topic maps and multimedia storage of events. Additionally a KMS supports knowledge management through the creation of network based OM and support for virtual project teams and organizations and communities of practice. A final goal of a KMS is to support knowledge/OM creation. Nonaka (1994) describes four methods of knowledge creation through knowledge transfer: socialization, externalization, combination, and internalization. The KMS supports knowledge creation through a number of methods such as extraction, manipulation, codification, and visualization. These methods allow users to create knowledge by establishing new relationships between knowledge and incorporating knowledge into their own cognitive understanding/mental models.

There are two approaches to building a KMS. A process/task based approach and an infrastructure/generic system based approach. The process/task based approach focuses on the use of Knowledge/OM by participants in a process, task or project in order to improve the effectiveness of that process, task or project. This approach identifies the information and knowledge needs of the process, where they are located, and who needs them. The KMS is designed to capture Knowledge/OM unobtrusively and to make Knowledge/OM available when needed to who needs it.

The infrastructure/generic system based approach focuses on building a base system to capture and distribute Knowledge/OM for use throughout the organization. Concern is with the technical details needed to provide good mnemonic functions associated with the identification, retrieval, and use of Knowledge/OM. The approach focuses on network capacity, database structure and organization, and knowledge/information classification. The key difference is that the process/task approach has known users and Knowledge/OM requirements while the infrastructure/generic system approach does not. The process/task approach focuses on a group of known users with a common context of understanding, resulting in a KMS that does not need to capture context with the knowledge/OM. The infrastructure/generic KMS must capture context with the knowledge/OM to ensure that users use the knowledge/OM correctly. Finally, the process/task approach tends to more immediate payoffs and visible success while the infrastructure/generic system approach tends to long-term payoff with little quick visible success.

Both approaches may be used to create a complete organization wide OM. The process/task based approach supports specific processes and projects, getting users involved and motivated quicker, while the infrastructure/generic system approach integrates all Knowledge/OM into a single system, leading to bigger dividends when successful because the Knowledge/OM can be leveraged over the total organization instead of just a process or project. The process/task based approach is preferred for identifying localized Knowledge/OM needs and meeting them, and for smaller organizations with well defined Knowledge/OM goals and strategy. The infrastructure/generic system approach is preferred when specific Knowledge/OM users and needs are not known, but the organization knows Knowledge/OM use is necessary. It gives the system developers time to determine needs while building the OM infrastructure. Morrison and Weiser (1996) support the dual approach concept by suggesting that an KMS be designed to combine an organization's various task/process based KMSs into a single environment and integrated system.

Delone and McLean IS Success Model

In 1992 DeLone and McLean published their seminal work proposing a taxonomy and interactive model for conceptualizing and operationalizing IS Success (DeLone and McLean 1992). The DeLone and McLean (D&M) IS Success Model is based on a review and integration of 180 research studies that used some form of system success as a dependent variable. The model identifies six interrelated dimensions of success as shown in Figure 1. Each dimension can have measures for determining their impact on success and each other. Jennex, et. al. (1998) adopted the generic framework of the D&M IS Success Model and customized the dimensions to reflect the System Quality and Use constructs needed for an organizational memory information system, OMS. Jennex and Olfman (2002) expanded this OMS Success Model to include constructs for Information Quality.

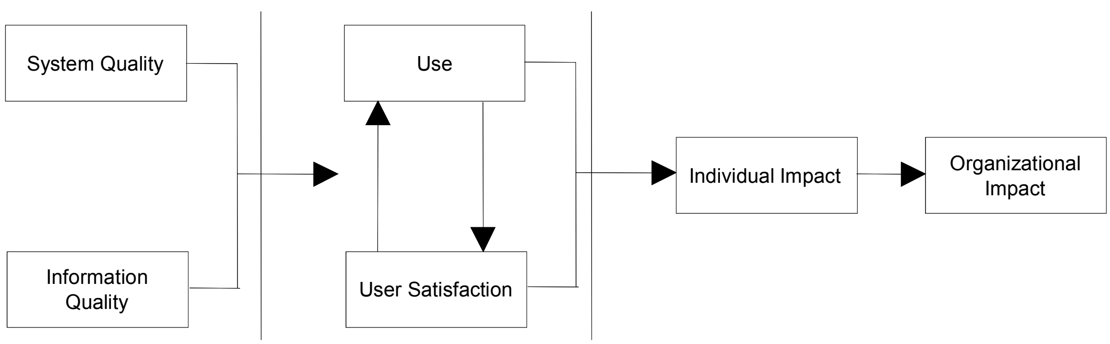

Figure 1. DeLone and McLean's IS Success Model

DeLone and McLean (2002) revisited the D&M IS Success Model by incorporating subsequent IS Success research and addressing criticisms of the original model. 144 articles from refereed journals and 15 papers from the International Conference on Information Systems, ICIS, citing the D&M IS Success Model were reviewed with 14 of these articles reporting on studies that attempted to empirically investigate the model. The result of the article is the modified D&M IS Success Model shown in Figure 2. Major changes include the additions of a Service Quality dimension for the service provided by the IS group, the modification of the Use dimension into a Intent to Use dimension, and the combination of the Individual and Organizational Impact dimensions into an overall Net Benefits dimension. This paper modifies the Jennex and Olfman OMS Success Model into a KMS Success Model by applying KM research and the modified D&M IS Success Model.

KMS Success Model

The model developed in this paper was proposed by Jennex and Olfman (2002) following a five year study of knowledge management in an engineering organization and is based on the DeLone and McLean (2002) revised IS Success Model. The proposed model was developed to explain the findings of Jennex and Olfman (2002). Figure 3 shows the KMS Success Model.

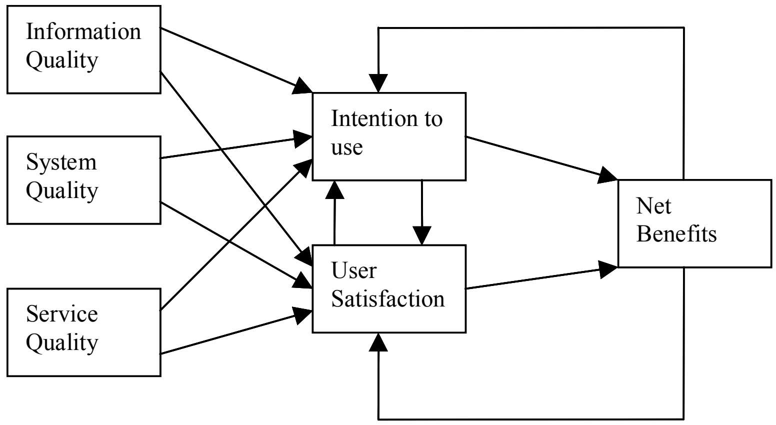

Figure 2. DeLone and McLean's Revisited IS Success Model

The KMS Success Model does not include a Service Quality dimension. Jennex and Olfman (2002) found that service quality for a KMS was a construct of system quality and so include the Service Quality dimension as part of the System Quality dimension. Also, since the KMS Success Model is assessing the use of Knowledge/OM, the Information Quality dimension is renamed the Knowledge/Information Quality dimension. Finally, because use of a KMS is usually voluntary, the KMS Success Model expanded the Intention to Use dimension to include a Perceived Benefit dimension based on Thompson, Higgins, and Howell's (1991) Perceived Benefit model used to predict system usage when usage is voluntary. Descriptions of the dimensions of the model follow.

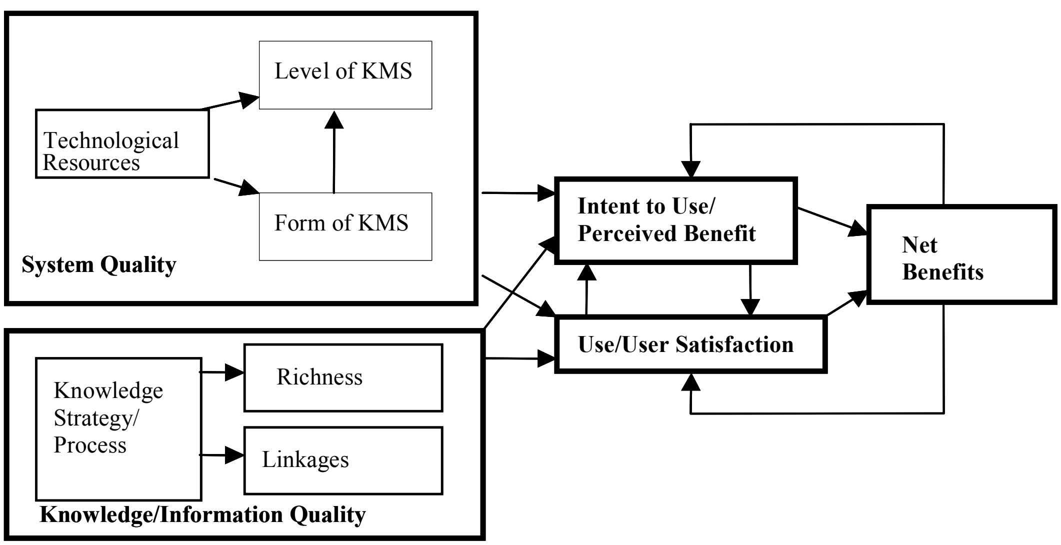

Figure 3. KMS Success Model

System Quality

The System Quality dimension defines system quality by how well the KMS performs the functions of knowledge creation, storage/retrieval, transfer, and application; how much of the OM is codified and included in the computerized portion of the OM, and how the KMS is supported by the IS staff and infrastructure. Three independent constructs: the technological resources of the organization, the form of the KMS, and the level of the KMS are identified. Technological resources define the capability of an organization to develop, operate, and maintain a KMS. These include aspects such as amount of experience already gained in developing and maintaining a KMS, the amount of expertise that is used to develop and maintain the system, the type of hardware used for the KMS and its users, networks used to support the KMS, databases used to hold OM, and the competence of the users to use the KMS.

The form of KMS refers to the extent to which the OM and knowledge management processes are computerized and integrated. This includes how much of the accessible OM is on line and available through a single interface and how integrated the processes of knowledge creation, storage/retrieval, transfer, and application are automated and integrated into the routine organizational processes. This construct incorporates concerns from the integrative and adaptive effectiveness clusters proposed for KMS effectiveness use by Stein and Zwass (1995). The technological resources of the system influence form.

The level of the KMS refers to its ability to bring OM to bear upon current activities. This refers explicitly to the search and retrieval functions of the KMS and how well the KMS implements these functions. The technological resources and form of the KMS influence this construct.

Ultimately, 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.

Knowledge/Information Quality

The Knowledge/Information Quality dimension ensures that the right knowledge/OM with sufficient context is captured and available for the right users at the right time. One independent and two dependent constructs: the knowledge strategy/process, knowledge/information richness, and linkages between knowledge components are identified. The construct knowledge strategy/process looks at the organizational processes for identifying knowledge/OM users and knowledge/OM for capture and reuse, the formality of these processes including process planning, and the format and context of the knowledge/OM to be stored. The dependent constructs, linkages and richness reflect the accuracy and timeliness of the stored knowledge/OM. Linkages reflect the knowledge and topic maps and/or listings of expertise available to the organization. Richness refers to the amount of context surrounding captured knowledge/OM as well as its accuracy and timeliness.

Hansen et al (1999) describes two types of knowledge strategy, personalization and codification and warns of trying to follow both strategies at the same time. These strategies refer to how knowledge is captured, represented, retrieved, and used. However, knowledge management strategy/process also needs to reflect that the knowledge needs of the users change over time as found by Jennex and Olfman (2002). As an example new users will follow personalization until they understand the context in which knowledge is captured and used, then they are willing to switch to a codification strategy. Personalization corresponds to "linkages" in the model shown in Figure 3, and refers to the situation where new users initially feel more comfortable seeking knowledge contexts from recognized human experts on a particular subject. Following this phase, these users switch directly to codified knowledge; thus, codification corresponds to "richness" in the model. This model recognizes Hansen et al's (1999) finding that organizations need to select a single strategy to concentrate on while using the other strategy in a support role yet also recognizes that this strategy will change as the organization's personnel become more experienced in the use of knowledge. Another aspect of knowledge strategy is from Jennex and Olfman (2002) who found KMS users have formal and/or informal drivers that guide them in selecting information and knowledge to be retained by the KMS. They also found formal and informal processes for reviewing and modifying stored information and knowledge and called the overall construct knowledge strategy/process.

Use/User Satisfaction

The Use/User Satisfaction dimension indicates actual levels of KMS use as well as the satisfaction of the KMS users. Actual use refers to the utilization of the outputs of the system. This construct is most applicable as a success measure when the use of a system is required. User satisfaction is a construct that measures satisfaction with the KMS by users. It is considered a good complementary measure of KMS use when use of the KMS is required, and effectiveness of use depends on users being satisfied with the KMS. User satisfaction is considered a better measure for this dimension as a KMS may not be used constantly yet still is considered effective. Jennex and Olfman (2002) found that some aspects of the KMS, such as email, may be used daily while others may be used once a year or less. However, it was also found that the importance of the once a year use might be greater than that of the daily use. This makes actual use a weak measure for this dimension given that the amount of actual use may have little impact on the success of the KMS.

Intent to Use/Perceived Benefit

The Intent to Use/Perceived Benefit dimension is a construct that measures perceptions of the benefits of the KMS by users. It is good for predicting continued KMS use when use of the KMS is voluntary, and amount and/or effectiveness of KMS use depends on meeting current and future user needs. Jennex and Olfman (2002) used a perceived benefit model adapted from Thompson, Higgins, and Howell (1991) to measure user satisfaction and predict continued intent to use the KMS when use of the KMS is voluntary. Thompson, Higgins, and Howell's (1991) perceived benefit model utilizes Triandis' (1980) theory that perceptions on future consequences predict future actions. This construct adapts the model to measure the relationships between social factors concerning knowledge/OM use, perceived KMS complexity, perceived near-term job fit and benefits of knowledge/OM use, perceived long-term benefits of knowledge/OM use, and fear of job loss with respect to willingness to contribute knowledge to the OM.

Net Impact

An individual's use of a KMS will produce an impact on that person's performance in the workplace. In addition, 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. DeLone and McLean (2002) recognized this difficulty and combined all impacts into a single construct. We agree with this approach as well as the addition of the feedback loop to the KMS Use/User Satisfaction and Perceived Benefit dimensions. Jennex and Olfman (2002) showed this feedback in their model relating KM, OM, organizational learning, and effectiveness shown in Figure 4. This model recognizes that the use of knowledge/OM may have good or bad benefits. It is feedback from these benefits that drives the organization to either use more of the same type of knowledge/OM or to forget the knowledge/OM and which also provides users with feedback on the benefit of the KMS. Alavi and Leidner (2001) also agree that a KMS should allow for forgetting of some knowledge/OM when it has no or detrimental benefits.

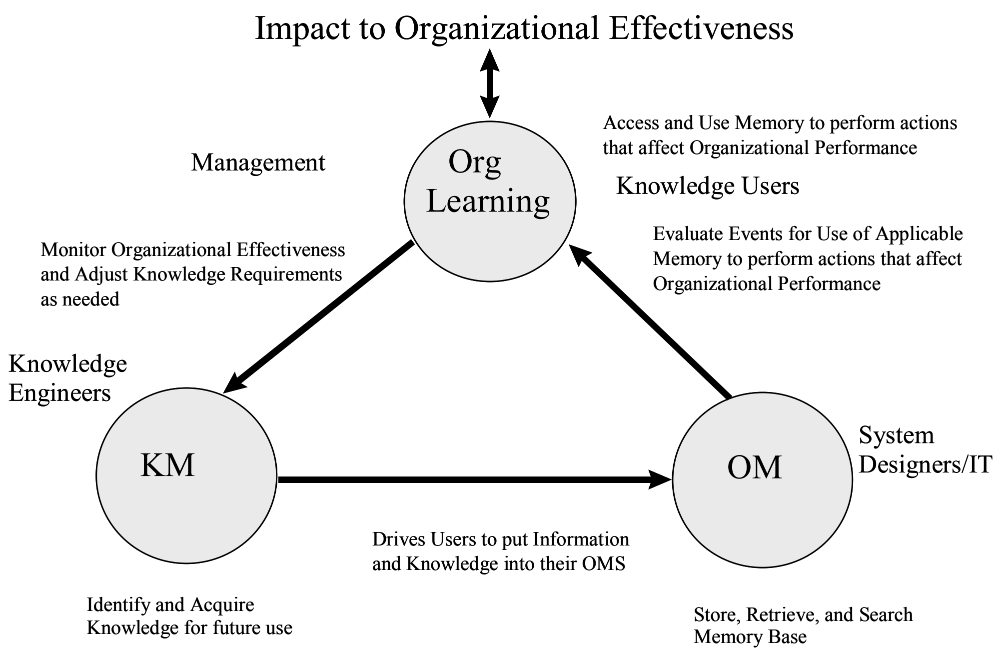

Figure 4. The OM/KM Model

Operationalization of the Success Model

Jennex and Olfman (2002) performed a longitudinal study of KM in an engineering organization looking for a link between knowledge/OM use and improved organizational effectiveness. This was found to be true. Although a great deal of quantitative data was taken, it was not possible to quantify productivity gains as a function of knowledge/OM use. The KMS was found to be effective and to have improved in effectiveness over a five-year period. The engineers were found to be more productive and much of the improvement was attributed to improved systems, including improved KMS components. This finding was expected.

Jennex (2000) applied a version of this model to the construction and implementation of a knowledge management website for assisting a virtual project team. It was found that applying the model to the design of the site resulted in the project going from lagging to a leading project in just a few months.

Hatami et al. (2003) used the KM Success Model to analyze knowledge reuse and the effectiveness of decision-making. They found the model useful in explaining the effects of culture and knowledge needs on the overall success of the KMS.

Jennex, Olfman, and Addo (2003) investigated the need for having an organizational KM strategy to ensure that knowledge benefits gained from projects are captured for use in the organization. They found that benefits from Y2K projects were not being captured because the parent organizations did not have a KM strategy/process. Their conclusion was that KM in projects can exist and can assist projects in utilizing knowledge during the project. However, it also led to the conclusion that the parent organization will not benefit from project based KM unless the organization has a KM strategy/process. This supports the position that infrastructure/generic system based KMS should exist in conjunction with project/process/ task based KMS for any organization wanting an overall KMS.

The following discussion combines these studies to provide methods of operationalizing the constructs proposed previously. These measures have been used to quantify and test the KMS Success Model. Table 1 summarizes the various measures applied in these studies.

Table 1. KMS Success Model Data Collection Methods

Success Model Factor	Data Collection Method
Technical Resources	User competency survey, observation and document research of IS capabilities, interview with IS support Manager on IS capabilities
Form of KMS	Interviews and survey of knowledge/OM sources and form
Level of KMS	Survey of satisfaction with retrieval times, usability testing on KMS functions
Knowledge Strategy/Process	Survey on drivers for putting knowledge/OM into the KMS and for satisfaction with the knowledge in the KMS, check on if a formal strategy/process exists
Richness	Usability test on adequacy of stored knowledge/OM and associated context, interviews and satisfaction survey on adequacy of knowledge/OM in KMS
Linkages	Usability test on adequacy of stored linkages, interviews and satisfaction surveys on satisfaction with linkages stored in KMS
Amount of KMS use	Survey on usage, Igbaria, Pavri, and Huff (1989) measures for usage
User Satisfaction	Doll and. Torkzadeh (1988) End User Satisfaction Measure, any other user satisfaction measure
Intent to Use/Perceived Benefit	Thompson, Higgins, and Howell's (1991) survey on perceived benefit
Net Impacts	Determine Individual and Organizational productivity models through interviews, observation

System Quality

System quality was defined previously as how good the system is in terms of its operational characteristics. Three constructs were proposed for the system quality block and to capture characteristics of the KMS: the technical capabilities of the organization, the form of the KMS, and the level of the KMS.

Jennex and Olfman (2002) found evidence to show that the capabilities of the IS organization and the users can impact the success of the KMS. IS organizational capabilities that enhanced KMS effectiveness included a fast, high capacity infrastructure, strong application development skills, network skills, and awareness of the user organization's OM requirements. Users' capabilities that enhanced KMS effectiveness included a high degree of computer literacy and high-end personal computers. Providing training on how to ask questions and use memory was also found to enhance KMS effectiveness.

Given the importance of the above technical capabilities, the goal is to measure the technical capabilities factor by focusing on the overall experience of the development group in building and maintaining networked systems that support OM, the capabilities of the end-users of the KMS, and the level of hardware and operating system capabilities of workstations.

The level of the KMS was defined as the ability to bring past information to bear upon current activities. This can be measured in terms of Stein and Zwass's (1995) mnemonic functions including knowledge acquisition, retention, maintenance, search, and retrieval. It is expected that a more effective KMS will include more sophisticated levels of the these functions. For example, a more sophisticated KMS should contain the ability to do filtering, guided exploration, and to grow memory.

The form of KMS refers to the extent to which it is computerized and integrated. In essence, the more computerized the memory, the more integrated it can be. That is, if all sources of the KMS are available in computer-based form, then it will be possible to more effectively search and retrieve the OM. Integration also speaks to the external consistency of the various forms of KMS. Jennex (1997) found that although much of the KMS at the station engineering unit was computerized, there were many different systems, each with varying kinds of storage mechanisms and interfaces. These systems were poorly integrated, relying mainly on the copy and paste features of the Windows interface, and therefore limited the ability of workers to utilize the KMS effectively. It was evident that more sophisticated technical resources could produce a more integrated set of systems.

Knowledge/Information Quality

Knowledge/Information quality has three constructs. Jennex and Olfman (2002) used surveys of users to determine drivers for putting knowledge/OM into the KMS and user satisfaction with the knowledge that was in the KMS. Jennex, Olfman, and Addo (2003) surveyed organizations to determine if they had a KM strategy and how formal it was. Jennex and Olfman (2002) used interviews of KMS users to determine their satisfaction with the accuracy, timeliness, and adequacy of knowledge/OM in the KMS. The need for linkages was found through interviews with users on where they went to retrieve knowledge/OM as there was always a need to talk to the source of the knowledge. Additionally, it was found that users' KMS needs vary depending on their experience level in the organization. Context of the knowledge/OM is critical. New members did not have this context. This KMS did not store sufficient context for a new member to understand and use the stored knowledge/OM. It was found that new members need linkages to the human sources of knowledge/OM. It is not expected that a KMS will ever be able to do an adequate job of storing context so it is recommended that the KMS store linkages to knowledge/OM. This is consistent with Davenport and Prusak (1998).

Use/User Satisfaction

Information use refers to the utilization of the outputs of the system. Igbaria, Pavri, and Huff (1989) measured information system usage on five dimensions: number of tasks performed, actual daily usage, frequency of use (e.g., hourly, daily, etc.), number of application packages used, and level of sophistication of usage. Jennex (1997) measured usage in a similar manner. User satisfaction is a construct that measures perceptions of the system by users. This is one of the most frequently measured aspects of I/S Success, and it is also a construct with a multitude of measurement instruments. User satisfaction can relate to both product and service. As noted above, product satisfaction is often used to measure information quality. Product satisfaction can be measured using the 12-item instrument developed by Doll and Tordzadeh (1988). This measure addresses satisfaction with content, accuracy, format, ease of use, and timeliness.

Intent to Use/Perceived Benefit

Jennex (1997) used Thompson, Higgins, and Howell's (1991) Perceived Benefit Model to predict continued voluntary usage of the KMS for the station engineering organization. Four factors from the model plus one added by Jennex and Olfman were in the survey:

- Job fit of KMS, near term consequences of using the KMS
- Job fit of KMS, long term consequences of using the KMS
- Social factors in support of using the KMS
- Complexity of the KMS.
- Fear of job loss for contributing to knowledge/OM to the KMS

All five factors were found to support continued use of the KMS during the initial measurements. Jennex and Olfman (2002) found continued use of the KMS throughout the five years of observing KMS usage and concluded that the Perceived Benefit model was useful for predicting continued use. Jennex (2000) used these factors to design the site, work processes, and management processes for a virtual project team using a web based KMS to perform a utility Year 2000 project. Promoting the Social factors and providing near term job fit were critical in ensuring the virtual project team utilized the KMS. Use of the KMS was considered highly successful as the project went from performing in the bottom third of utility projects to performing in the top third of all utility projects.

Net Benefits

While Jennex (1997) addressed two types of impacts, individual and organizational, the revised DeLone and McLean and the KMS Success Models address only net impacts. This is because KMS specific, quantitative impacts could not be measured at either the individual or organizational level. However, qualitative impacts could be measured and are discussed below.

The impact of a KMS on an individual is rooted in performance changes. Jennex (1997) queried supervisors and managers to determine what they believed were the nature of individual productivity in the context of the station-engineering unit. The interviews revealed a complex set of factors. Those impacted by the KMS include:

- Timeliness in completing assignments and doing them right the first time
- Number of assignments completed
- Identification and completion of high priority assignments
- Completeness of solutions
- Quality of solutions (thoroughness and accuracy)
- Complexity of the work that can be assigned to an engineer
- Client satisfaction.

While many of these factors are measured quantitatively, it was not possible to directly attribute changes in performance solely to KMS use although improvements in performance were qualitatively attributed to KMS use. Additionally, Jennex (1997) asked 20 engineers to indicate whether they were more productive now than 5 or 10 years ago, and all but one thought they were. This improvement was primarily attributed to KMS use but was also a qualitative assessment.

Organizational impacts relate to the effectiveness of the organization as a whole. For a nuclear power plant, specific measures of effectiveness were available. These measures relate to assessments performed by external organizations, as well as those performed internally. External assessments were found to be the most influenced by KMS use. Jennex (1997) and Jennex and Olfman (2002) found measures such as the SALP, Systematic Assessment of Licensee Performance, Reports issued by the Nuclear Regulatory Commission and site evaluations performed by the Institute of Nuclear Power Operations, INPO. Review of SALP scores issued since 1988 showed an increase from a rating of 2 to a rating of 1 in 1996. This rating was maintained through the 5 years of the study. An INPO evaluation was conducted during the spring of 1996 and resulted in a 1 rating. This rating was also maintained throughout the 5 years of the study. These assessments identified several strengths directly related to engineer productivity using the KMS. These include decision-making, root cause analysis, problem resolution, timeliness, and Operability Assessment documentation. This demonstrates a direct link between engineer productivity and organization productivity. Also, since organization productivity is rated highly, it can be inferred that engineer productivity is high.

Two internal indicators were linked to KMS use: unit capacity and unplanned automatic scrams. Unit capacity and unplanned scrams are influenced by how well the engineers evaluate and correct problems. Both factors improved over time. These two factors plus unplanned outages and duration of outages became the standard measure during the Jennex and Olfman (2002) study and reporting and monitoring of these factors significantly improved during the study.

The conclusion is that net impacts should be measured using measures that are specific to the organization and are influenced by the use of the KMS. Suitable measures were found in all the studies used for this paper and it is believed they can be found for any organization.

Conclusions

The D&M IS Success Model is a generally accepted model for assessing success of an IS. Adapting the model to a KMS is a viable approach to assessing KMS success. The model presented in this paper meets the spirit and intent of DeLone and McLean (1992, 2002). Additionally, Jennex (2000) used an earlier version of the KMS Success Model to design, build, and implement an Intranet based KMS that was found to be very effective and successful. The conclusion of this paper is that the KMS Success Model is a useful model for predicting KMS success. It is also useful for designing an effective KMS.

Areas for Future Research

Jennex and Olfman (2002) provided a basis for exploring a quantitative analysis and test of the KMS Success Model. To extend this work, it is suggested that a survey instrument to assess the effectiveness of the KMS of other nuclear power plant station engineering organizations in the United States be developed and administered. Since these organizations have similar characteristics and goals, they provide an opportunity to gain a homogeneous set of data to use for testing the model.

Additionally, other measures need to be assessed for applicability to the model. In particular, the Technology Acceptance Model, Perceived Usefulness (Davis 1989) should be investigated as a possible measure for Intent to Use/Perceived Benefit.

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