Assessing Knowledge Management Success/Effectiveness Models

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Abstract

This paper proposes a framework for assessing knowledge management system, KMS, Success Models. The framework uses three criteria: how well the model fits actual KMS success factors, the degree to which the model has a theoretical foundation, and if the model can be used for two types of approaches to building a KMS. The framework is then applied to four KMS success models found in the literature and is determined to be a useful framework for assessing KMS success models.

1. INTRODUCTION

Knowledge Management Systems, KMS, are systems designed to manage organizational knowledge. Alavi and Leidner [4] clarify KMS as IT-based systems developed to support/enhance the processes of knowledge creation, storage/retrieval, transfer, and application. Additionally a KMS supports knowledge management through the creation of network based Organizational Memory, 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.

There are two approaches to building a KMS, the process/task approach and the infrastructure/generic approach. The process/task 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. This approach requires the KMS to capture minimal context because users are assumed to understand the milieu of the knowledge that is captured and used.

The infrastructure/generic approach focuses on building a system to capture and distribute knowledge/OM for use throughout the organization. Concern is with capturing context to explain the captured knowledge and 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.

Both approaches may be used to create a complete KMS. The process/task approach supports specific work activities, while the infrastructure/generic approach integrates organizational knowledge into a single system that can be leveraged over the total organization instead of just a process or project. Morrison and Weiser [25] support the dual approach concept by suggesting that an organization-wide KMS be designed to combine an organization's various task/process based KMSs into a single environment and integrated system.

Once a KMS is implemented, whichever type it is, its success or effectiveness needs to be determined. Turban and Aronson [29] list three reasons for measuring the success of a Knowledge Management System, KMS:

- To provide a basis for company valuation
- To stimulate management to focus on what is important
- To justify investments in KM activities.

All are good reasons from an organizational perspective. Additionally, from the perspective of KM academics and practitioners, the measurement of KMS effectiveness or success is crucial to understanding how these systems should be built and implemented.

To meet this need several KMS success/effectiveness models have been proposed. It is the purpose of this paper to propose a framework for assessing the usefulness of these models. To do this the paper describes an evaluation model based on comparing the KMS success model to KMS success factors, determining the degree to which the model has a theoretical foundation, and determining if the model can be applied to both approaches to building a KMS.

The paper will first define the assessment framework. Then four KM/KMS success/effectiveness models will be described followed by an analysis with respect to how well the models match the assessment framework and a conclusion on the usefulness of the framework. KM/KMS success/effectiveness will not be defined because we found that each model defines

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success/effectiveness as part of the model.

2. METHODOLOGY

The proposed assessment framework consists of three main questions: how well the KMS success model meets KMS success criteria, the degree of the model's theoretical foundation, and if it can be applied to both approaches to building a KMS. Stinchcombe [27] recommends that theories should be tested by determining how well they reflect observed data, and notes that the more observations that can be compared the better. The proposed framework does this by comparing the KMS success models to a set of KMS success criteria. The set of KMS success criteria was determined through a literature survey. Several studies were found that reported issues affecting the success of a KMS. The studies used in this paper utilize a variety of methods including surveys, case studies, Delphi studies, and experimentation. A total of 78 projects or organizations were investigated using case studies. Three surveys were administered and one Delphi study and one experiment were performed.

The second criterion is the generalizability of the KMS success model. It is proposed that a model that is based on accepted theory or other widely supported models will be generalizable because theories and models published in the academic literature normally have been rigorously reviewed and validated by the research community.

The third criterion is for the KMS success model to be applicable to both KMS approaches outlined above. This criterion is assessed in this paper by judging the focus of the model to determine if it is specific to either the task/process approach or the generic/infrastructure approach.

3. KMS SUCCESS FACTORS

A successful KMS should perform the functions of knowledge creation, storage/retrieval, transfer, and application well. However, other factors can influence KMS success. Mandviwalla et al. [23] summarized the state of the research and described several strategy issues affecting the design of a KMS. These include the focus of the KMS (who are the users), the quantity of knowledge to be captured and in what formats, who filters what is captured, and what reliance and/or limitations are placed on the use of individual memories. Additional technical issues affecting KMS design include knowledge storage/repository considerations, how information and knowledge are organized so that the KMS can be searched and items can be linked to appropriate events and use, and processes for integrating the various repositories and for re-integrating information and knowledge extracted from specific events. Some management issues include how long the knowledge is useful, access locations (because users rarely access the KMS from a single location, which leads to network needs and security concerns), and the work activities and processes that utilize the KMS.

Ackerman [1] studied six organizations that had implemented his Answer Garden system. Answer Garden is a system designed to grow organizational memory in the context of help-desk situations. Only one organization had a successful implementation because expectations of the capabilities of the system exceeded the actual capabilities. Ackerman and Mandel [2] found that a smaller task-based system was more effective on the sub-organization level because of its narrower expectations. They refer to this narrower system as "memory in the small".

Jennex and Olfman [16] studied three KM projects to identify design recommendations for building a successful KMS. These recommendations include:

- Develop a good technical infrastructure by using a common network structure; adding KM skills to the technology support skill set; using high end PCs, integrated databases, and standardizing hardware and software across the organization.
- Incorporate the KMS into everyday processes and IS by automating knowledge capture.
- Have an enterprise wide knowledge structure.
- Have Senior Management support.
- Allocate maintenance resources for KMS.
- Train employees on use and content of the KMS.
- Create and implement a KM Strategy/Process for identifying/maintaining the knowledge base.
- Expand system models/life cycles to include the KMS and assess system/process changes for impact on the KMS.
- Design security into the KMS.
- Build motivation and commitment by incorporating KMS usage into personnel evaluation processes, implementing KMS use/satisfaction metrics, and identifying organizational culture concerns that could inhibit KMS usage.

Additionally, Jennex and Olfman [17] performed a longitudinal study of KM on one of these organizations and found that new members of an organization did not use the computerized KMS due to a lack of context for understanding the knowledge and the KMS itself. They found that these users needed pointers to knowledge more than codified knowledge.

Jennex, Olfman, and Addo [19] 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 surveyed Year 2000 (Y2K) project leaders and 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, but this “memory in the small” does not guarantee an organization-wide KMS.

Davenport, et al. [9] studied 31 projects in 24 companies. Eighteen projects were determined to be successful, five were considered failures, and eight were too new to be rated. Eight factors were identified that were common in successful KM projects. These factors are:

- Senior management support
- Clearly communicated KMS purpose/goals
- Linkages to economic performance
- Multiple channels for knowledge transfer
- Motivational incentives for KM users
- A knowledge friendly culture
- A solid technical and organizational infrastructure
- A standard, flexible knowledge structure.

Malhotra and Galletta [22] identified the critical importance of user commitment and motivation through a survey study of users of a KMS being implemented in a health care organization. They found that using incentives did not guarantee a successful KMS. They created an instrument for measuring user commitment and motivation based on self-determination theory that uses the Perceived Locus of Causality and is similar to the Perceived Benefit model [28].

Ginsberg and Kambil [12] explored issues in the design and implementation of an effective KMS by building a KMS based on issues identified in the literature and then experimentally implementing the KMS in a field setting. They found knowledge representation, storage, search, retrieval, visualization, and quality control to be key technical issues; and incentives to share and use knowledge to be the key organizational issues.

Alavi and Leidner [3] surveyed executive participants in an executive development program with respect to what was needed for a successful KMS. They found organizational and cultural issues associated with user motivation to share and use knowledge to be the most significant. They also found it important to measure the benefits of the KMS and to have an integrated and integrative technology architecture that supports database, communication, and search and retrieval functions.

Holsapple and Joshi [14] investigated factors that influenced the management of knowledge in organizations through the use of a Delphi panel consisting of 31 recognized KM researchers and practitioners. They found leadership and top management commitment/support to be crucial. Resource influences such as having sufficient financial support, skill level of employees, and identified knowledge sources are also important.

Koskinen [20] investigated tacit knowledge as a promoter of success in technology firms by studying ten small technology firms. Key to the success of a KMS was the ability to identify, capture, and transfer critical tacit knowledge. A significant finding was that new members take a long time to learn critical tacit knowledge and a good KMS facilitates the transference of this tacit knowledge to new members.

Barna [5] studied six KM projects with various levels of success (three were successful, two failed, and one was an initial failure turned into a success) and identified two groups of factors important to a successful KMS. The main managerial success factor is creating and promoting a culture of knowledge sharing within the organization by articulating a corporate KM vision, rewarding employees for knowledge sharing, creating communities of practice, and creating a “best practices” repository. Other managerial success factors include obtaining senior management support, creating a learning organization, providing KMS training, and precisely defining KMS project objectives. Design/construction success factors include approaching the problem as an organizational problem and not a technical one; creating a standard knowledge submission process; having methodologies and processes for the codification, documentation, and storage of knowledge; having processes for capturing and converting individual tacit knowledge into organizational knowledge; and creating relevant and easily accessible knowledge-sharing databases and knowledge maps.

Cross [8] proposes that KM would not improve business performance simply by using technology to capture and share the lessons of experience. It was postulated that for KM to improve business performance it had to increase organizational learning through the creation of organizational memory. To investigate this proposition, 22 projects were examined. The conclusion was that improving organizational learning increased the likelihood of KM success. Factors that improved organizational learning include:

- Supporting personal relationships between experts and knowledge users
- Providing incentives to motivate users to learn from experience and to use the KMS
- Providing distributed databases to store knowledge and pointers to knowledge

- Providing work processes for users to convert personal experience into organizational learning
- Providing direction to what knowledge the organization needs to capture to produce learning.

Sage and Rouse [26] reflected on the history of innovation and technology and identified the following issues:

- Modeling processes to identify knowledge needs and sources
- KMS strategy for the identification of knowledge to capture and use and who will use it
- Provide incentives and motivation to use the KMS
- Infrastructure for capturing, searching, retrieving, and displaying knowledge
- An understood enterprise knowledge structure
- Clear goals for the KMS
- Measuring and evaluating the effectiveness of the KMS.

Based on our analysis of the above noted studies we identified potential success factors. We reviewed and paraphrased them into a set of 12 success factors. We ranked the factors based on the number of sources citing them. Table 1 lists the set of success factors in their rank order. Additionally, success factors SF1 through SF4 are considered the key success factors as they were mentioned by at least half of the success factor studies.

Table 1. KMS Success Factor Summary

ID	Success Factor	Source
SF1	Integrated Technical Infrastructure including networks, databases/repositories, computers, software, KMS experts	Alavi and Leidner (1999), Barna (2002), Cross (2000), Davenport, et al. (1998), Ginsberg and Kambil (1999), Jennex and Olfman (2000), Mandviwalla, et al. (1998), Sage and Rouse (1999)
SF2	A Knowledge Strategy that identifies users, sources, processes, storage strategy, knowledge and links to knowledge for the KMS	Barna (2002), Ginsberg and Kambil (1999), Holsapple and Joshi (2000), Jennex, Olfman, and Addo (2003), Koskinen (2001), Mandviwalla, et al. (1998), Sage and Rouse (1999)
SF3	A common enterprise wide knowledge structure that is clearly articulated and easily understood	Barna (2002), Cross (2000), Davenport, et al. (1998), Ginsberg and Kambil (1999), Jennex and Olfman (2000), Mandviwalla, et al. (1998), Sage and Rouse (1999)
SF4	Motivation and Commitment of users including incentives and training	Alavi and Leidner (1999), Barna (2002), Cross (2000), Davenport, et al. (1998), Ginsberg and Kambil (1999), Jennex and Olfman (2000), Malhotra and Galletta (2003)
SF5	An organizational culture that supports learning and the sharing and use of knowledge	Alavi and Leidner (1999), Barna (2002), Davenport, et al. (1998), Jennex and Olfman (2000), Sage and Rouse (1999)
SF6	Senior Management support including allocation of resources, leadership, and providing training	Barna (2002), Davenport, et al. (1998), Holsapple and Joshi (2000), Jennex and Olfman (2000)
SF7	Measures are established to assess the impacts of the KMS and the use of knowledge as well as verifying that the right knowledge is being captured	Alavi and Leidner (1999), Davenport, et al. (1998), Jennex and Olfman (2000), Sage and Rouse (1999)
SF8	There is a clear goal and purpose for the KMS	Ackerman (1994), Barna (2002), Davenport, et al. (1998), Cross (2000)
SF9	The search, retrieval, and visualization functions of the KMS support easy knowledge use	Alavi and Leidner (1999), Ginsberg and Kambil (1999), Mandviwalla, et al. (1998)
SF10	Work processes are designed that incorporate knowledge capture and use	Barna (2002), Cross (2000), Jennex and Olfman (2000)
SF11	Learning Organization	Barna (2002), Cross (2000), Sage and Rouse (1999)
SF12	Security/protection of knowledge	Jennex and Olfman (2000), Sage and Rouse (1999)

4. KNOWLEDGE MANAGEMENT SUCCESS MODELS

4.1. Knowledge Value Chain

Bots and de Bruijn [7] assessed KM and determined that the best way to judge good KM was through a knowledge value chain. In this evaluation process KM is assessed for effectiveness at each step of the knowledge process and is deemed good if each of the indicated activities is performed well with the ultimate factor being whether the KM enhances competitiveness. Figure 1 illustrates the KM value chain. The model was developed by viewing and contrasting KM through an analytical (technical) perspective and an actor (user) perspective. These perspectives are conflicting and KM assessment occurs by determining how well the KMS meets each perspective at each step.

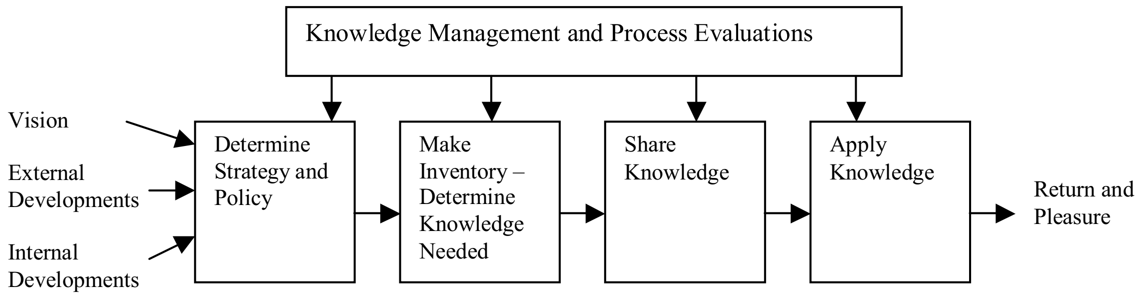

Figure 1, KM Value Chain [7]

4.2. Massey, Montoya-Weiss, and Driscoll KM Success Model

Massey, et al. [24] present a KM success model derived from a case study of Nortel. The model is based on the framework proposed by Holsapple and Joshi [15] and reflects that KM success flows from understanding the organization, its knowledge users, and how they use knowledge. It recognizes that KM is an organizational change process and KM success cannot separate itself from organizational change success. The result is that KM success is essentially defined as improving organizational or process performance. The model is presented in Figure 2. Key components of the model are:

KM Strategy – which defines the processes using knowledge and what that knowledge is; the sources, users, and form of the knowledge; and the technology infrastructure for storing the knowledge.

Key Managerial Influences – which defines management support through leadership, allocation and management of project resources, and oversight of the KMS through coordination and control of resources and the application of metrics for assessing KMS success.

Key Resource Influences – these are the financial resources and knowledge sources needed to build the KMS.

Key Environmental Influences – describe the external forces that drive the organization to exploit its knowledge to maintain its competitive position.

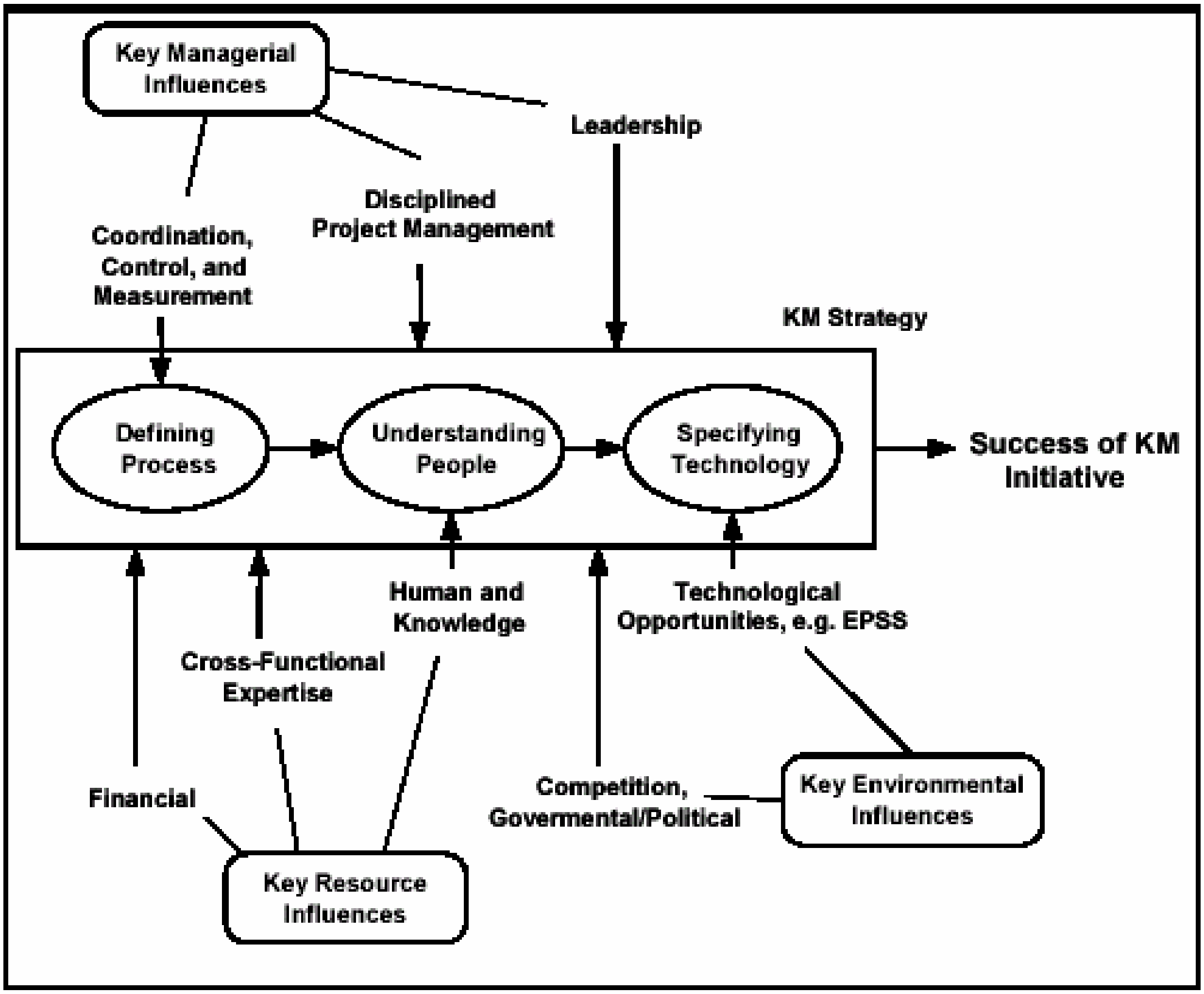

Figure 2, Massey, Montoya-Weiss, and Driscoll KM Success Model, [24]

4.3. Lindsey KM Effectiveness Model

Lindsey [21] proposed a KM effectiveness model based on combining Organizational Capability Perspective Theory [13] and Contingency Perspective Theory [6]. The model defines KM effectiveness in terms of two main constructs: Knowledge Infrastructure Capability and Knowledge Process Capability, with the Knowledge Process Capability construct being influenced by a Knowledge Task. Knowledge infrastructure capability represents social capital; the relationships between knowledge sources and users; and is operationalized by technology (the network itself), structure (the relationship), and culture (the context in which the knowledge is created and used). Knowledge process capability represents the integration of KM processes into the organization, and is operationalized by acquisition (the capturing of knowledge), conversion (making captured knowledge available), application (degree to which knowledge is useful), and protection (security of the knowledge). Tasks are activities performed by organizational units and indicate the type and domain of the knowledge being used. Tasks ensure the right knowledge is being captured and used. KM success is measured as satisfaction with the KMS. Figure 3 illustrates the Lindsey model.

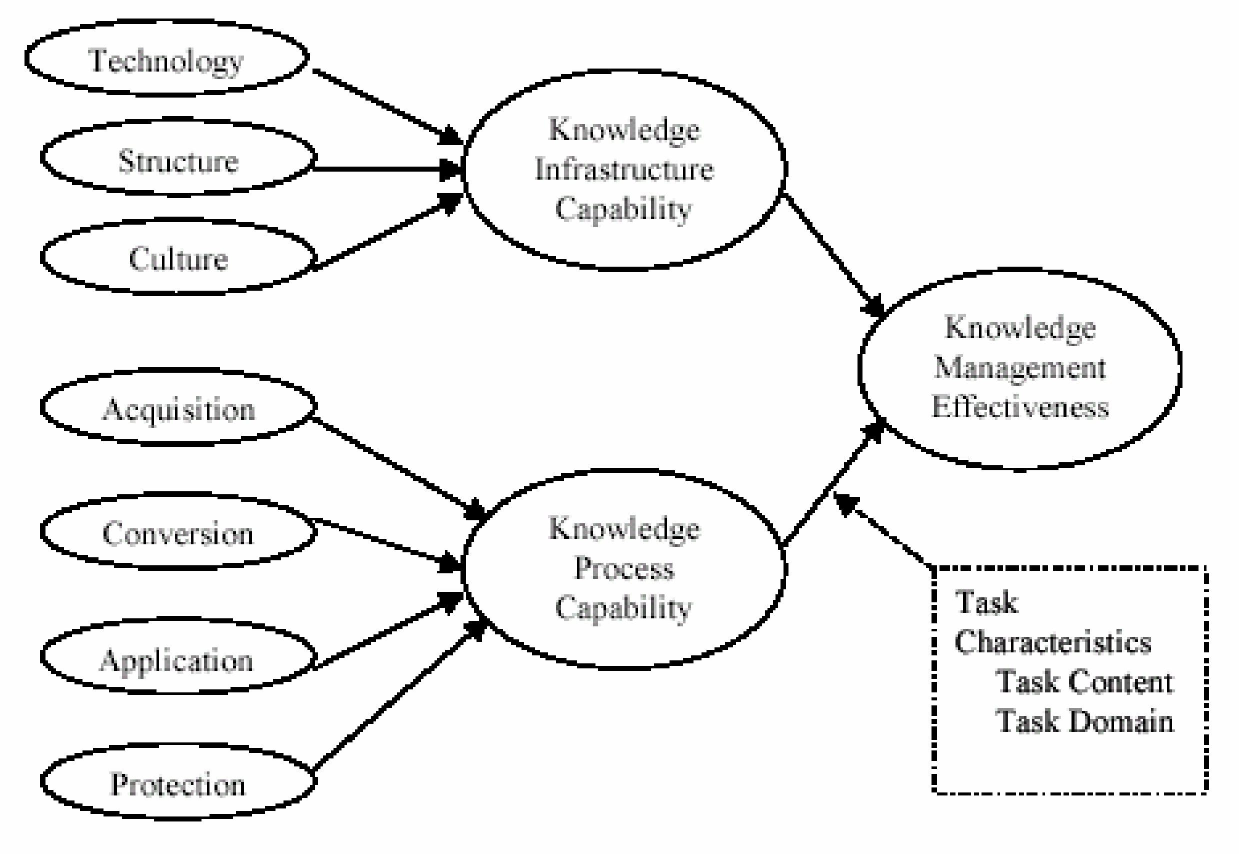

Figure 3, Lindsey KM Effectiveness Model, [21]

4.4. Jennex and Olfman KMS Success Model

Jennex and Olfman [18] present a KMS Success model that is based on the DeLone and McLean [10], [11] IS Success Model. Figure 4 shows the KMS Success Model. This model evaluates success as an improvement in organizational effectiveness based on use of and impacts from the KMS. Descriptions of the dimensions of the model follow.

System Quality - defines 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.

Knowledge/Information Quality - ensures that the right knowledge/OM with sufficient context is captured and available for the right users at the right time.

Use/User Satisfaction - indicates actual levels of KMS use as well as the satisfaction of the KMS users. Actual use 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.

Perceived Benefit - measures perceptions of the benefits and impacts of the KMS by users and is based on the Perceived Benefit Model [28]. 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.

Net Impact - An individual's use of a KMS will produce an impact on that person's performance in the workplace. 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. That is why this construct combines all impacts into a single construct. This model recognizes that the use of knowledge/OM may have good or bad benefits and allows for feedback from these benefits to drive the organization to either use more knowledge/OM or to forget specific knowledge/OM.

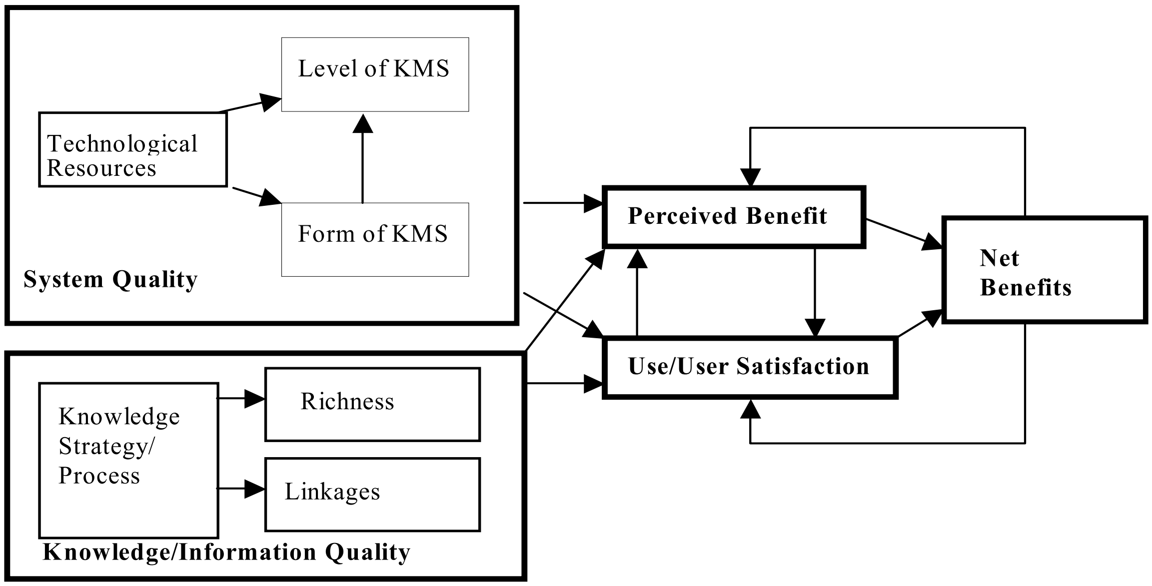

Figure 4. KMS Success Model, [18]

5. APPLICATION OF THE FRAMEWORK

To illustrate the use of the framework the KMS Success models are first analyzed by comparing them to the identified set of success factors and determining how well the models reflect the set of success factors. Table 2 summarizes this comparison. Assessing responsiveness to the top four success criteria finds that the Value Chain, and Lindsey models are not as good at reflecting the observed data as the Massey, et al. and Jennex Olfman models. Also, the only difference between the Massey, et al. and Jennex and Olfman models is SF5, Culture. Given that this would be the next most important success factor it is determined that the Jennex and Olfman model most closely fits the observed data as reflected by the success factors model.

Looking at the theoretical foundation for the KMS success models finds that all four have some theoretical foundation. The Value Chain model uses the commonly used Value Chain approach. The Massey et al. model relies on the Holsapple and Joshi [2002] framework. The Lindsey model utilizes Organizational Capability Perspective Theory and Contingency Perspective Theory. The Jennex and Olfman model utilizes the widely accepted DeLone and McLean IS Success Model. Assessing the ability to generalize from the theory it can be determined that the Value Chain and Jennex and Olfman models are utilizing theory that is more widely utilized for assessing effectiveness. However, the Massey et al. and Lindsey models' theoretical foundations may be proven to be widely applicable after being applied and studied in a variety of organizations and applications.

Assessing the KM success models for applicability to both approaches for building a KMS it can be determined that the Massey et al. and Jennex and Olfman models have no characteristics that would limit their applicability to either KMS approach, while the Value Chain and Lindsey models could be interpreted as being specific to an approach. The Value Chain model is typically applied to organizational systems to determine strategic processes, this would limit its usefulness to assessing the success of a project/task KMS. The Lindsey model specifically incorporates task specific components that may make it difficult to focus the model on assessing organizational effectiveness. However, it can be concluded that all four models could be applied to both KMS approaches if the user is aware of the differences between the approaches and the limitations of the models.

In summary, the proposed framework provides a manager with a measuring stick for selecting a KMS success model. Managers wanting a model based on widely accepted success models and that fits the observed data (as expressed in the KMS success factors) would rank the four models in order of preference as Jennex and Olfman, Massey et al., Value

Chain, and Lindsey. Users wanting a model for assessing a project/task KMS may opt for the Lindsey model. Users focusing on generic/infrastructure KMS may opt for the Value Chain model.

Table 2, KM Success Models versus KM Success Factors

Success Factor ID	Value Chain	Massey et al.	Lindsey	Jennex and Olfman
SF1	No clear tie – share knowledge stage	KM Strategy	Technology construct – networks	Technical Resources Construct
SF2	Strategy stage	KM Strategy	Task and Acquisition constructs	KM Strategy /Process Construct
SF3	No clear tie	KM Strategy	Structure and Conversion constructs	Form Construct
SF4	Weak – Apply knowledge stage	Key Management Influences	No clear tie	Perceived Benefit Construct
SF5	No clear tie	No clear tie	Culture construct	Perceived Benefit Construct
SF6	Implied – no clear tie	Key Management Influences	No clear tie	Perceived Benefit Construct
SF7	Return stage	Key Management and Environmental Influences	Task construct	Net Impacts Construct
SF8	Strategy stage	KM Strategy	Task construct	KM Strategy/ Process Construct
SF9	Share knowledge and apply knowledge stages	KM Strategy	Conversion and Task constructs	Level Construct
SF10	Apply knowledge stage	KM Strategy	Application construct	Perceived Benefit Construct
SF11	No clear tie	No clear tie	No clear tie	No clear tie
SF12	No clear tie	No clear tie	Protection Construct	No clear tie

6. CONCLUSIONS

The proposed framework for assessing KMS Success models appears to be useful. It allows users to validate that the KMS success model they are using reflects observed factors that have been found to affect KMS success. The use of the KMS Success Factors to assess this fit is very powerful and is the major contribution of this paper. The KMS success factors were identified from a large number of studies, projects, and KMS' providing a broad view of KMS success.

The use of the other two criteria of the framework are less powerful but still important. It is important to determine that a KMS success model has a theoretical foundation as otherwise it could simply be a reflection of a single data point's success criteria and may not be applicable to the KMS to be assessed. Additionally, it is also important to ensure that the KMS success model being used applies to the approach of the KMS under consideration. It is inappropriate to apply an organizational effectiveness model to a task/process KMS and vice versa.

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