

UNDERSTANDING KNOWLEDGE STORAGE/RETRIEVAL
SYSTEM SUCCESS: AN ANALYTIC NETWORK PROCESS
PERSPECTIVE

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DEDICATION

This dissertation is dedicated to the two loves of my life: my wonderful wife, Gulenay "Gigi" Ozcan, and my beautiful son, Evan Taraszewski: It is the thought of them that inspired me to complete this research. I also dedicate this to the memories of both my father, Joseph A Taraszewski, and my brother, David J Taraszewski, who I know would have been so proud of me. Finally, I dedicate this to my mother, Carol Taraszewski, who was a source of constant encouragement throughout my educational journey.

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ABSTRACT

Organizations often begin knowledge management (KM) efforts by building knowledge repositories to store organizational knowledge to ensure that it may be later retrieved to reuse, share with, and transfer to knowledge workers. The use of such storage/retrieval systems (S/RS) are particularly relevant in preserving and restoring internal organizational knowledge; such implementations support reduced costs associated with knowledge reacquisition, recreation, and reinvention, thus increasing the efficiency of knowledge transfer. Additionally, there is an increased interest in newer uses of S/RS to support large-scale knowledge-bases and knowledge sharing communities. Therefore, it is important for organizations to understand the factors that influence success in S/RS, as generally, KM systems (KMS) initiatives have failed to realize promised results. This study focuses on knowledge flow from the knowledge repository to the knowledge consumer to facilitate and enable knowledge transfer (FEKT). Because of the strong relationship between S/RS processes and technologies and IS/IT, DeLone and McLean's (2003) IS success model serves as the foundation for the S/RS success model, which is modified here to include the complexities inherent in an S/RS. This empirical study presents a model of S/RS success in FEKT and identifies, prioritizes, and weights both the constructs that define S/RS success and the critical success factors (CSF) that influence these success constructs. In addition to informing KM practitioners, this research also addresses a research gap in the KM literature in

respect to storage/retrieval systems in facilitating knowledge transfer. Moreover, while prior KMS research has generally assumed an independence in factors and constructs when empirically testing KMS success, this study embraces the notion that real-world factors and constructs are interrelated, intertwined, and interdependent; thus, the analytic network process (ANP) is used as an analytic methodology to address this complexity and further, the ANP is employed in this study in a rather unique manner to determine the ranking of the success constructs. Finally, the ANP row-based influence, marginal, and perspective sensitivity analyses are performed on the synthesized model to more deeply investigate the robustness of the model and help illuminate interesting relationships for practitioners and future researchers alike.

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NOMENCLATURE

ACRONYMS USED

AHP	Analytic Hierarchy Process
ANP	Analytic Network Process
CFA	Confirmatory Factor Analysis
CFF	Critical Failure Factor
CMC	Computer Mediated Communication
CoP	Communities of Practice
CSF	Critical Success Factor
DBMS	Database Management System
EUCS	End User Computing Satisfaction
FEKT	Facilitate and Enable Knowledge Transfer
ICT	Information and Communication Technology
IM	Instant Messaging
IRR	Internal Rate of Return
IS	Information System
IT	Information Technology
KBV	Knowledge-based View of the Firm
KDD	Knowledge Discovery through Data
KM	Knowledge Management
KMC	Knowledge Management Chain (Cycle)
KMS	Knowledge Management System
MCDA	Multi-Criteria Decision Analysis
MCDM	Multi-Criteria Decision Making
MIS	Management Information Systems
OM	Organizational Memory
OMIS	Organizational Memory System
RBV	Resource-based View of the Firm
ROI	Return on Investment
S/RS	Storage/Retrieval System
SECI	Socialization, Externalization, Combination, Internalization
SEM	Structural Equation Modelling
SME	Small-Medium Enterprise
SNA	Social Network Analysis
VOIP	Voice over IP
VVOIP	Video and Voice of IP

CHAPTER I

INTRODUCTION

1.1 Background

As the United States has increasingly become an information- and knowledge-based economy, the importance of organizational knowledge assets, and the effective management of such assets, have similarly increased. Knowledge is both an important organizational asset and a source of sustainable competitive advantage (Grant, 1996). In addition, these knowledge-based assets are more resistant to imitation and can thus provide an organization with sustainable competitive advantage (Alavi and Leidner, 2001). Furthermore, unlike traditional material assets that decrease as they are consumed by an organization, knowledge actually increases through its use by way of further product and service innovation and the creation of new knowledge and thus, provides a continuous source of competitive advantage (Davenport and Prusak, 1998; Nonaka, and Takeuchi, 1995; Zhang, 2007).

However, Holsapple and Joshi (2000) relate that, while the modern organization can be viewed as a knowledge-based enterprise, the treatment of knowledge as an organizational asset has traditionally not received "the degree of systematic, deliberate, or explicit" attention from management that other types of resources (e.g., human, financial, or material) have historically received. In order to remain competitive in this fast-paced environment, organizations must leverage and extract value from their knowledge assets by implementing formalized processes to actively manage these knowledge resources (Kulkarni et al., 2007). This study directly addresses the challenge posed by Alavi and Leidner in their seminal work, where they state, "research on the development of effective organizational and technical strategies for organizing, retrieving, and transmitting knowledge are needed to facilitate knowledge transfer" (Alavi and Leidner, 2001). For knowledge management (KM) practitioners, this still remains an important and relevant research challenge as organizations struggle to make sense of underperforming KM initiatives due to, perhaps, the misalignment or outright absence of internal knowledge search technologies, especially in light of the ever-increasing number of internal sources and volume of organizational information and knowledge (AIIM, 2014).

1.2 Knowledge Management Systems

From the practitioner's perspective, effective KM requires a wide range of skill sets and organizational resources because it involves "a complex interplay of technical and social factors" (Ciganek et al., 2008). Similarly, KM research transcends diverse academic research areas such as organizational behavior, management science, industrial psychology, philosophy, and MIS. Within their respective fields, both researchers and

practitioners have adopted various understandings of exactly what constitutes this management of knowledge, which in turn is influenced by an organization's or an individual's primary objective for engaging in KM.

The guiding principles, philosophies, and ideals of the various KM perspectives are operationalized in the people, processes, and technology that form knowledge management systems (KMS). The specific understandings of KM precepts inform how KMS are designed, implemented, and constructed. For example, a KMS focused on knowledge through data discovery (KDD) – perhaps supported through the use of autonomous epistemic agent-based programming, predictive analytics, and data mining technologies for knowledge discovery – is very different in both its design and management focus when compared to a KMS targeted at, for example, sharing best-practices within a particular industry.

Of relevance to information system (IS) research is the belief that a KMS is a special class of IS (Alavi and Leidner, 2001); however, it may be more accurate to refer to a KMS as the people, processes, and technologies used to realize the management of knowledge that is supported and enabled by IS. Furthermore, Holsapple and Joshi (2000) take a rather pragmatic approach in describing a KMS as that which is necessary to "ensure that the right knowledge is available to the right processors, in the right representations and the right times, for performing their knowledge activities (and to accomplish this for the right cost)."

1.3 Knowledge Management Frameworks

KM frameworks are useful for describing the major elements, concepts, and principles, and identifying how they interact, in order to study and implement KMS

(Holsapple and Jones, 2004). These KM frameworks provide generic, conceptual models that classify related KM activities and processes into a reduced quantity of primary classes or dimensions to provide a holistic view of the entire KM process. One such KM framework, as developed by Alavi and Leidner (2001), is based on the view of the organization as a social collective and knowledge system (see Figure 1). Alavi and Leidner put forth a framework of "socially enacted knowledge processes" that is of particular interest to IS researchers in that the framework's specified purpose was to analyze and discuss the potential role of IT or IS in supporting KM. The Alavi and Leidner KM framework – or knowledge management chain (KMC), as it will be referred to in this research – is a process-oriented model that describes the end-to-end flow of knowledge assets across four primary KM activities: 1) creation, 2) storage/retrieval, 3) transfer, and 4) application. While reducing the KM activities to just four primary dimensions, the Alavi and Leidner framework effectively tells the story of how knowledge should be sequentially managed within an organization: knowledge is first created (or acquired); stored so that it is not forgotten; retrieved at a future time for transferability to other employees; and ultimately, used within the organization. Furthermore, these four dimensions are more than simply collections or blocks of dozens of independent and detailed KM processes; instead, they are knowledge activities and processes that are both interrelated, interdependent, and intertwined. Whether referred to as a KM framework, model, cycle, or chain, the Alavi and Leidner framework proposed in their formative article has garnered much interest, as evidenced by nearly 9,900 citations (as of March, 2017) within academic research. However, the Alavi and Leidner framework is not the only KMS framework and has been criticized as being western-

culture dominant, lacking of metrics tied to organizational metrics, descriptive rather than prescriptive in nature, and with an emphasis on IT-based codified and explicit knowledge management. Furthermore, it is viewed as having the potential for problems associated with computer-based KMS over socially enacted tacit KM. In fact, Heisig (2009) conducted a meta-analysis of 160 KM frameworks from science, academia, enterprises, management consultants, associations, and standardization bodies from around the world and found 117 of these frameworks specifically addressed the management of knowledge. Further, Heisig performed a content analysis of KM dimensions and found that, similar to Alavi and Leidner in 2001, the most common activities within a KMS focused on creating, identifying, storing, sharing, and using knowledge.



Figure 1. The Knowledge Management Chain (KMC) (Alavi and Leidner, 2001).

1.4 Factors Influencing the Knowledge Management Framework

KM researchers have generally studied the KM frameworks from two distinct perspectives: at the macro and micro levels. At the macro level, KM frameworks are often examined in their entirety with a more strategic perspective. At the micro level, focus is on a single dimension of a KM framework, such as knowledge creation or knowledge transfer, through a more tactical lens. Aligned with this dual level of understanding of KMS, and of interest to both practitioners and researchers alike, research streams in KM have examined the specific success factors, or Critical Success

Factors (CSF), that influence the success of KM initiatives at both macro and micro levels within KM frameworks. CSFs can be thought of as factors that management must monitor and control – key areas which "must go right" – that are necessary, but not sufficient, precursors for the success of some organizational initiative (Rockart, 1979). Moreover, understanding the factors that lead to the successful implementation and continued use of a KMS is vital for organizations to take advantage of their collective knowledge assets (Heisig, 2009; Jennex and Zakharova, 2005; Magnier-Watanabe and Benton, 2013).

At the macro level, CSFs that are relevant to various KM frameworks (in an overarching sense) highlight antecedents for success that essentially transcends the entire KMS. For example, some researchers (e.g., Farzin et al., 2014; Holsapple and Joshi, 2000; Holsapple and Jones, 2005; Huang and Lai, 2012; Jennex and Zakharova, 2005; Kulkarni et al., 2007; and Mercado, 2010) have proposed KM success antecedents or factors that influence the entire KMS, such as *Top Management Support*, *Steering Committee*, *Alignment of KM with Organizational Goals*, *KM Strategy*, and *Link to Economic Performance or Industry Value*. At a micro level, other researchers (e.g., Ismail Al-Alawi et al., 2007; Bock et al., 2005; Cumming and Teng, 2003; Ko et al., 2005; and Reagans and McEvily, 2003) have examined KMS success at a finer level of detail by identifying CSFs that influence a smaller segment or specific dimension of the KM cycle. For example, researchers examining knowledge transfer have identified *Source Credibility*, *Knowledge Distance*, *Shared Understanding*, and *Absorptive Capacity* as CSFs specific to this dimension of the KM cycle.

Interestingly, while some macro level or overarching success factors such as *Top Management Support* or *Knowledge-Oriented Culture* also influence the micro level success of KM dimensions, such as knowledge storage/retrieval and/or knowledge transfer, other overarching factors may not be as relevant when focused on specific detailed KM dimensions or processes. For example, Hasanali (2002) posited an *Effective Steering Committee* "to provide guidance, suggestion, and support" as an overarching success factor that influences the direction of the entire KMS effort; however, there is no support for this factor at the micro level in respect to the knowledge storage/retrieval dimension. Conversely, because of specificity, some antecedents of success at the micro level do not necessarily scale up to the macro level; micro-level success factors may be too detailed or tactically related to a specific KMC dimension and, therefore, less relevant when considering the entire KM cycle. In addition, the ranking and strength of influence of micro-level CSFs can differ from these same factors at the macro level.

This study takes a micro-level approach by both identifying and prioritizing CSFs that focus on a single component of a KMS – the storage and retrieval system (S/RS) – that supports KM activities at the storage/retrieval dimension of the KMC. The knowledge S/RS is important in supporting the transference of knowledge from organizational memory housed within the knowledge repository (Magnier-Watanabe and Benton, 2013). As a specialized type of IS, it is appropriate to analyze the multidimensional nature of success of a KMS's S/RS with multidimensional success constructs similar to those proposed by DeLone and McLean (2003) in their IS success model (Karlinsky-Shichor and Zvarin, 2016). As noted by Magnier-Watanabe and Benton (2013), in general, the software systems designed to support KM differ from other forms of IS in that they

"allow users to assign meaning, content, and context to the information." More clearly, system users can, and do, influence the ongoing quality of information (knowledge) stored within a KMS. For this study, the dimensions of success relevant to a KMS's S/RS are represented by six constructs (which have been slightly modified and renamed to distinguish KMS from the traditional IS), as derived from DeLone and McLean's (2003) IS success model: *Knowledge Content Quality*, *KMS Quality*, *KMS Service Quality*, *Use*, *User Satisfaction*, and *Net Benefits*. These six constructs define dimensions of success of one component of a KMS (specifically the S/RS), which ultimately facilitate and enable knowledge transfer. Note that henceforth, the "FEKT" acronym is used to represent the phrase, "facilitate and enable knowledge transfer". *Enabling* knowledge transfer in this research refers to providing the necessary support to get the appropriate knowledge artifacts with the proper context to the knowledge worker to strengthen his/her ability to transfer knowledge. Conversely, *facilitating* knowledge transfer refers to easing the process of knowledge transfer by, perhaps, placing knowledge artifacts in the correct format, at the right place, at the right time, and to the right person with the intent to reduce knowledge search and thereby ease the knowledge transfer process. Importantly, for the remainder of this study, the overall goal and measures of success of the S/RS is in terms of FEKT. It is essential to note that a KMS S/RS can only facilitate and enable knowledge transfer, not cause such a transfer. Of course, the actual transference of knowledge is much more complex than simply ensuring the recipient has new knowledge available and involves other factors such as knowledge distance, mental models, need for knowledge, and many more factors that are not investigated here, as the actual transference of knowledge is beyond the scope of this research. As discussed in the study,

an extensive literature review and analysis yielded 18 CSFs, which were identified and mapped to one of four categories, or clusters (which will be the term used throughout the remainder of this study in relation to these four categories): Strategy and Leadership; Culture; People; and Information Technology (or Technology), as proposed by Yeh et al.'s (2006) taxonomy for KM CSFs. The four clusters are composed of multiple interrelated and interdependent CSFs that may individually affect each of the six success constructs described above. For example, the Technology cluster is comprised of four CSFs (*IT and Organizations Strategies Aligned*, *Competence of Technology Teams*, *Effective Technological Infrastructure*, and *Usability*) that, to some degree, influence each of the six success constructs. In addition, these Technology CSFs may or may not directly or indirectly influence other CSFs within the Technology cluster (i.e., internally). Finally, these Technology-related CSFs may also influence CSFs within the Strategy and Leadership, Culture, and People clusters (i.e., externally).

With respect to CSF research in KM, there are streams of research that have identified and empirically tested CSFs related to industry-specific KM adoption (e.g., Egbu, 2004; Lin and Lin, 2006); product innovation (e.g., Chen and Huang, 2007; Mercado, 2010); country-specific implementation issues (e.g., Valmohammadi, 2010); and small-and-medium enterprise (SME) adoption of KMS (e.g., Toloie-Eshlaghy and Akbari-Yusefvand, 2011; Wong and Aspinwall, 2005); to name a few. As previously mentioned, CSF identification for the KMC at the macro level has been explored by several researchers. At the micro level of the KMC (i.e., the individual dimensions), there is a developed research stream on CSFs for both knowledge creation and knowledge transfer (e.g., Ismail Al-Alawi et al., 2007; Cummings and Tend, 2003; and Szulanski, 2000), but

there is a much smaller stream directed at the CSFs relevant to the knowledge application. More importantly for this study, research is not widely available that specifically relates to identifying/prioritizing CSFs for the knowledge storage/retrieval dimension and the supporting S/RS in FEKT (i.e., micro-level analysis). This research addresses this research gap and adds to the general body of knowledge of KM by identifying and prioritizing the factors (CSFs) that positively influence the success of the S/RS in FEKT.

Of equal interest, existing CSF research in KM has generally assumed an independence of factors and constructs and has used research and statistical methods where this independence was assumed and/or required. However, this present study assumes internal and external interdependencies and interrelationships both between and within CSF clusters and between several of the success model's constructs. Correctly addressing the expected interdependencies among factors and constructs requires an appropriate research methodology that is capable of handling this complexity. To address this complexity, the Analytical Network Process (ANP), a Multiple Criteria Decision Making (MCDM) methodology, borrowed from Operations Research and Operations Management, is employed to both prioritize the constructs of success of a KMS S/RS in FEKT and to prioritize the specific factors (CSFs) that are most critical to success.

1.5 Importance of this Research

The KBV of the firm suggests that while individuals develop knowledge, the firm has a critical role in communicating and applying knowledge through coordinating and integrating efforts and further, the creation of mechanisms for knowledge creation and transfer are the primary reasons for the existence of the firms (Ismail, 2012). Practicing

KM professionals have realized that a key driving force in launching knowledge management efforts is the competitive advantage that knowledge assets provides (Richter et al, 2013). Despite addressing numerous KM processes and technologies, the vast majority of organizations implementing an organization-wide strategy for knowledge transfer have failed to realize any improvement in performance or develop core competencies. Reasons for this failure or difficulty may include problematic technology implementations, the acceptance of technology into the workplace, failure of knowledge search/discovery technologies, informal knowledge transfer, organizational culture, lack of support, and failure to meet goals, among others (Basten et al, 2015; Davison et al, 2013; Ko and Dennis, 2012; Malhotra, 2005; Sherif and Sherif, 2008). Dulipovici and Robey (2013) and Holsapple and Joshi (2000) propose that some practitioners and researchers believe that knowledge resources matter more than traditional organizational resources; as such, to maintain organizational agility, knowledge "must be managed explicitly, not left to fend for itself..." and knowledge managers "...can benefit from an understanding of the factors, including managerial, financial, and environmental, that influence the success of knowledge management initiatives." Consequently, a primary focus of this present study is in understanding the facilitators of the successful management and operation of the S/RS in FEKT. As a technological component of a KMS, the S/RS serves to support the numerous activities and processes associated with the knowledge storage/retrieval dimension of the KMC. Additionally, success of the S/RS is a primary goal of most KMS to increase efficiency of knowledge transfer, preserve organizational knowledge, restore such assets (when needed), and break up or prevent knowledge silos (Richter et al, 2013). In addition to the important role that

knowledge S/RS play in the support of the processes of the knowledge storage/retrieval dimension within the KMC, both researchers and practitioners are interested in newer uses of KMS. This has spawned a renewed interests in the success of knowledge S/RS. For example, the proliferation of large-scale knowledge bases and knowledge sharing communities, as well as the advent of knowledge vaults, rely heavily upon the successful operation of individual knowledge S/RS (Dong et al, 2014; Shen et al, 2015). Finally, central to this research is the understanding that real-world factors and constructs are interdependent and interrelated elements that require an appropriate research methodology capable of addressing such dependencies.

From the perspective of a practitioner and/or organization, knowledge that is not retained in some type of persistent repository is continually recreated, or worse, entirely forgotten. This study is relevant to the KM practitioner as it directly addresses the success of an underlying sub-system of a KMS – the S/RS – that supports the retention of organizational knowledge. While an organization's ultimate goal of the KMS is in the application of knowledge, the application of knowledge must be preceded by knowledge transfer among employees, which is directly supported by the knowledge S/RS. Richter et al.'s (2013) literature review points out the importance of the S/RS component of a KMS; these scholars have discovered that "the creation of knowledge repositories, the facilitation of access to knowledge and knowledge sharing and the articulation of knowledge" is the *raison d'etre* for most organizations' KMS efforts. From a KM practitioner's perspective, employee churn is created as employees retire or leave organizations to take up positions in other organizations. This creates a great need to capture and store employee knowledge for later transference (i.e., knowledge storage and

retrieval), or it may permanently disappear from an organization and forever remain in the minds of former employees. Therefore, the focus of this current study – the prioritization of S/RS success constructs and the CSFs influencing success of this KMS component – is important in supporting the capture, retention, curation, and dissemination of organizational knowledge to prevent the waste of valuable organizational resources and loss of opportunities for competitive advantage when attempting to recreate/reinvent both past and extant knowledge.

1.6 Theoretical Lens

This research draws upon five distinct theoretical underpinnings: the knowledge-based view of the firm (KBV), Alavi and Leidner's (2001) knowledge management framework, Rockart's critical success factor (CSF) theory, the Yeh et al. (2006) KM CSF taxonomy, and the DeLone and McLean (2003) model for IS success.

The KBV asserts that knowledge assets are key sources of resilient sustainable competitive advantage and innovation within organizations. Alavi and Leidner (2001) establish a strong research relationship between the IS and KM domains. In addition, the Alavi and Leidner four-dimensional KM framework, based on the view of organizations as social collectives and knowledge systems, provides the foundation for knowledge flow along a KM chain. Rockart (1979), expounds the view of critical success factors as "the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization." In the context of KMS implementations, the CSFs are the necessary conditions that managers must vigilantly monitor to facilitate a successful system implementation. Yeh et al. (2006) provide a taxonomy or classification of similar CSFs for KM success that is useful for reducing the factor

dimensionality of the success model. Presently, the four classifications proposed by Yeh et al. (2006) form the basis for the clusters of factors used in the ANP model. Finally, as a special type of IS, the factors of success for the S/RS of a KMS are assessed using a modification of the DeLone and McLean (2003) IS success model that takes into account the complexity associated with a KMS S/RS by including additional relationships between constructs to model this complexity.

1.7 Research Questions

The success of a KMS S/RS can be defined in three different manners: 1) success in respect to facilitating the creation of new knowledge through KDD, 2) success viewed in terms of the processes that define S/RS without regard to knowledge flows in either direction (i.e., without concern for supporting knowledge creation or supporting knowledge transfer), and 3) success defined in terms of facilitating and enabling knowledge transfer. It is important to note that this current research examines the KMS S/RS success from the perspective of furthering the flow of knowledge along the KMC by FEKT. This research is, therefore, limited to examining success for S/RS with respect to FEKT. Furthermore, the set of CSFs and (most probably) the degree of importance of both the CSFs and the success constructs used in this study would be quite different if success were examined from either of the first two perspectives of S/RS success mentioned above.

Specifically, this research identifies and prioritizes both the constructs of success of the KMS S/RS, as well as the CSFs influencing these constructs (where success of the S/RS is defined in terms of FEKT). The primary research questions addressed in the study are:

- 1) What are the multidimensional, interrelated, and interdependent constructs that define S/RS success with respect to FEKT?*
- 2) Which of the S/RS success constructs are most important in FEKT (i.e., what are the priorities of the success constructs)?*
- 3) How much more important are the highest influencing success constructs when compared to the other success constructs in ensuring S/RS success in FEKT?*
- 4) What are the set of CSFs that influence S/RS success in FEKT?*
- 5) Which of the critical success factors are most important to the success of an S/RS in FEKT (i.e., what are the priorities of the CSFs)?*
- 6) How much more important are the highest influencing CSFs when compared to the other CSFs in supporting S/RS success in FEKT?*

These principal research questions focus on identifying success factors and success constructs, ranking them in order of influence, and determining the strength of their influence. Equally important, this research embraces the idea that real-world factors and constructs are often interrelated and interdependent and therefore, utilize the ANP – still a relatively new research approach in IS and KMS research – as an appropriate research methodology to capture this complexity. From a KM practitioner’s perspective, this research identifies and prioritizes the constructs of success, as well as the CSFs which organizations must pay particular attention to in order to ensure that knowledge flow is enabled by the KMS's S/RS (i.e., making knowledge available when, where, and how it is needed for the appropriate target audience).

1.8 Significance

This study adds to the general body of knowledge for KM research and practice by identifying and prioritizing CSFs and success constructs that are relevant to the knowledge storage/retrieval KMC dimension and, in particular, to the underlying success of the KMS S/RS in FEKT. Furthermore, this evaluation or prioritization was performed by KM experts that judged the relative influence of the both CSFs and success constructs. This storage/retrieval dimension of the KMC and the supporting KMS S/RS is also of interest to IS researchers because of the heavy reliance on IS and IT for facilitating and enabling the codifying, storing, searching, and delivering of knowledge content to knowledge workers. Additionally, organizational KM practitioners will benefit from the normative quality of the success model, the prioritization of success constructs, and prioritization of success factors; these can be used to inform organizations of the most efficient and effective use of the limited and valuable organizational resources in order to facilitate successful KM efforts.

With respect to methodological significance, prior research has used analytical techniques such as structured equation modeling (SEM), confirmatory factor analysis (CFA), regression analysis, case study analysis, meta-analysis, and more recently, the analytical hierarchical process (AHP) to evaluate success factors for KMS (Ismail Al-Alawi et al., 2007; Chua and Lam, 2005; Heisig, 2009; Kazemi and Allahyari, 2010; Wong and Aspinwall, 2005; Zaim et al., 2007). Whereas these techniques generally assume an independence of factors, this study posits that there exist interdependencies among factors. For example, lack of *Top Management Commitment and Ongoing Support* can affect the amount and level of *Employee Training* or lead to eliminating or

restricting budget funding supporting *Dedicated Staff and Leadership*. Similarly, the degree of a *Mutually Trusting Environment* will have an effect on *Willingness to Share Knowledge*, and possibly, vice versa. The analysis of such interrelated factors requires an analytic technique, such as the ANP, that allows for, and assumes, interrelationships between factors and constructs. Recently, multiple criteria decision-making (MCDM) methodologies, such as the AHP and the ANP, have been slowly introduced into KM research analyses. For example, MCDM techniques have been used in identifying optimal choice of KM strategies, KM adoption, KM assessment by SMEs, and the identification of a KM framework (Hung et al., 2011; Kazemi and Allahyari, 2010; Wu, 2008; Wu and Lee, 2006). The ANP is generally a methodology used to rank alternatives in decision-making by using the judgment of experts to perform pairwise comparisons of the components or factors of the model where there are multiple and complex criteria—criteria which may have interdependencies both within and between clusters of criteria. The use of the ANP in this study represents a relatively new research approach in KM research; furthermore, the ANP is used here in a rather unique manner to prioritize and weight success constructs for S/RS success.

CHAPTER II

LITERATURE REVIEW

2.1 Data-Information-Knowledge

Just as data are the basic focal unit under control in a database management system (DBMS) and information is the focus of an IS, knowledge is central to a KMS. To understand the unique qualities required of a KMS, it is necessary to differentiate between data, information, and knowledge. *Data* are described as collections of unprocessed raw facts, figures, and/or observations about some event, condition, or situation that require(s) little human judgment. As representations of observations or facts, data taken out of context have no inherent meaning (Alavi and Leidner, 2001; Davenport and Prusak, 1998; Grover and Davenport, 2001; Kakabadse et al., 2003; Nold, 2011; Nonaka, 1994; Zack, 1999). *Information* is described as flows of messages or meanings that can be codified and presented in text, graphics, words, or other symbolic forms, delivered through a variety of mechanisms (including but not limited to

documents, audible or visual communication, and information systems), containing syntactic and semantic structures that are organized to give relevance and purpose within certain contexts (Alavi and Leidner, 2001; Davenport and Prusak, 1998; Dretske, 1981; Grover and Davenport, 2001; Nold, 2011; Nonaka and Takeuchi, 1995; Tuomi, 1999). Davenport and Prusak (1998) refer to information as "data that makes a difference." This conversion of data to information involves processes such as transference, classification, calculation, categorization, summarization, correction, contextualization, transformation, and condensation of data to add value and become information. However, these processes bind information to a certain context by adding details such as place and time; therefore, the information has utility only within the specific context (Davenport and Prusak, 1998; Grover and Davenport, 2001; Suppramaniam et al., 2012). The epistemological debates surrounding knowledge are not discussed here, as defining knowledge in terms of the "search for universal truth" or "justified true belief" are not driving factors in KM research or practice (Alavi and Leidner, 2001). Instead, more pragmatic definitions of knowledge – informed by the idea of knowledge within the framework of KM research – are explored. Awad and Ghaziri (2004) support the idea that the definition of knowledge remains contextually constrained by the research domain, stating quite simply: "Knowledge has different meanings, depending on the discipline where it is used." From an IS perspective of KM research, *knowledge* has been variously defined as: 1) information processed in the minds of individuals, 2) personalized information, 3) the capability to use information, 4) information sufficient to act upon, 5) being created by a flow of information that is anchored in the "beliefs and commitment of its holder", 6) a condition that provides access to information, and 7) information that has undergone a

cognitive process within the minds of individuals that enrich and transform it into knowledge through comparisons, consequences, connections, conversations, experiences, expertise, and judgment (Alavi and Leidner, 2001; Connell et al., 2003; Davenport and Prusak, 1998, Grover and Davenport, 2001; Jasimuddin et al., 2012; Nissen, 2002; Nonaka, 2004; Nonaka and Takeuchi, 1995; Tuomi, 1999). These definitions generally imply that knowledge stems from information that is, in some way, cognitively processed and transformed to elevate it to a position of higher value to individuals and organizations than just data or information.

2.2 Knowledge Management

Knowledge management is multidimensional and interdisciplinary in nature, whose users include interested individuals from business management, information systems, economics, computer science, philosophy, sociology, economics, engineering, artificial intelligence, and human resource management domains (Awad and Ghaziri, 2004; Lloria, 2008; McAdam and McCreedy, 1999; Meihami and Meihami, 2014). Given this heterogeneous range of interests, it is not surprising that there is no comprehensive, universally accepted definition of KM because existing definitions are often contextualized by specific reference disciplines (Awad and Ghaziri, 2004; Lloria, 2008; Jennex, 2005a; Ortiz-Laverde et al., 2003). The understanding of KM, as explicated by a singular or particular definition or perspective, determines the boundaries of what researchers form as guiding tenets. For example, the adoption of a view of KM that emphasizes technology might focus a researcher on the use of advanced IT, such as data mining, databases, AI, and communication systems. Likewise, the same researcher might concentrate on the associated KM processes, which are focused on the codeability of

knowledge and access to KM through groupware and intranets (Andreu and Sieber, 1999; Lloria, 2008). On the other hand, definitions and perspectives of KM that focus on what may be referred to as the softer domains (such as organizational behavior, industrial psychology, or sociology) center the researcher and practitioner on human, social, cultural, psychological, and trust issues. In this way, KM processes might address reducing organizational barriers that inhibit knowledge sharing or implementation of incentive and reward systems that encourage knowledge flow within an organization (Argot et al., 2003; Earl, 2001; Lloria, 2008). The literature makes a strong argument for a holistic view of KM in terms of the management of people, culture, structure, technology, and processes required to acquire, create, store, transfer, measure, maintain, deploy, and protect knowledge and intellectual assets. This allows the opportunity to create competitive advantage, increase competitiveness, generate greater revenues, enhance organizational efficiency and effectiveness, achieve strategic goals, and improved problem-solving capability and decision-making (Alavi and Leidner, 2001; Lehaney et al., 2003; Ajmal et al., 2010; Barcelo-Valenzuela et al., 2008; Davenport and Prusak, 1998; Dayan and Evans, 2006; du Plessis, 2007; Earl, 2001; Hasanali, 2002; Holsapple and Joshi, 2000; Jennex, 2005a; Lloria, 2008; Rubenstein-Montano et al., 2001; Takeuchi, 2001). However, because the literature is varied, little is documented in detail regarding what should be managed, including the level or degree of management controls put in place. At one end of the research spectrum, a minimalist perspective of management is adopted by researchers: the role of physically managing knowledge is entirely missing in the researchers' definitions or perspectives of KM, and KM is perceived as a series of process-centric activities such as the KMC (i.e. creating, storing,

retrieving, transferring, and using knowledge) or codifying explicit knowledge (Argote et al., 2003; Brooking, 1996; Hersey, 2000; Hibbard, 1997). Other researchers, such as Zeleny (2002), espouse a centrist view of KM based upon the premise that knowledge is a process and that KM should be much less about managing knowledge as an object and much more about managing the knowledge *processes* (Zeleny refers to this as "knowledgement"). A third group of researchers and practitioners have taken a more holistic perspective of KM, putting forth the notion of KM as the active management of the knowledge and intellectual organizational assets as well as the requisite organizational infrastructures such as IT, IS, and communication and network systems. This view also explicates the necessity to actively foster and nurture cultural and trust issues within organizations that are necessary for knowledge flows, which are not directly controllable through management but rather enabled by management (Alavi and Leidner, 2001; Awad and Ghaziri, 2004; Burstein and Linger, 2003; Davenport and Prusak, 1998; Grover and Davenport, 2001; Holsapple and Joshi, 2004; Jennex, 2005a; Lehaney et al., 2003; Lloria, 2008). Moreover, this holistic, Churchmanian view of KM allows for the design of a KMS to take whatever form necessary to accomplish KM goals (du Plessis, 2007; Jennex, 2005a; Jennex and Zakharova, 2005; O'Dell and Grayson, 1999; Parlby and Taylor, 2000).

2.3 Knowledge Management Systems

KMS are the physical realizations or operationalizations of KM concepts. The design of KMS are guided by the specific perspectives of KM adopted; therefore, the success of a KMS is a reflection of the success of KM for an organization. Alavi and Leidner (2001) posit that a KMS is a special class of IT-based system that both facilitates and enables the

creation, storage, retrieval, transference, and application of knowledge assets. Further, there is a tendency to focus KMS on a technological solution that stores and disseminates explicit knowledge with the goal of getting knowledge to the right individuals at the right time. In fact, the first step into KM by most organizations involves technology because a solid technology infrastructure is a necessary condition for KM success (Davenport and Prusak, 1998; Hasan and Crawford, 2007). Clearly, information and communication technologies (ICT) are ideal for codifying, storing, and delivering knowledge within an organization, and the deployment of these technologies are achievable goals, given the appropriate resources (Nold, 2011). Specialized information technologies have been integrated into KMS such as: software knowledge codification agents (Datta and Acar, 2010); computer-mediated communication such email, instant messaging (IM), chat (multi-participant IM), VOIP, and video conferencing (Schwartz, 2007); virtual communities of practice (Fahey et al., 2007; Wenger et al., 2002); and wikis, groupware, and other Web 2.0 technologies (O'Dell and Hubert, 2011). However, the literature also cautions that a KMS is not solely an IT solution, suggesting that KMS are more complex and require both social and technical factors (Alavi and Leidner, 2001; Ciganek et al., 2008). Jennex and Olfman (2008) provide a comprehensive and holistic view of KMS: "... a KMS is a system that includes IT/ICT components, repositories, user, processes that use and/or generate knowledge, knowledge, knowledge use culture, and the KM initiative with its associated goals and measures."

Researcher(s)	Knowledge Management Process Dimensions
Alavi and Leidner (2001)	creation, storage/retrieval, transfer, and application
Becerra-Fernandez et al. (2004)	discovery, capture, sharing, and application
Bhatt (2001)	creation, validation, presentation, distribution, and application
Cepeda and Vera (2006)	creation, capturing, retention, and utilization
Cricelli and Grimaldi (2010)	identification, creation, storage, sharing and distribution, application, capitalization, and refinement
Davenport and Prusak (1998)	generation, codification and coordination, transfer, and roles and skills
Gottschalk (2008)	creation, capturing, sharing, distribution, and understanding
Grover and Davenport (2001)	generation, codification, and transfer/realization
Hoffmann (2001)	create, store, distribute, and apply
Jashapara (2004)	organizing, capturing, evaluating, sharing, storing, and presenting
Johnson and Blumentritt (1998)	identification, capture, diffusion, embodiment, realization, utilization/application
KPMG (2000)	capturing, storing, diffusing, and use
Maier (2004)	discovery, publication, collaboration, and learning
Mathews (2008)	capturing, analyzing, integrating, gaining and learning from knowledge, and disseminating and sharing
Nonaka and Takeuchi (1995)	creation, saving and acquisition, spread, and application
Peachey et al. (2005)	creation, storage/retrieval, transfer, application, knowledge roles and skills
Probst et al. (2002)	identification, acquisition, development, distribution, utilization, preservation, determining goals, and knowledge assessment
Rao (2005)	creation, codification, retrieval, application, distribution, validation, tracking, and personalization
Rastogi (2000)	identification, mapping, capturing, acquiring, storing, sharing, applying, and creating
Robinson et al. (2001)	discovery, locating, capturing, organizing, storing, sharing, transferring, modifying, applying, archiving, and refinement
Rollett (2003)	planning, creating, assessing, integrating, organizing, transferring, and maintaining
Sarvary (1999)	organizational learning, knowledge production, and knowledge distribution
Tan et al. (2006)	capture, sharing, reuse, and maintain
Tannebaum and Alliger (2000)	sharing, accessibility, assimilation, and application
Tiwana (2002)	finding, creating new, packaging, assembling, reusing, and revalidating knowledge
Wong and Aspinwall (2004)	acquiring, organizing, sharing, and applying
Zack (1999)	acquisition, refinement, storage and retrieval, distribution, and presentation

Table 1. Knowledge Management Process Models

2.4 Knowledge Management Cycle / Frameworks

In the literature, researchers have proposed various collections of tasks and KM processes that are “necessarily loose and collaborative” in nature (Allee, 1997;

Baskerville and Dulipovici, 2006). This process-based perspective of KM provides both descriptive and normative models, which focus organizations and researchers on end-to-end knowledge flows and allow for the systematization of the KM processes (Cricelli and Grimaldi, 2008; Guns and Valikangas, 1998; Mehta, 2007). The dimensions of the KMC, and the core processes contained within, are both complex, intertwined, and interrelated as they are often recursive, dynamic, and discontinuous (Alavi and Leidner, 2001; Grover and Davenport, 2001; Saito et al., 2007). Further adding to this complexity, multiple dimensions (i.e., knowledge creation, storage/retrieval, transfer, and application) of the KM process exist simultaneously; and many cycles and iteration of the processes contained both within and across each dimension of the KMC occur concurrently within organizations (Grover and Davenport, 2001; Tan et al., 2006). These groups or collections of interrelated processes constitute what this research refers to as the KMC. The KMC has been variously titled in the literature with such labels as a systematic framework (Alavi and Leidner, 2001; Raisinghani and Meade, 2005), knowledge refinery process (Zack, 1999), KM activities (Sarvary, 1999), knowledge life-cycle (Evans et al., 2015), knowledge/learning cycle (Mathews, 2008), KM process (Tiwana, 2002; Johnson and Blumentritt, 1998), building blocks of KM (Probst and Romhardt., 1997), and even as engineering processes (Becerra-Fernandez et al., 2004). From the KM research literature, the author identified 27 frameworks/models that define the processes constituting the KMC (see Table 1).

Among these frameworks and models, there are some common ideas or themes that emerge that are of interest to KM researchers and practitioners: 1) KMC dimensions (e.g., acquisition, creation, transfer, etc.) are comprised of multiple interrelated KM activities,

2) many of these models can be reduced to the activities of knowledge creation, storage, retrieval, transfer, and application, and 3) at any given time within an organization, there are multiple instances of KM activities occurring simultaneously within and across the KMC dimensions. As an example of the first theme, the knowledge creation dimension can include multiple interrelated knowledge processes such as: 1) creating the arena or environment needed for discourse where knowledge is created (Nold, 2011; Nonaka and Konno, 1998; Hautala, 2011); 2) implementing knowledge discovery applications (Mehta, 2007); 3) adapting externally acquired knowledge for future use in knowledge creation (Holsapple and Jones, 2004); 4) motivating employees to use the KMS (Kaiser et al., 2009); 5) overcoming limited absorptive capabilities (Chou, 2005); 6) information acquisition (Ortiz-Laverde et al., 2003); 7) providing an organizational culture that fosters knowledge sharing (Chou, 2005); and 8) providing a KM mindset (Smith et al., 2010).

The second emergent theme among the many KM frameworks presently examined was the view of the KMC as a series of processes that included: 1) creation: creating knowledge or acquiring knowledge from internal and/or external sources, 2) storage: capturing, codifying, and storing knowledge artifacts in a knowledge repository, 3) retrieval: creating a mechanism for finding, retrieving, and presenting knowledge how, when, and where it is required, 4) transference: the transference of knowledge within or perhaps, between organizations, and 5) application: ultimately applying this knowledge within the organization. One well-accepted model of the KMC that adheres to this general schema is the Alavi and Leidner (2001) KM framework. This KMC model is perhaps the most commonly adopted and referenced model in both research and in

practice. While the actual number of dimensions among the KMC models varies (as seen in Table 1), many of these additional dimensions reflect divisions of the major KMC processes described above. For example, *identification* (Cricelli and Grimaldi, 2010; Johnson and Blumentritt, 1998; Probst et al., 2002), and *finding* or *discovery* (Becerra-Fernandez et al., 2004; Maier, 2004; Robinson et al., 2001; Tiwana, 2002) can be considered processes encompassed in the creating/acquiring dimension. Likewise, *retention* (Cepeda and Vera, 2006), *codification* (Davenport and Prusak, 1998; Rao, 2005), *presenting* (Jashapara, 2004; Zack, 1999), *publication* (Maier, 2004), and *distribution* (Bhatt, 2001; Cricelli and Grimaldi, 2010; Gottschalk, 2008; Hoffmann, 2001; Probst et al., 2002; Rao, 2005; Sarvary, 1999; Zack, 1999) are sub-processes of either the storage or retrieval dimensions described above. The Alavi and Leidner model of the KMC, consisting of creation, storage/retrieval, transfer, and application, is attractive in its parsimony and in coverage of the processes related to the KMC. This model presents a system of "socially enacted knowledge processes" that defines both the cognitive and social nature of organizational knowledge that consists of "distinct but interdependent" dimensions and describes organizations as social collectives and knowledge systems (Alavi and Leidner, 2001).

The third emergent idea among the models is that in practice, organizations engaged in KM generally have multiple instances of KM activities occurring simultaneously within and across the KMC dimensions (Alavi and Leidner, 2001; Davenport and Prusak, 1998; Nonaka, 1994; Pasher and Ronen, 2011). For example, within an organization, there may be several employees engaged in the various processes related to knowledge creation/acquisition such as post-project debriefings and story-telling; KMS experts busy

updating, pruning, evaluating and re-evaluating, and maintaining existing knowledge assets; and, knowledge workers searching knowledge-based web portals and consulting social network analysis (SNA) directories to identify domain expertise. At the same time, there also may be experienced senior employees coaching and mentoring junior associates in organizational best-practices, knowledge experts participating in virtual communities of practice (CoP) to share industry knowledge, and, marketing management experts collaborating on how to best use their organizational resources to reach a new market (Davenport and Prusak, 1998; Jennex, 2005b; Leistner, 2010).

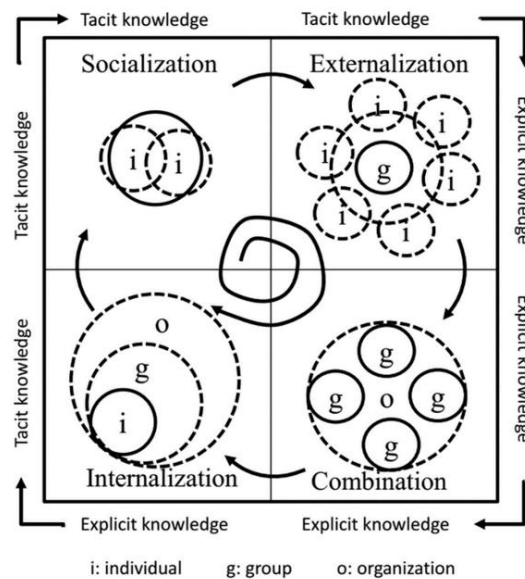


Figure 2. Nonaka and Takeuchi SECI Knowledge Creation Spiral (Nonaka and Konno, 1998).

2.4.1 Knowledge Creation Dimension

While Nonaka and Takeuchi (1995) posit that knowledge is created in individuals, within the context of KM, knowledge creation can be thought of as the processes that support and amplify the knowledge created by individuals and crystallize it within the context of an organization (Ortiz-Laverde et al., 2003). Furthermore, knowledge creation involves developing new content and replacing existing content in regard to both explicit and tacit organizational knowledge (Alavi and Leidner, 2001; Pentland, 1995).

Khodakarami and Chan (2014) relate that organizational knowledge creation theory is premised on the interaction between explicit and tacit knowledge and leads to creation of new knowledge. Furthermore, this perspective supports the well-established model of socialization, externalization, combination, and internalization (SECI), proposed by Nonaka and Takeuchi (1995), which explains how knowledge is created within organizations through a four-stage process that involve the interplay of explicit and tacit knowledge (Khodakarami and Chan, 2014). Briefly, the SECI spiral model (as seen in Figure 2) is based on: 1) *socialization*, or sharing tacit knowledge through social interaction, 2) *externalization*, which converts tacit knowledge to explicit knowledge that can more easily be shared within an organization, 3) *combination*, which integrates various sources of explicit knowledge and creating new explicit knowledge, and 4) *internalization*, which creates tacit knowledge from explicit knowledge (Nonaka and Takeuchi, 1995). Alavi and Leidner (2001) note that knowledge can be created which is either new to the organization, or is not new to the organization, but is new to individuals within the organization (i.e., individual learning).

Various processes that comprise the knowledge creation dimension of the KMC have been identified in the literature. These processes can include:

- the facilitation of knowledge sharing (Lin, 2006),
- knowledge conversion processes supporting SECI (Babu et al., 2012; Nonaka et al., 2000),
- support for both internal and external collaboration (Esterhuizen et al., 2012),

- identification of persons with appropriate knowledge and identification of sources of explicit knowledge that can be used to create new explicit knowledge (Bock et al., 2005; Esterhuizen et al., 2012);
- preparation and maintenance of an enabling space or "*ba*" for knowledge creation (Durgam and Sinha, 2014; Nonaka and Konno, 1998; Peschl and Fundneider, 2012);
- eliciting tacit knowledge from experts (Taylor, 2007);
- recombining, sorting, and categorizing of existing explicit knowledge to create new knowledge (Basten et al., 2015);
- data and web mining, OLAP, categorization, analysis, and structuring large amounts of data for knowledge discovery (Khodakarami and Chan, 2014);
- development and support for Web 2.0 technologies used for both internal and external collaboration (Durgam and Sinha, 2014); and
- knowledge discovery, capturing, sharing, codification, and searching (Dalkir, 2011; Meihami and Meihami, 2014).

2.4.2 Knowledge Storage/Retrieval Dimension

Organizations that create knowledge and learn also forget newly developed knowledge or lose track of acquired knowledge (Alavi and Leidner, 2001; Chou, 2005, Wei et al., 2013). Therefore, it is important to store, organize, refine, and make recoverable this organizational knowledge as part of an effective KMS. Additionally, it is also critical to reduce the cognitive burden of knowledge workers, and promote reuse and new use of organizational knowledge (Pasher and Ronen, 2011; Raghu and Vize, 2007; Wei et al., 2013). The storage/retrieval dimension of Alavi and Leidner's (2001) framework views

this dimension as the people, technologies, and processes that support organizational memory. Organizational memory (OM) includes the storage, organization, and retrieval of knowledge residing in various artifacts and components, which include databases, expert systems, and that which is "stored in the minds of organizational participants... that which has been acquired and retained by groups or teams and that which is embedded in the processes, products or services and its relationships with customers, partners and suppliers" (Alavi and Leidner, 2001; Meihami and Meihami, 2014). While researchers, such as Basten et al (2015), address a growing interest in examining knowledge storage systems and their underlying databases with respect to knowledge creation through data mining and knowledge discovery through databases or (KDD), the large share of the existing literature examining storage/retrieval has focused on the underlying culture, technologies, and processes that support OM through codification processes (storage) and knowledge access (retrieval). In fact, early research on knowledge repositories referred to such systems that supported OM as organization memory information systems or OMIS (Hackbarth and Grover, 1999; Markus, 2001). Notably, there is a distinction in an IS supporting OM from the traditional IS because KMS often involve human intervention beyond design and implementation phases. For example, in a traditional IS, the content and structure of the data is predefined and typically runs in an automatic mode; however, in a KMS, the content and structure must be evaluated and assessed by knowledge workers for its value, relevance, and importance (Meihami and Meihami, 2014). This difference is important in this research and requires a revision of the DeLone and McLean (2003) IS success model, which will be discussed later.

The existing storage/retrieval literature stream is relatively sparse, but is represented by researchers from a variety of reference domains outside of MIS. This literature has primarily focused on constructs relevant to supporting OM, including:

- the technology for storage, dissemination, and access of organizational information and knowledge (Chou, 2005; De Vasconcelos et al., 2003; Gunning, 2013; Leidner et al., 2006; Mariano and Casey, 2007; Suppramaniam et al., 2012);
- processes involved in the codification and classification of knowledge within the repository (Babu et al., 2012; La Brie and St. Louis, 2003; Markus, 2001);
- ontology, information retrieval, and search (Althoff et al., 2000; De Vasconcelos et al., 2003; Ju, 2006; La Brie and St. Louis, 2003; Raman et al., 2013);
- maintenance of the knowledge life cycle contained within the repository (Babu et al., 2012; La Brie and St. Louis, 2003); and
- management of the strategic, cultural, and human aspects as related to the social processes involved, and the reduction of barriers to success (Franco and Mariano, 2007; Gunning, 2013; Suppramaniam et al., 2012).

Finally, Quin and Bock (2005) present the only study closely related to this current research – analyzing knowledge reuse in successful knowledge repository systems – and adopt and modify a portion of DeLone and McLean 1992 success model (Use, User Satisfaction, and Individual Impact as dependent variables) without consideration of feedback mechanisms or additional complexities inherent in KMS.

Technology associated with the storage/retrieval dimension supports the actual storage of explicit knowledge and information (in the form of expertise) that is captured and stored as digital artifacts within relational databases, multimedia databases, data warehouses, case bases, personal hard drives, shared folders, document repositories, wikis, blogs, and other Web 2.0 technologies (Chou, 2005; De Vasconcelos et al., 2003; Gunning, 2013; Mariano and Casey, 2007; Markus, 2001). Additionally, technologies are used to support the transfer of tacit knowledge; but in this case, the technologies serve as corporate directories that provide knowledge consumers with access to experts, communication support systems, audio/video technologies for capturing and retaining face-to-face conversations, technologies supporting communities of practices, and technologies to reduce search costs (La Brie and St. Louis, 2003; Markus, 2001, Mariano and Casey, 2007; Suppramaniam et al., 2012). Also, such technologies are important in supporting the retrieval and dissemination of organizational knowledge, including enterprise portals, virtual communities of practice, document sharing services, share points, and intra- and internets (Chou, 2005; Franco and Mariano, 2007; Gunning, 2013; Mariano and Casey, 2007).

Codification and classification processes of organizational knowledge are particularly important in the ability to subsequently search for and access knowledge stored within a repository. Researchers have identified processes such as indexing, query formulation to predict an artifacts usefulness, relevance feedback, interactive retrieval, machine learning for classification, content architecture, abstraction, sorting, tagging, and knowledge representation (Althoff et al., 2000; Babu et al., 2012; De Vasconcelos et al., 2003; Gunning, 2013; Ju, 2006). Codification processes should be extremely sensitive as to the

representation of knowledge and its contextualization. Furthermore, the ultimate usefulness of the knowledge representation is dependent upon codification schemes taken from three perspectives: 1) knowledge codified for self, 2) knowledge codified for those with similar pre-existing knowledge bases, and 3) knowledge codified for consumers without a common existing knowledge base (Alavi and Leidner, 2001; La Brie and St. Louis, 2003; Markus, 2001). Closely related to the codification and classification process are those that address information retrieval, ontology, and search. To efficiently and effectively retrieve information and knowledge within electronic repositories, researchers have stressed the necessity to develop ontology that contains meta-information and knowledge descriptors in order to successfully search for and retrieve relevant knowledge from a repository (Althoff et al, 2000; De Vasconcelos et al, 2003; and Raghu and Vinze, 2007). Other researchers advocate for the importance of search tools, keyword usage, reduction of search costs, and supporting knowledge structures that permit efficient and effective searching (Franco and Mariano, 2007; La Brie and St. Louis, 2003; Mariano and Casey, 2007; Raman et al., 2013). Yet another set of processes directly related to storage and retrieval is the maintenance and possible retirement of existing knowledge stored within the repository. The processes involved can include pruning; the use of evaluating relevance feedback for knowledge artifacts in respect to relevance, pertinence, and innovative usage; and development of knowledge structures to support consumers with different levels of background knowledge (Babu et al., 2012; Davenport and Prusak, 1998; La Brie and St. Louis, 2003).

Finally, researchers have identified several possible barriers to the access and reuse of valuable organizational memory which require mitigation for a successful

implementation of a knowledge repository. First, Chou (2005), Franco and Mariano (2007), and Mariano and Casey (2007) stress the need to create an organizational culture that is receptive to knowledge sharing and KMS and their usage. Next, the preservation and management of knowledge assets should be at the corporate level, formalized IT practices should be employed to protect the knowledge assets, and the organization should be well-staffed to support these processes (De Vasconcelos et al., 2003; Suppramaniam et al., 2012). Lastly, fragmentation is problematic in respect to knowledge repositories; one centralized repository should be employed to reduce search, reduce maintenance, and promote more effective retrieval (Franco and Mariano, 2007; Ju, 2006; Maheswari and Duraiswamy, 2009).

2.4.3 Knowledge Transfer Dimension

Knowledge transfer generally describes the exchange of knowledge from a knowledge source to a knowledge recipient (Baskerville and Dulipovici, 2006, Decker et al., 2009). Effective knowledge transfer can lead to organizational learning, which results in associations, cognitive systems, and memories that are shared by the organization's members. The literature stream for knowledge transfer is both varied and vast. However, here, knowledge transfer is discussed in relation to the KMC and between individuals and organizational memory (and vice versa), where four types of knowledge transfer can be supported by IS: 1) the transfer of individual explicit knowledge to a group's semantic memory, 2) the transfer of a group's semantic memory to an individual, 3) the transfer of an individual's tacit knowledge to a group's episodic memory, and 4) the transfer of a group's episodic memory to an individual (Alavi and Leidner, 2001). Within this context, the role of IT would be to support and accelerate communication through channels via

technologies which enable knowledge flow between organizational episodic and semantic memory and individuals (Wei and Yeganeh, 2013). Still, communication and information system technologies, while facilitating knowledge flows, are not enough to ensure knowledge transfer. The lack of understanding of the human, social, and cultural aspects of knowledge transfer remain root issues in KMS failures (Decker et al., 2009; Sherif and Sherif, 2008).

There is a well-developed research stream concerning antecedents of knowledge transfer that is useful for this study. It is important to understand the factors that influence knowledge transfer to help enable and facilitate, where possible, knowledge transfer by way of support from the S/RS and processes. Goh (2002) identifies organizational culture, trust, and support structures, as well as recipient characteristics and knowledge type as important factors for effective transfer of knowledge. Computer-mediated communications (CMC) modalities were examined by Schwartz (2007) as barrier reductions for knowledge transfer based on the level of social presence, the level of naturalness, the level on context, and the level of media richness. These modalities included email, forum, portals, IM, chat, VOIP, and VVOIP including structured and unstructured text, images, video, and voice as information types. Decker et al. (2009) synthesized much of the prior research on knowledge transfer factors and presented a model of knowledge transfer that is based on factors associated with the knowledge source and the knowledge recipient, as well as moderating factors, such as the type of knowledge that is transferred and contextual factors. These factors include:

- Contextual factors – *politics, culture/learning culture, organization structure, other support structures, reward systems, training, technology, management*

techniques, law and technical regulations, knowledge articulability and embeddedness, knowledge distance, strength of tie between the source and receiver, size of the organization, senior management involvement, leadership;

- Recipient factors – *absorptive capacity, trust the source, motivation to transfer, the perceived need for knowledge, and mental models.*

Users' lack of knowledge about technology supporting the KMS, and how it can be used within the organizational setting, have also been identified as barriers to knowledge transfer that need intervention to overcome. As addressed by Paulin and Suneson (2012), it remains difficult to use a system if the knowledge of how to operate and control the system is lacking. Additionally, Feng et al. (2009) examine the use of expert systems in knowledge transfer and the issue of distance from the knowledge source to the recipient and propose the use of knowledge intermediaries where necessary. Directly related to the KMS's S/RS, Massey and Montoya-Weiss (2006) present a knowledge conversion process that highlights the important role of knowledge repositories and communication and discourse systems in transferring knowledge artifacts to consumers. Retrieval from knowledge sources (such as S/RS) involves a two-step process: searching and decoding. The success of knowledge transfer is dependent on how the knowledge is reconstituted, which may be limited by contextual specificity and lack of absorptive capacity. It is therefore necessary to ensure background context is provided with knowledge content in order to both find the knowledge and ensure the correct decoding or interpretation of the knowledge obtained (Gammelgaard and Ritter, 2005). Furthermore, Gammelgaard and Ritter (2005) suggest that as the complexity of the knowledge increases and where the distance from the source is great, the more the reliance on social interactions becomes

necessary to decode and contextualize the knowledge for effective transfer. Therefore, the concept of what is referred to as weak and strong ties, and their relationship to personalization and codification, is also important in knowledge transfer. Weak ties refer to infrequent and distant relationships between individuals and are useful for searching and scanning for information, whereas strong ties cover close, frequent, and long-lasting personal relationships, which are needed to transfer complex or sticky knowledge, since the encode/decode process is difficult with communication technologies (Gammelgaard and Ritter, 2005; Granovetter, 1972; Hansen, 1999; Huber, 1991; Steensma and Corley, 2000). For firms where there are large geographic distances between sources and recipients, virtual CoPs and other advanced communication technologies (e.g., wikis, portals, VOIP, virtual conferencing, etc.) may be required to facilitate the socialization required for complex knowledge transfer (Gammelgaard and Ritter, 2005; Schwartz, 2007). More recently, Jasimuddin et al. (2012) argue, in opposition to the Alavi and Leidner KMC model, that storage/retrieval should not be considered separate from knowledge transfer. Furthermore, they propose that it is appropriate for organizations to use information and communication technologies, such as Lotus Notes, to support an integrated knowledge storage and transfer approach.

2.4.4 Knowledge Application Dimension

According to the knowledge-based view of the firm, it is not knowledge as such but rather the application of knowledge that is a source of competitive advantage (Grant, 1996). Transferred knowledge can be applied to new situations and contexts, increase innovation, and lead to project success, alliance success, firm performance, and firm survival (Evans et al., 2015). However, while knowledge can be created, stored,

retrieved, and assimilated, it is not necessarily the case that the knowledge will actually be applied (Alavi and Leidner, 2001). This is problematic because KM is an action-oriented discipline, indicating that knowledge must be applied and used to have an impact (Jennex and Olfman, 2008). In fact, Jennex (2005a) actually defines KM as "the practice of selectively applying knowledge from previous experience of decision making to current and future decision making activities with the express purpose of improving the organization's effectiveness." Chua and Lam (2008), drawing from Markus (2001), define knowledge reuse based on the application of knowledge, which may involve a "recontextualization" of the knowledge gained from general principles from a KMS to a specific situation where it is applied by four different types of "situations" or users: shared work producers, shared work practitioners, expertise-seeking novices, and secondary knowledge miners.

The main impetus for many KM efforts has been performance improvements, sharing of best practices, less need to reinvent, enhanced productivity, improved customer service, and cost reduction efforts (Chua and Lam, 2008; Gallivan et al., 2003; Repenning, 2002; Hansen et al., 1999). In contrast, a limited number of cross-sectional empirical studies have found the opposite; that is, the use of a KMS decreases performance (Ko and Dennis, 2012). However, unlike traditional IS that are used to accomplish specific tasks, KMS are one step removed. Quite simply, this means that KMS are used to acquire knowledge on how to accomplish tasks and not to perform the tasks itself. The benefits may be difficult to directly observe, and furthermore, it does not seem reasonable that using, reusing, and sharing of organizational knowledge should result in negative results. Ko and Dennis (2012) performed a longitudinal study and,

indeed, found a delayed but positive impact on individual performance. They further found that this impact was initially higher for more experienced knowledge workers but eventually converged with the positive performance of less experienced knowledge workers over time.

Alavi and Leidner (2001) posit that technology supports the application of knowledge by embedding knowledge into business process and organizational routines. Knowledge application or reuse was examined through the lens of expectancy theory by Watson and Hewett (2006), where they explained the facilitation of knowledge reuse by the belief that: 1) the reuse of knowledge could solve the problem at hand, 2) this knowledge could be obtained, and 3) the knowledge accessed was of value. Also, three mechanisms were identified by Grant (1996) that allow for the integration of knowledge to create organizational capabilities: directives, organizational routines, and self-contained task teams. Applications based on directives are characterized by the conversion of experts' tacit knowledge into efficient communications for non-specialist or non-experts. Organizational routine knowledge applications involve task performance and task coordination, interaction standards, and process specifications that allow individuals to integrate their own specialized knowledge without having to communicate it with others (Alavi and Leidner, 2001).

2.5 Knowledge-Based View of the Firm

A fundamental issue that is often dealt with in both strategic management literature and at tables within boardrooms is how a firm can create and sustain competitive advantage (Mehta, 2007). Knowledge assets and intellectual capital represent one of the most important and sustainable competitive advantages available to firms. Unlike

tangible assets such as natural resources, machinery, and equipment (which rarely are primary modern-day drivers of sustainable competitive advantage), knowledge assets bring about a positive-sum, increasing-returns characteristic that both expands and increases in value as they are utilized and shared within an organization (Davenport and Prusak, 1998; Nonaka, and Takeuchi, 1995; Zhang, 2007). Given the strategic significance of knowledge, the management of knowledge is critical to the success of an organization. The resource-based view of the firm (RBV) asserts that assets or capabilities that are rare (i.e. hard to accumulate and heterogeneously distributed), difficult to transfer and accumulate, valuable, appropriable, non-substitutable, not consumed through its use, and inimitable, can result in sustainable competitive advantage for a firm (Barney, 1991; Conner and Prahalad, 1996; Grant, 1996; Penrose, 1959; Schiuma, 2009; Teece, 2000). Penrose (1959) describes firms as bundles of heterogeneously distributed capabilities and resources and that those firms who possess resources and capabilities that cannot be copied and disentangled from the firm's other complementary assets provide the firm with a sustainable competitive advantage. The knowledge-based view of the firm (KBV) further extends the ideas of the RBV and proposes knowledge as the most valuable of organizational assets (Nonaka and Takeuchi, 1995; Zhang, 2007).

The KBV was developed to study and explain the competitive implications of a firm's knowledge assets. Knowledge assets can be viewed as organizational differentiators capable of producing a sustainable competitive advantage; and organizations must be clear in designing initiatives that manage and capitalize on these knowledge-based assets (Teece, 2000). The KBV brings to light the criticality of resources required for

competitiveness and that knowledge-based resources and knowledge processes play an ever-growing role in both expanding and enhancing organizational performance (Alavi and Leidner, 2001; Schiuma, 2009). Regarding the KBV of an organization, knowledge assets are "cognitive artifacts" that are organizational resources comprised of knowledge, or representing knowledge, that frame the knowledge domains of the firm (Teece, 2000). Such resources are often tacit in nature, socially complex, developed and deployed within the firm (and then become intertwined with other complementary organizational resources), and are embedded in firm-specific processes. As a result, they are difficult to imitate or possess by competitors (Nonaka, 1994; Polyani, 1967; Teece, 2000; Zhang, 2007). Additionally, because specific industry dynamics may serve to limit the possibility of a sustainable competitive advantage based on a single particular resource or competency, organizations can still compete by developing knowledge quicker than the competition (Azan and Sutter, 2010). Tangible resource services are dependent upon how they are combined and applied; as such, they are dependent on a firm's knowledge. Organizations that are better able to create, transfer, and apply their knowledge assets are equally better positioned to develop further competencies and ultimately offer better products or services to the marketplace. Mehta (2007) proposed that a firm's specific, unique knowledge underpins its products and/or services and that firms that successfully manage their organizational knowledge develop the capabilities to reconfigure their extant knowledge resources and develop the skill set to create new ones to further develop new competencies. Furthermore, the KBV supports the notion that possessing knowledge as such is less valuable and less a source of competitive advantage to an organization than the organization's ability to apply the knowledge and generate new

knowledge (Alavi and Leidner, 2001). Therefore, knowledge is perceived as an idiosyncratic, difficult-to-imitate, resource. The challenge for a KMS then becomes creating, managing, and leveraging the organization's collective knowledge to create value—value which ultimately leads to competitive advantage. In meeting this challenge, the use of information technology and systems promise to facilitate and enable these knowledge-based, value-creating processes (Alavi and Leidner, 2001; Hult, 2003; Von Krogh, 1998; Schiuma, 2009).

2.6 Knowledge Management System Success

As previously noted, a KMS is an operationalization of KM concepts; in part, a KMS is a special class of information system. As such, a number of KMS researchers have employed various constructs and components of both the DeLone and McLean 1992 and 2003 models of IS success within the KMS literature stream (Alavi and Leidner, 2001; Jennex and Olfman, 2006; Jennex et al., 2007; Jennex, 2008; Kulkarni et al., 2007; Wu and Wang, 2006). Further supporting this notion, Jennex and Olfman (2006) state, "The DeLone and McLean IS Success Model is a generally accepted model for assessing success of IS. Adapting the model to KM is a viable approach to assessing KM success." Both DeLone and McLean models have received substantial interest and/or support in the literature, evidenced by their 1992 article having received over 10,000 citations and their 2003 paper nearly 8,000 citations (as of January 2017). Similar to Jennex and Olfman, other researchers have taken the DeLone and McLean (2003) IS success model or Seddon's (1997) re-specification of the DeLone and McLean (1992) model and adapted it to reflect the additional complexity that differentiates KMS from IS. These researchers include Halawi et al. (2008), Karlinsky-Shichor and Zviran (2016), Kulkarni et al.

(2007), Maier (2002), Velasquez et al. (2009), and Wu and Wang (2006). Velasquez et al. (2009) find that these KMS success models, indeed, keep intact the foundation of the IS success models from which they are based.

The DeLone and McLean IS success model is particularly attractive for use in this study as it is parsimonious (only six constructs), well-researched, often-used, and easily understood. In this study, the newer and more robust DeLone and McLean (2003) IS success model is referenced as a theoretical foundation for the proposed KMS S/RS success model and is further refined to address the unique design, implementation, and usage considerations that differentiate KMS from traditional IS. This enhanced complexity, interdependency, and dynamic and fluid nature of a KMS requires modifications to DeLone and McLean's 2003 model to reflect the bi-directional relationships between constructs that are present in a KMS that are atypical of a traditional IS (Meihami and Meihami, 2014).

Before discussing modifications of the DeLone and McLean (2003) model to address the above concerns, it is necessary to briefly introduce and present the constructs from the DeLone and McLean IS success models. DeLone and McLean's (1992) IS success model attempted to provide both a model of success and taxonomy to address the multi-dimensional and interdependent nature of IS success constructs, while reducing the actual number of measures in an attempt to allow comparisons between studies. This 1992 model consists of six constructs or dimensions that define IS success: *System Quality*, *Information Quality*, *Use*, *User Satisfaction*, *Individual Impact*, and *Organizational Impact*. As noted by DeLone and McLean (1992), "The six success categories and the many specific I/S measures within each of these categories clearly indicate that MIS

success is a multidimensional construct and that it should be measured as such." While the DeLone and McLean success constructs will be discussed in detail in sections that follow, briefly, DeLone and McLean define *System Quality* – The Measure of Information Process Itself – as the measures related to response time, access, system flexibility, throughput, error-rate, and downtime. *Information Quality* – Measures of Information System Output – has been used to evaluate the output of an information system in terms of relevance, timeliness, currency, completeness, accuracy, reliability, format, precision, freedom from bias, and understandability. *Information Use* – Recipient Consumption of the Output of an Information System – deals with measuring how frequently a system is used, how long it is used, if the use is voluntarily or not, if it is used in decision making, number and nature of queries, and the extent or depth of use (i.e. number of features used). *User Satisfaction* – Recipient Response to the Use of the Output of an Information System – is a measure of how much users "like" a system (e.g. how much an information systems output has met the users' expectations) and has strong face validity as users that tend to "like" a system, also are satisfied with the same system. *Individual Impact* – The Effect of Information on the Behavior of the Recipient – is a rather difficult concept to directly measure, but includes metrics such as improved decision-making, task efficiency and effectiveness, and confidence in information-based decisions. Finally, *Organizational Impact* – The Effect of Information on Organizational Performance – has been measured in terms of organizational efficiency, cost effectiveness, net profitability, production efficiency, ROI, IRR, and information systems' contribution to organizational goals (DeLone and McLean, 1992).

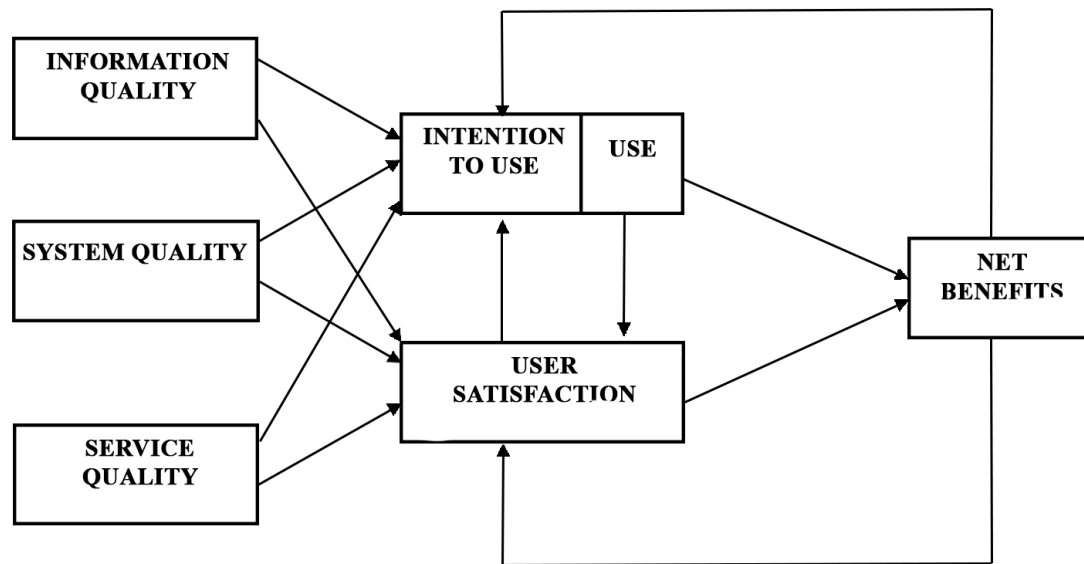


Figure 3. DeLone and McLean (2003) Information System Success Model

After 10 years of empirical testing and validation of the 1992 model, DeLone and McLean proposed some substantive changes and extensions to the 1992 success model in order to address the changing nature of IS and address concerns of researchers (DeLone and McLean, 2003). First, the *Service Quality* dimension was added to the information system success model, which specifically addressed information service tangibles, degree of reliability and assurance, responsiveness, and empathy. Second, the *Use* construct in the original model was extended to include actual system usage as either a behavior or the intention to use a system as an attitude. Next, recognizing that there can be many levels of constituents (i.e., levels of analysis), DeLone and McLean's 2003 model refined their two original impact dimensions – *Individual Impact* and *Organizational Impact*. For the sake of parsimony, these impact dimensions were collapsed into a single *Net Benefits* dimension of IS success to reflect either positive or negative net benefits. Finally, a feedback loop was included from *Net Benefits* to *Use (or Intention to Use)* and from *Net*

Benefits to User Satisfaction that reinforces subsequent use and user satisfaction – in the case of positive net benefits, or decreased use and user satisfaction – in the case of negative net benefits (see Figure 3).

2.7 Critical Success Factor Theory

A primary objective of this research is to identify and prioritize the set of Critical Success Factors (CSFs) that has the greatest influence enabling and facilitating the transference of knowledge embedded in an organization's knowledge repository or OMIS to those that need the knowledge, when they need it, and in a format that they need it in. Rockart (1979) defines CSFs as, "the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization": These are key areas that must go right for a business to succeed or factors that are critical for success. Therefore, CSFs point to areas that management must have constant vigilance and attention, and continually monitor and measure as necessary conditions for success. Significantly, while management often implicitly know of such factors, the CSF method clearly, concisely, and *explicitly* brings forward these key areas so that the stakeholders know them. Caralli et al. (2004) describes these as "explicit representation[s] of the key performance areas of an organization." In fact, managers that easily recognize CSFs often have difficulty in clearly and concisely articulating exactly what they are or understand their importance. Therefore, explicating CSFs help organizations focus attention on things that managers implicitly or intuitively know, do, and/or discover by accident, which helps direct and guide organizations toward their missions (Caralli et al., 2004). Moreover, identifying the factors that have the most impact on the success of an organization's specific initiative is important because of limited organizational resources.

Realistically, few (if any) organizations have unlimited resources to resolve issues or address initiatives to advance and support the organization's competitive advantage.

From its initial use as a management tool to reduce information overload, CSFs have subsequently been used in a wide variety of applications that include strategic planning and alignment of information systems with organizations, development of organizational goals, IT planning, project management, IS reliability, and various types of IS implementations. In the context of IS success, "CSFs describe the underlying or guiding principles of an effort that must be regarded to ensure that it is successful" (Caralli et al., 2004). This research adopts a common approach within IS research, wherein CSFs take the role of factors that enable the achievement of specific goals (see Figure 4). CSFs can initially be derived from interviews with key experienced management personnel; domain experts and consultants; as well as individuals that encounter various barriers in respect to goal achievement within their specific domain and understand the enablers and facilitators needed to address these barriers to their objectives (Gates, 2010). Additionally, CSFs can be further identified through document review and analysis and literature review.

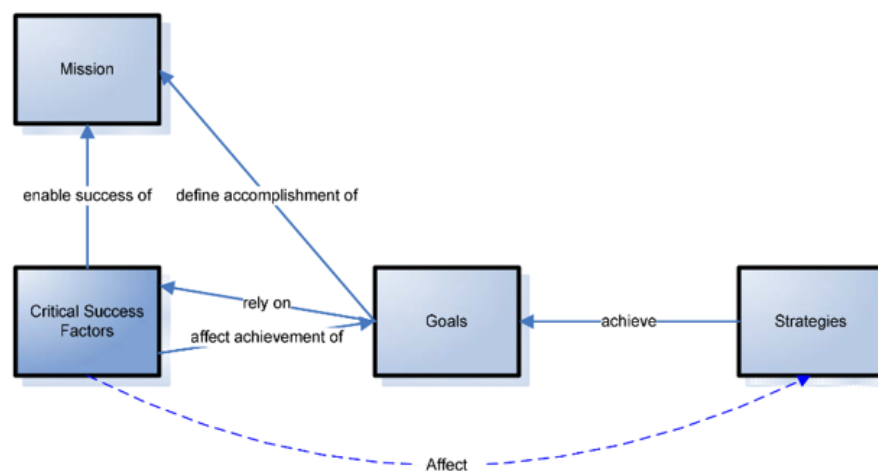


Figure 4. CSFs relationship to missions, goals, and strategies (Gates, 2010).

CHAPTER III

METHODOLOGY AND MODEL

This research adopts the Alavi and Leidner KM framework, which serves as the basis for describing knowledge flow, from creation to application, within an organization. With respect to the KMC, the flow of knowledge from the storage/retrieval to the transfer dimension of the Alavi and Leidner framework is central to this study. Specifically, S/RS CSFs and success constructs that facilitate and enable the transference of knowledge stored in organizational knowledge repositories to the organization's employees are identified and prioritized. As noted by Kankanhalli and Tan (2004), the KM framework presented by Alavi and Leidner is useful for describing the KM processes at all levels – individuals, groups, and organizations; and because of both its parsimony and completeness, the KM framework has been adopted by numerous researchers.

In this research, prior researchers' postulation of a KMS as a special class of information system is embraced. This study focuses on the S/RS, one of the technological

subsystems of a KMS, that helps support knowledge storage and retrieval processes such as knowledge codification or locating (in the case of some tacit knowledge), storage, curation, search, access, and dissemination. The *constructs* that define S/RS success, as well as the *factors* that influence success (or CSFs), of the S/RS are identified, measured, and prioritized in respect to their effectiveness in supporting these processes. Further, the evaluation of such constructs and CSFs are in respect to enabling and facilitating the transference of organizational knowledge from knowledge repositories to employees when they need it, where they need it, and in a format that facilitates this transference of this knowledge. More clearly, this study is concerned with the *flow* of knowledge – what Mehta (2007) refers to as the process perspective of KM.

The DeLone and McLean (2003) model of IS success is employed here as the theoretical grounding for the S/RS success constructs; albeit, with some modifications that take in account the dynamic and sometimes reflexive nature and complexity that differentiate a KMS from an IS. DeLone and McLean's IS success model is premised on six interrelated and interdependent dimensions, or categories, that define IS success. Briefly, the DeLone and McLean (2003) IS success model posits that *system quality*, *information quality*, and *service quality* will subsequently influence *use* and *users' satisfaction*, and that *net benefits* will occur as a result of this use, which will then influence future *use* and *user satisfaction*. This research also establishes the prioritization of the set of CSFs, derived from a larger set of previously identified CSFs, that must be properly managed by organizations to ensure that the constructs that describe the S/RS success (e.g., *Knowledge Content Quality*, *KMS Quality*, etc.) are achieved, which in turn FEKT within the organization. Importantly, the prioritization of these S/RS success

constructs are also established to focus organizational attention on the dimensions of KMS S/RS success that provide the greatest influence on FEKT. However, as previously mentioned, while the overall success of the entire KM initiative is of great importance for an organization engaged in KM activities, this study is at a micro level of the KMC; therefore, it is not strictly concerned with the overall success of the KMC in its entirety (i.e., from knowledge creation to its ultimate application in an organization). Rather, it adds to the body of knowledge of KM research in bringing to light the CSFs and constructs of success of the knowledge S/RS of a KMS that enable and facilitate knowledge flow from an organization's knowledge repository for transference to its constituents.

As will be demonstrated, the groups or clusters of factors (as well as the specific factors themselves) share an interdependent, intertwined, complex, and often reflexive relationship with each other. The analytic network process (ANP) is an appropriate multi-criteria decision making (MCDM) analytic methodology for this type of research that involves complexity and interdependence. For this reason, it is used within this study to prioritize both success constructs and CSFs. While this will be explained in detail in following sections, briefly, the ANP can generally be used to find the best alternative from a set of alternatives, especially for complex problems where there is interdependence and feedback. In this research, the alternatives are the KMS storage/retrieval success model constructs – *Knowledge Content Quality, KMS Quality, KMS Service Quality, Use, User Satisfaction, and Net Benefits*. The best alternative is determined as the success construct (referred to as a *node* in the ANP) that receives the highest ranking among the alternative nodes. The CSF prioritizations are similarly

determined through the experts' pairwise comparison process and are evaluated with respect to the overall global priorities.

3.1 Model of KMS Storage/Retrieval System Success

The intention of the DeLone and McLean model was to provide "a general and comprehensive definition of IS success that covers different perspectives of evaluating information systems" (DeLone and McLean, 1992). The DeLone and McLean (2003) model of IS success is modified in this research in order to account for the increased complexity and expected interdependencies between the success constructs (see Figure 5). KMS are special, complex variants of IS that can greatly differ from traditional IS in that they are somewhat "fuzzy and messy," or loose collaborative systems (Allee, 1997). As previously stated, Meihami and Meihami (2014) assert that content, context, and structure within a KMS must be continually reevaluated for value, importance, relevance, and validity; thus, requiring intervention by knowledge workers that goes beyond the system design and implementation phases. KMS are often fluid and dynamic in their design. This structure is often informed by changing organizational needs based on the actual use of the KMS. For example, knowledge users' needs may very well change over time, requiring a specialized system and supporting services that are more agile and malleable. These issues include addressing exactly what knowledge and supporting information/data are required, how knowledge is represented within the repository, to whom and where the knowledge should be delivered, and in what specific format. This increased system complexity is represented in the proposed model by the additional relationships between many of the constructs. As will be discussed in Chapter 4, the direct influence between the S/RS success constructs is measured in the pairwise

comparisons. Furthermore, these local priorities are subsequently weighted by the cluster matrix values to create the weighted supermatrix, which contain only the first-order influences. Additionally, there may be thousands (or tens of thousands) of indirect relationships between the S/RS success constructs, as well as indirect and bi-directional influences from the CSFs to the S/RS success constructs. Therefore, the ANP method's solution is based on taking the weighted supermatrix to powers to create a limit matrix. In this case, the synthesized solution contains the global priorities (ranking and weights) with respect to an overall goal. Moreover, what is particularly important about the model paths is that they define the connections between constructs and nodes, and describe the directions of influence. This is what creates the ANP model's structure.

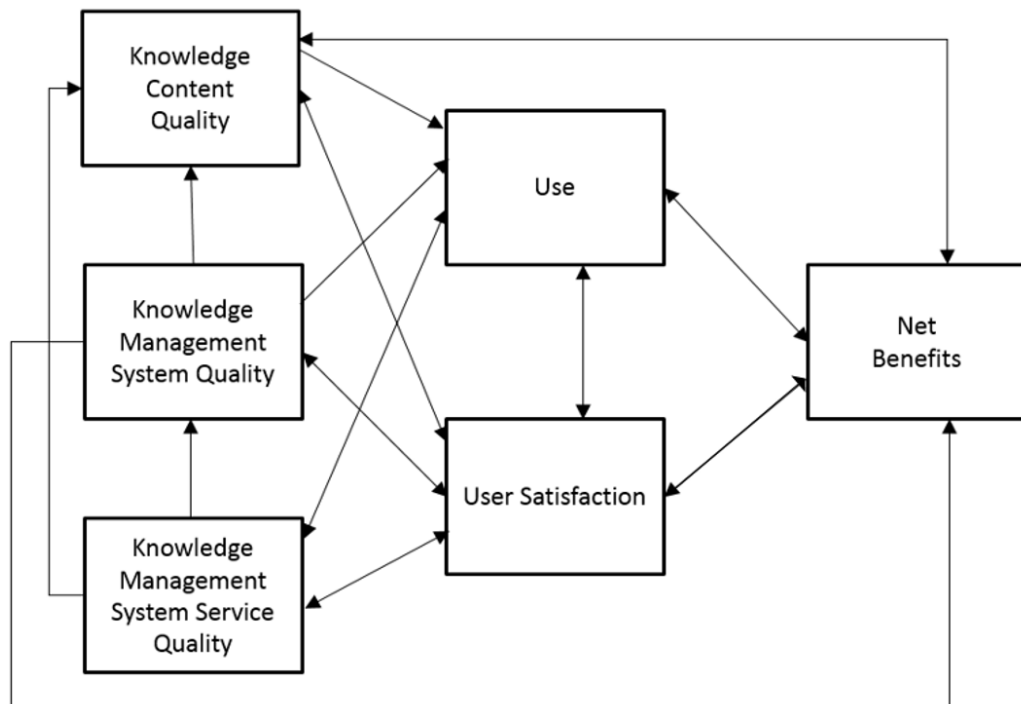


Figure 5. Conceptual KMS Storage/Retrieval System Success Model

The model or influence paths from the conceptual KMS Storage/Retrieval System Success Model are explicitly shown in Figure 6. In this view of the model, previously identified relationships from the KM literature are shown with both solid lines and capital letters, identifying a prior research source for the model relationships. In addition, six new construct relationships – those not empirically tested in prior literature – are

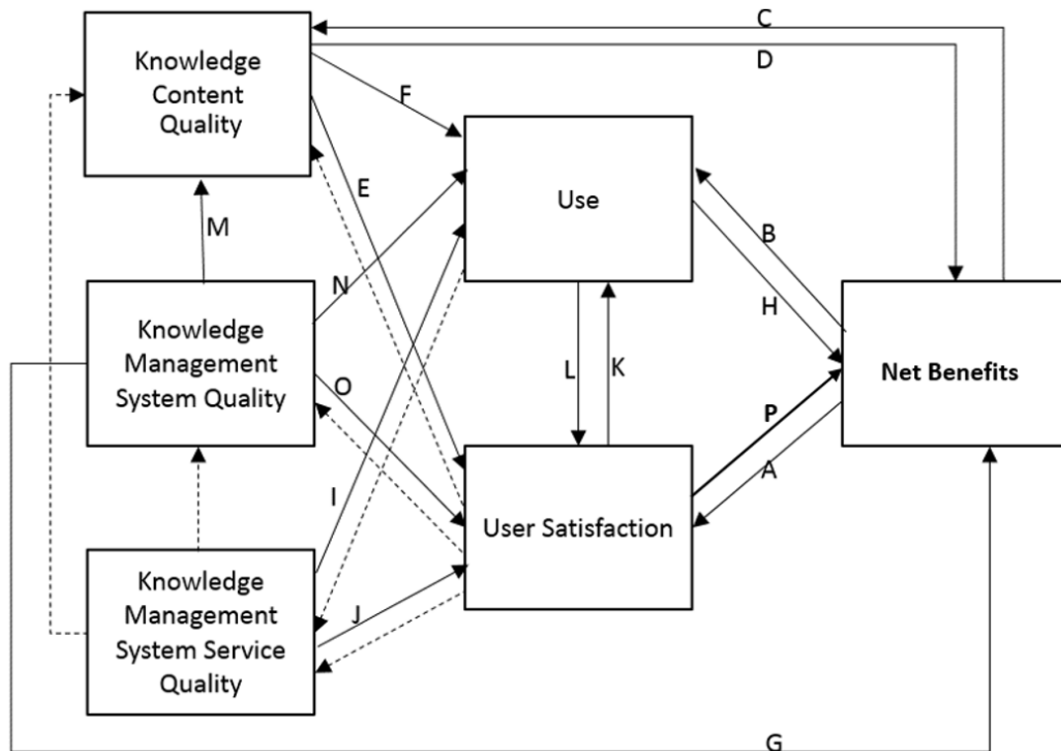


Figure 6. Model paths: Previously identified relationships from the KM literature stream are identified by solid lines and capital letters. Wu and Wang (2006) – A, B, E, H, K, O, and P; Jennex and Olfman (2006) – C, F, I, J, L, and N; Karlinsky-Shichor and Zviran (2016) – D and G; and Yu et al. (2007) – M.

proposed in the model. These additional model paths (represented by dashed lines in Figure 6) depict the intensely complex nature of real-world storage and retrieval systems. Finally, these new paths consist of four relationships that complete bi-directional connections between two constructs and two additional one-way relationships. The newly introduced paths, also referred to as construct relationships, are discussed in Section 3.3 below.

3.2 KMS Success Model Dimensions

This proposed model of KMS success borrows heavily from the DeLone and McLean (2003) framework. However, the model modifies the success dimensions as appropriate for use in the knowledge management domain. Similar to the DeLone and McLean model, this model is comprised of six interdependent KMS success dimensions – *Knowledge Content Quality*, *Knowledge Management System Quality (KMS Quality)*, *Knowledge Management System Service Quality (KMS Service Quality)*, *Use*, *User Satisfaction*, and *Net Benefits*. Next, each KMS success dimension is discussed in some detail as a component of success for KMS. Appendix A contains a wider range of success construct measures, which are synthesized from prior IS/KMS empirical research for each of the six success dimensions discussed below.

Knowledge Content Quality – This success dimension is analogous to DeLone and McLean’s Information Quality dimension in their IS success model. Within the context of information systems, there has been much empirical evidence that support causality between Information Quality and User Satisfaction and Information Quality and Use (DeLone and McLean, 2003; Wu and Wang, 2006). *Knowledge Content Quality* refers to the quality of knowledge that resides in repositories and knowledge stores as electronic artifacts such as documents, reports, lessons learned, and the like. Also included in this construct is the notion of reviewed, pruned, and modified knowledge content and the linkages and context that add richness to organizational knowledge (Jennex and Olfman, 2006). However, this *Knowledge Content Quality* dimension is significantly more rich and complex than traditional information quality in that there are two components to knowledge quality: 1) the presentation of knowledge in an appropriate format, and 2) the

usefulness of the knowledge or quality of the communicated knowledge from the KMS (Resatsch and Faisst, 2004; Kulkarni et al., 2007).

The characteristics of *Knowledge Content Quality* include relevance, accuracy, timeliness, completeness and coverage, consistency, currency, applicability, comprehensibility, presentation format(s), structure, knowledge representation, the extent of insight, and the availability of expertise and advice (Ajmal et al., 2010; DeLone and McLean, 2003; Kulkarni et al., 2007; Wu and Wang, 2006; Yu et al., 2007). Yu et al. (2007) relate that a knowledge repository populated with low quality knowledge (e.g., irrelevant, inaccurate, or unreliable) makes the knowledge search process much more time-consuming and unproductive. This unproductivity will eventually decrease *Use* and lower *User Satisfaction*. Therefore, they suggest that, "creating, acquiring and sharing high quality knowledge should be one of the most important objectives of KM" (Yu et al., 2007).

Specific examples of Information Quality or *Knowledge Content Quality* measures from prior empirical research include: accuracy, precision, reliability, freedom from bias, relevance to decisions, adequacy to complete work tasks, report appearance, interpretability, informativeness, and information/knowledge richness (Balasubramanian et al., 2015; Brown and Jayakody, 2008; Clay et al., 2006; DeLone and McLean, 1992; DeLone and McLean, 2003; Gable et al., 2008; Iivari, 2005; Jennex and Olfman, 2003; Jennex and Olfman, 2006; Kulkarni et al., 2007; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Resatsch and Faisst, 2004; Sedera et al., 2004; Sirsat and Sirsat, 2016; Urbach and Muller, 2012; Zaied, 2012).

KMS Quality – This is characterized by the ease-of-use of the system(s) (for both input and output), functionality, reliability, flexibility, portability, integration, up-time, response time, accessibility, search capability, and documentation (DeLone and McLean, 2003; Doll and Torkzadeh, 1998; Kulkarni et al., 2007; Yu et al., 2007). This dimension may be viewed as an analog for DeLone and McLean's (2003) System Quality dimension that, similar to Information Quality discussed above, has been shown to positively influence Use and User Satisfaction in IS research (DeLone and McLean, 2003; Petter et al., 2008; Wu and Wang, 2006). Yu et al. (2007) state:

"If the quality provided by a KM system does not satisfy the users' expectations, then that system will not only be deserted by the users but also fail to improve organizational performance. On the other hand, an easy-to-use, easy-to-access, responsive, and reliable KM system will enhance the process and outcomes of end users' knowledge creation, sharing, and utilization."

Jennex and Olfman (2006) posit that the more integrated and "computerized" knowledge is, the more important this construct is in respect to the KMS.

In the DeLone and McLean IS success model, system quality essentially measures reliability and predictability of the information system and is independent of the information contained within. Moreover, Wu and Wang (2006) find these qualities equally applicable in the context of KMS success measurement. For KMS, it is essential that the supporting technical system be flexible and agile enough to support the changing needs of the organization. A KMS is generally not a static system; rather, it is a system that must be responsive to new organizational demands for knowledge storage formats, remote accessibility, 24x7 access, increased usage, and security. The design of traditional information systems, as well as the necessary technological infrastructures, are often dictated (or at least heavily influenced by the actual information content needs of the

system). In a KMS, however, the content may be much less well-defined, or "fuzzy." Hence, a system is required that can scale and respond to changing requirements. The importance of a technological infrastructure to support KM efforts has been supported in the research by Alavi and Leidner (2001), Davenport et al. (1998), Jennex and Olfman (2000, 2002, and 2006), and Sage and Rouse (1999).

KMS Quality measurement from both IS and KMS empirical research include the following metrics: convenience, realization of user expectations, user friendliness, stability, availability, functionality, level of frustration, search capability, output flexibility, availability of tools to locate knowledge, and infrastructure capacity (Balasubramanian et al., 2015; Brown and Jayakody, 2008; Clay et al., 2006; DeLone and McLean, 1992; DeLone and McLean, 2003; Gable et al., 2008; Iivari, 2005; Jennex and Olfman, 2006; Kim and Lee, 2014; Kulkarni et al., 2007; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Resatsch and Faisst, 2004; Sedera et al., 2004; Sirsat and Sirsat, 2016; Urbach and Muller, 2012; Zaied, 2012).

KMS Service Quality – the characteristics of *KMS Service Quality* are perceived in terms of the quality of an organization's support for the knowledge management system. Quite simply, *KMS Service Quality* is necessary to ensure that users can utilize the KMS effectively: it is the support provided by the organization so that the KMS can be used by the workers (Jennex and Olfman, 2006). This success construct includes the efficiency and effectiveness of IT support technicians, knowledge engineers, and other support staff that assure the availability, reliability, responsiveness, and assurance of the knowledge management system's hardware and software as well as the empathy, skill, experience, and capabilities of the support staff (DeLone and McLean, 2003; Yoon and Guimaraes,

1995). Jennex and Olfman (2006) suggest that this dimension is absolutely necessary to support both the *KMS Quality* and *Knowledge Content Quality* dimensions. The SERVQUAL instrument, which has been previously used in information systems research domain, addresses many of the characteristics of this dimension, such as up-to-date hardware and software and the dependability of the knowledge management system. It also addresses if employees: 1) provide prompt support to end-users, 2) have the requisite knowledge to perform their jobs, and 3) have the best interests of the end-users in mind.

While all other dimensions of the 2003 DeLone and McLean IS success model have, in one way or another, been adopted in various models of KM success, the *KMS Service Quality* dimension has seen much less enthusiasm within KM success research (Petter et al., 2008; Wu and Wang, 2006). While Jennex and Olfman (2006) include this dimension in their KM success model (transcending the entire KMS), Wu and Wang (2006) identify that, within many of the extant KM success models, *KMS Service Quality* appears to have caused confusion in its interpretation as to whether it is a dependent or an independent variable. However, within the context of this present model at a micro level for S/RS, *KMS Service Quality*, in fact, describes service quality not only as found in traditional information systems (as described above), but also in the context of servicing *Knowledge Content Quality* and the KMS system. For example, in this research, *KMS Service Quality* not only addresses measures of support activities typically seen in traditional information systems, but also encompasses KM activities. This would include updating knowledge presentation formats or representations, ensuring that end-users have the most current or appropriate knowledge available, and purging outdated knowledge (an

important component in the success of the KM effort). *KMS Service Quality* is particularly relevant to a KMS when addressing the storage and retrieval of tacit knowledge and its transference where Communities of Practice (CoP), debriefings, and knowledge maps may be involved. To be effective, the processes involved with tacit knowledge storage and retrieval require scheduling, monitoring, capturing, recording, and coordinating activities – all of which are supported by KMS servicers (Keyes, 2006).

Prior empirical KMS and IS research have used the following as *KMS Service Quality* metrics: empathy, technical competence, skill/experience/capabilities of support staff, data integration skills, knowledge representation skills, awareness of users knowledge requirements, the ability to maintain KMS components, building and maintenance of infrastructure to support KMS, knowledge to answer users' questions, and response time (Balasubramanian et al., 2015; Brown and Jayakody, 2008; DeLone and McLean, 2002; DeLone and McLean, 2003; Jennex and Olfman, 2005; Jennex and Olfman, 2006; Kim and Lee, 2014; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Resatsch and Faisst, 2004; Sirsat and Sirsat, 2016; Urbach and Muller, 2012; Zaid, 2012).

Use – this is the actual use of the KMS. Without use of the KMS, there is very little chance that a knowledge system can be successful over a sustained period of time. System use, whether mandatory or voluntary, may be measured as frequency of use, time of use, number of accesses, usage pattern, and dependency. Additionally, *Use* is measured using qualitative metrics such as the nature, quality, and appropriateness of the use of the knowledge management system, which also characterize this dimension. Furthermore, this dimension not only addresses the quantifiable number of "times" a

system is used, or how long a user engages with the KMS, but also how "deeply" a system is used (informed and effective use), and the use or non-use of basic and advanced capabilities. More simply asked: do users explore the system and find new uses for it?

This study considers *Use* in terms of KMS S/RS usage, and while this obviously implies that knowledge is accessed through some KMS mechanism and ultimately "used", what is presently considered in this construct is the use of the *system* itself (not necessarily the use of the knowledge). DeLone and McLean (2003) describe their *Use* dimension in terms of a behavior or alternatively, as an attitude in terms of "Intention to Use". Jennex and Olfman's (2006) KMS success model diverges from this research; they consider *Intention to Use* rather than actual system use. Jennex and Olfman contend that *use* is a weak measure of KMS success, given that the actual amount of use has little to do with success and that a KMS might not be used frequently. However, their argument for using *Intention to Use* rather than *Use* is rather specious; *Intention to Use* without actual future *Use* can hardly sustain success for any information system or KMS. Wu and Wang (2006) sustain that *Use* as a behavior is a necessary but not sufficient condition for obtaining KMS *net benefits*. If a KMS is not used, an organization will not be able to continue a flow of knowledge. More plainly, *Intention to Use* alone (without actual use) neither enables nor facilitates further knowledge flow within an organization. Furthermore, Yu et al. (2007) relate that *Intention to Use* is only appropriate as a proxy for *Use* when it is not possible to measure actual use of a KMS, and subsequently remove this attitude and opt for the actual behavior measure of *Use*.

KMS and IS researchers have used the following metrics in empirical studies that measure system *Use* or *Intention to Use*: level of sophistication of usage, self-reported

use, nature of use, frequency of specific use, recurring use, extent of use, and use of KMS as part of normal work routine, and institutionalization/routinization of use (Balasubramanian et al., 2015; Brown and Jayakody, 2008; Clay et al., 2006; DeLone and McLean, 1992; DeLone and McLean, 2002; DeLone and McLean, 2003; Iivari, 2005; Jennex and Olfman, 2003; Jennex and Olfman, 2004; Jennex and Olfman, 2005; Kulkarni et al., 2007; Maier, 2002; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Sirsat and Sirsat, 2016; Urbach and Muller, 2012; Velasquez et al., 2009).

User Satisfaction – This is perhaps one of the most commonly used metrics of KMS success. Users that are satisfied with their organization's knowledge management efforts will be more likely to voluntarily participate in KM activities, which may include feedback, ratings, and ranking used to improve the quality of the S/RS. Similar to end-user computing satisfaction (EUCS) research, this dimension has been assessed using six components: content, accuracy, format, ease-of-use, timeliness, and service quality (DeLone and McLean, 2003; Doll and Torkzadeh, 1998). Additionally, in prior knowledge management research, *User Satisfaction* has been measured in respect to "the quality and quantity of knowledge, knowledge search capability, KM system functionalities, incentives for knowledge contribution, and overall organizational management of knowledge" (Yu et al., 2007).

However, the EUCS metrics have caused some concern in measuring user satisfaction in IS research. Because of these concerns, this study adopts a much narrower view or scope in which to measure the overall users' approval or "likeability" of the KMS and its output. This is important because *User Satisfaction* has been criticized for use of satisfaction metrics that conflate user satisfaction with other constructs such system

quality, service quality, and/or content quality and thereby are confounding the measures (Petter et al., 2008). Metrics of user satisfaction include efficiency, effectiveness, adequacy, and enjoyment gained from use of the KMS. A bi-directional relationship exists between the constructs of *Use* and *User Satisfaction*; that is, more use of a KMS that yields positive results may result in a higher level of user satisfaction with the system. Conversely, a more satisfied user of the KMS may be more enthusiastic about more use of this same system.

Prior empirical studies has employed the following as metrics for *User Satisfaction* in IS and KMS research: effectiveness, efficiency, enjoyment, overall user satisfaction with system, decision-making satisfaction, KMS meets information or knowledge processing needs, satisfaction with KMS, feeling of pleasure or displeasure with KMS, self-efficacy, and approval or likeability of an IS or its output (Balasubramanian et al., 2015; Brown and Jayakody, 2008; DeLone and McLean, 1992; Iivari, 2005; Jennex and Olfman, 2003; Lai et al., 2008; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Sirsat and Sirsat, 2016; Urbach and Muller, 2012).

Net Benefits – Petter et al. (2008) point out that the practical application of the DeLone and McLean success model is dependent on the context of the organization and the system under study. Therefore, it is up to the researcher to understand the level of analysis defined by the research problem and choose the appropriate level metrics. They further describe *Net Benefits* as the extent that the IS or KMS has contributed to the success of both individuals and organizations. In this study, *Net Benefits* refer to the benefits (positive or negative) received by individuals resulting from the use of the S/RS; therefore, the level of analysis for the study and for the *Net Benefits* success construct is

that of the individual. This is because the system under study in this research is the KMS S/RS, and the overall goal is in respect to its use in FEKT, which occurs at the individual or personal level. It is individuals – not organizations – that transfer knowledge, which can be facilitated by the use of the KMS S/RS. Therefore, this study considers *Net Benefits* in respect to what DeLone and McLean called "Individual Impact" in their original 1992 success model. Subsequently, this construct was amalgamated into the newer *Net Benefits* construct in their 2003 IS success model. This can also be viewed as the degree of impact that the KMS or IS has made on the behavior of the recipient in relation to individual performance (Sirsat and Sirsat, 2016). Most KMS studies identify perceived usefulness as a metric for *Net Benefits* when the analysis is at the level of the individual(s). Perceived usefulness is defined as the degree to which stakeholders believe that using a particular system has enhanced their job performance. In this research context, the experts were asked to consider whether the use of the KMS S/RS had enhanced the ability of the users to transfer knowledge. Similarly, use of the S/RS is expected to impact a person's task performance. The experts were also asked to consider if S/RS use helped users become more productive in transferring knowledge, and if the users believed they were better able to transfer knowledge using the S/RS than without it.

Prior empirical KMS and IS research has employed the following metrics for *Net Benefits* at the individual level of analysis: individual learning, user productivity, user confidence in productivity, task performance, helps acquire new knowledge, effectively manages and store needed knowledge, eased ability to do job, effect on work practices, perceived benefits from use, task innovation, and job simplification (Balasubramanian et al., 2015; Brown and Jayakody, 2008; Clay et al., 2006; DeLone and McLean, 1992;

DeLone and McLean, 2002; DeLone and McLean, 2003; Gable et al., 2008; Iivari, 2005; Jennex and Olfman, 2003; Jennex and Olfman, 2004; Jennex and Olfman, 2006; Kulkarni et al., 2007; Lai et al., 2008; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Sedera et al., 2004; Sirsat and Sirsat, 2016; Urbach and Muller, 2012; Velasquez et al., 2009; Zaied, 2012).

In summary, the following definitions and metrics describe the six S/RS success constructs or dimensions used throughout the remainder of this study and are as they appeared on the research instrument (see Appendix B). As will be discussed later, the respondents were asked to consider these descriptions of the success constructs when they were making their pairwise comparisons.

Knowledge Content Quality (research instrument definition) – Refers to the quality of knowledge that resides in repositories and knowledge stores as electronic artifacts such as documents, reports, lessons learned, and so on. This includes the notion of reviewed, pruned, and modified knowledge content and the linkages and context that add richness to organizational knowledge. There are two components to knowledge quality: the presentation of knowledge in an appropriate format and the usefulness of the knowledge or quality of the communicated knowledge from the KMS. Measures include relevance, accuracy, timeliness, completeness and coverage, consistency, currency, applicability, comprehensibility, presentation formats, structure, knowledge representation, extent of insight, and the availability of expertise and advice.

KMS Quality (research instrument definition) – This is characterized by the system's ease-of-use (for both input and output), functionality, reliability, flexibility, portability, integration, up-time, response time, accessibility, search capability and output

quality, and documentation. An easy-to-use, easy-to-access, responsive, and reliable KM system will enhance the process and outcomes of end users' knowledge creation, sharing, and utilization. KMS Quality essentially measures reliability and predictability of the KMS and is independent of the information contained within. For KMS, it is essential that the supporting technical system be flexible and agile enough to support the changing needs of the organization. As a KMS is generally not a static system but rather, a system that must be responsive to new organizational demands for knowledge storage formats, remote accessibility, 24X7 access, increased usage, and security.

KMS Service Quality (research instrument definition) – The quality of an organization's support for the knowledge management system. Quite simply, KMS Service Quality is necessary to ensure that users can utilize the KMS effectively: It is the support provided by the organization so that the KMS can be used by the workers. This success construct includes the efficiency and effectiveness of IT support technicians, knowledge engineers, and other support staff that assure the availability, reliability, responsiveness, and assurance of the knowledge management system's hardware and software as well as the empathy, skill, experience, and capabilities of the support staff. KMS Service Quality not only addresses measures of support activities typically seen in traditional information systems, but also encompasses KM activities such as updating knowledge presentation formats or representations, ensuring end users have the most current or appropriate knowledge available, and purging outdated knowledge, among others, and thus is an important component in the success of the KM effort.

Use (research instrument definition) – This is the actual use of the KMS. Without use of the KMS, there is very little chance that a knowledge system can be successful

over a sustained period of time. System use may be measured as frequency of use, time of use, number of accesses, usage pattern, and dependency. Additionally, Use is measured using qualitative metrics such as the nature, quality, and appropriateness of the use of the knowledge management system. This dimension not only addresses the quantifiable “times” a system is used or how long a user engages with the KMS, but also how “deep” a system is used (informed and effective use) and the use or non-use of basic and advanced capabilities. In other words, do users explore the system and find new uses for it? Use as a behavior is a necessary but not sufficient condition for obtaining KMS net benefits.

User Satisfaction (research instrument definition) – This study adopts a rather narrow scope in which to measure the overall users’ approval or “likeability” of the KMS and its output. Metrics of user satisfaction include efficiency, effectiveness, adequacy, and enjoyment gained from use of the KMS. Users that are satisfied with their organization’s knowledge management efforts will be more likely to voluntarily participate in KM activities, which may include feedback, ratings, and ranking used to improve the quality of the S/R system. A bi-directional relationship exists between the Use construct and the User Satisfaction construct; that is, more use of a KMS that yields positive results may result in a higher level of user satisfaction with the system and conversely, a more satisfied user of the KMS may be more open and enthusiastic about more use of this same system.

Net Benefits (research instrument definition) – This research considers Net Benefits in respect to Individual Impact. Most KMS studies identify perceived usefulness as a metric for Net Benefits when the analysis is at the individuals’ level. Perceived

usefulness is defined as the degree to which stakeholders believe that using a particular system has enhanced their job performance. In this present context, has the use of the S/R system enhanced the users' ability to transfer knowledge? Do the users believe they were better able to transfer knowledge by using the S/RS than without it? Similarly, use of the S/R system is expected to impact a person's task performance. Has the use of the S/R system help users become more productive in transferring knowledge? Other measures of Net Benefits (Individual Impact) include increased task innovation, learning, and awareness/recall.

3.3 Conceptual KMS Storage/Retrieval System Success Model Dimensional Relationships

The proposed model of KMS S/RS success demonstrates a level of complexity and interdependency that defines a KMS. Further, the relationships between the dimensional constructs of the model is of major importance to this research, as the ANP methodology is capable of capturing all direct and indirect influence paths between constructs. The relationships may be unidirectional, as is the case with the relationship between *KMS Service Quality* and *Knowledge Content Quality*. Alternatively, they may be bi-directional, as in the case of *Use* and *User Satisfaction*. Table 2 summarizes the proposed relationships.

Adopting DeLone and McLean's success model, the KMS S/RS success model suggests that *Knowledge Content Quality*, *KMS Quality*, and *KMS Service Quality* influence subsequent *Use* and *Users' Satisfaction*. And as a result of using a system, certain *Net benefits* will occur. In turn, this further influences future *Use* and *User Satisfaction*. Other KMS researchers have added additional connections between these

six success constructs, which address the increased complexity of KMS. These researchers include Yu et al. (2007), who have found that *Knowledge Content Quality*, besides influencing *Net Benefits* indirectly through *Use* and *User Satisfaction*, also have a direct effect on *Net Benefits*. Additionally, Jennex and Olfman (2006) found that *Net Benefits* gained from the KMS also directly influence *Knowledge Content Quality*; Yu et al. (2007) suggest that *KMS Quality* directly affects *Knowledge Content Quality*. Finally, Karlinsky-Shichor and Zviran (2016) describe the direct influence from *KMS Quality* to *Net Benefits*. Furthermore, this research proposes the effect of several model paths that are not included in extent KMS success models in the literature, but reflect real-world complexities that differentiate KMS from traditional IS. For each of these paths, descriptive examples are given to explain the influence of one construct on a second construct.

KMS Service Quality* → *KMS Quality: The quality of the search results – a measure of *KMS Quality* – is directly related to the maintenance of meta-tags, keywords, and ontology, which is a function of the knowledge engineers supporting and servicing the knowledge repository. Also, as new technologies may become necessary or available to improve the store/search/retrieval/distribution of knowledge within the organization, these must be supported by those servicing, updating, and maintaining the technology supporting the KMS. Jennex and Olfman (2006) suggest that *KMS Service Quality* is necessary for *KMS Quality*.

DIMENSION "A" INFORMS AND/OR INFLUENCES DIMENSION "B"

DIMENSION A	DIMENSION B	PATH RELEVANCE ESTABLISHED
Knowledge Content Quality	→ Use	Jennex and Olfman (2006)
	→ User Satisfaction	Wu and Wang (2006)
	→ Net Benefits	Karlinsky-Shichor and Zviran (2016)
KMS Quality	→ Knowledge Content Quality	Yu et al. (2007)
	→ Use	Jennex and Olfman (2006)
	→ User Satisfaction	Wu and Wang (2006)
KMS Service Quality	→ Net Benefits	Karlinsky-Shichor and Zviran (2016)
	→ KMS Quality	<i>PRESENT STUDY</i>
	→ Knowledge Content Quality	<i>PRESENT STUDY</i>
	→ Use	Jennex and Olfman (2006)
Use	→ User Satisfaction	Jennex and Olfman (2006)
	→ Net Benefits	Wu and Wang (2006)
	→ KMS Service Quality	<i>PRESENT STUDY</i>
User Satisfaction	→ Use	Jennex and Olfman (2006)
	→ KMS Service Quality	<i>PRESENT STUDY</i>
	→ KMS Quality	<i>PRESENT STUDY</i>
	→ Knowledge Content Quality	<i>PRESENT STUDY</i>
Net Benefits	→ Use	Wu and Wang (2006)
	→ User Satisfaction	Wu and Wang (2006)
	→ Knowledge Content Quality	Jennex and Olfman (2006)

Table 2. KMS Storage/Retrieval System Success Model Dimensional Relationships

KMS Service Quality → Knowledge Content Quality: It is the ongoing responsibility of the knowledge managers and engineers servicing the KMS to ensure that the content within the repository are up-to-date, accurate, relevant, contextualized, and in a format that can be used by knowledge system users. These characteristics are all measures of success of the *Knowledge Content Quality* construct and are directly influenced by the level of efficiency and effectiveness of service of the KM support personnel. This relationship is also supported by Jennex and Olfman (2006) where they state that *KMS Service Quality* is necessary for *Knowledge Content Quality*.

Use → KMS Service Quality: Due to limited resources, personnel are much more likely to be enthusiastic and cooperative (empathetic) in maintaining service level and supporting a system that is actually being used. They are more likely to place a higher level of prioritization on such a system and conversely, may deescalate any sense of urgency in respect to servicing a system that no one uses. Lindner and Wald (2011) found support for the *Use* of a knowledge storage system to positively impact ICT support for KMS – i.e. service quality.

User Satisfaction → Knowledge Content Quality: Knowledge artifacts do not represent static reality but are instead malleable and negotiable. Knowledge workers provide feedback as to their satisfaction with knowledge quality, which is expressed in their inherently voluntary ratings, rankings, and comments in respect to the quality of the knowledge presented by the KMS and thereby improve the validity, quality level, usefulness, context, and credibility of the knowledge content (Awad and Ghaziri, 2011; Jennex et al., 2014; Meihami and Meihami, 2014; Pipek et al., 2011; Poston and Speier, 2005; Rao, 2011; Suresh and Mahesh, 2006).

User Satisfaction → KMS Quality: As a type of social system, Reimer et al.'s (2009) notion of "flexibility-in-use" connotes a KMS that emerges after interactions with users that are driven by their perception and level of satisfaction of the KMS and expressed in their voluntary ratings, rankings, and comments, which ultimately inform the design and implementation of a dynamic system over time. For example, personalization influences both usefulness and ease-of-use but is only possible through the capturing of users' perceptions and feedback in respect to *KMS Quality*. Similarly, *User Satisfaction* in respect to the quality, presentation, and relevance of search results can influence future

search results – a measure of *KMS Quality* (Jennex et al., 2014; Lai et al., 2008; Ong and Lai, 2004 and 2007; Poston and Speier, 2005; Richter et al., 2013).

User Satisfaction* → *KMS Service Quality: KMS are different from traditional IS, where the *KMS Service Quality* dimension not only includes IT-based technical support but also includes KM professional such as knowledge managers and knowledge engineers. *User Satisfaction* that is shared in the form of comments, ratings, and ranking are necessary for KMS servicers to help direct and inform their work (and prioritization) on processes such as curation, reformatting, rebuilding ontology, keyword development, etc., which in turn better satisfies knowledge users' requirements (Richter et al., 2013) . As the knowledge managers and knowledge engineers are often not the experts that created the knowledge, they rely on the feedback based on users' satisfaction with both the KMS and content quality to inform them as to what knowledge is no longer relevant or what knowledge is most impactful so that these KM servicers can manage the knowledge life-cycle (Poston and Speier, 2005).

3.4 Knowledge Management CSFs and Cluster Development

Of interest to both researchers and practitioners is the identification of CSFs for ensuring that knowledge continues to flow from storage and retrieval repositories, knowledge bases, and/or other knowledge retention stores so that it can be transferred among stakeholders. Identifying the factors that have the most impact on the success of these knowledge flows is important because of limited organizational resources. A question specifically addressed in this research is: which factors most positively influence the KMS S/RS that FEKT from some organizational knowledge repository?

This study is focused on the CSFs relevant to the continuation of knowledge flow from a knowledge storage/retrieval mechanism (e.g., repository, knowledge base, etc.) and not necessarily in overarching CSFs that transcend the entire KMC. On the other hand, this does not necessarily exclude an overarching CSF if it has been demonstrated to influence or effect storage/retrieval or transference of knowledge. Because this study is at a micro level, of greatest interest are CSFs that had formerly been identified within the literature stream to directly influence either the storage/retrieval dimension or the transfer dimensions (if relevant to the storage/retrieval dimension) of the KMC or are overarching CSFs influencing the flow of knowledge across these two dimensions. The CSFs that were considered had to either been empirically tested or supported through strong theoretical support. To identify these CSFs, an extensive search across various electronic search repositories was conducted that included:

- EJC (Electronic Journal Center)
- Business Source Premier
- AIS Library
- EBSCOhost
- IEEE Library
- ACM Library
- APQC (American Productivity and Quality Center)
- Google Scholar
- Google

Search terms across all the journals included combinations of Group 1 and Group 2, Group 1 and Group 3, Group 2 and Group 3, and Groups 1, 2, and 3 (see below):

- Group 1:
- Knowledge Management
- KM
- Knowledge Management System(s)
- KMS(s)
- Organizational Memory
- OMIS

Group 2:
Knowledge Flow
Knowledge Chain
Knowledge Storage
Knowledge Retrieval
Knowledge Transfer
Knowledge Repository

Group 3:
Critical Success Factor(s)
CSF(s)
Critical Failure Factor(s)
CFF

This search process resulted in a set of over 250 journal articles, conference proceedings, websites, and white papers. In addition, practitioner texts from organizations such as the APQC, MIT, Thomas Davenport, Springer Verlag, Information Science Reference (IGI Global), and others were also referenced in identifying CSFs. Many artifacts from this result set were not considered as they were focused on specific issues that were not germane to the research (e.g., ontologies, knowledge creation, knowledge auditing or metrics, country-specific cultural issues, etc.) or had little direct attention to CSFs. It should also be noted that Critical Failure Factors (CFF) were also included in the search because of their relationship to CSFs. CFFs are the "things" or issues that will cause a project or effort to fail if they are not managed properly. These CFFs were essentially CSFs in reverse; which, in this research, were reverse coded. For example, a CFF such as "*Lack of Top Management Support*" is fundamentally the same as a CSF called "*Top Management Support*".

It was important that each CSF was explicitly defined (or at least referenced an existing definition) to be considered for inclusion in this study. Often, there were several different names for the exact same concept; therefore, it was necessary for the definitions

to be referenced in evaluating and disambiguating each CSF. In qualitative processes, such as the open coding of CSFs, there exist no strict or stringent rules regarding when the search process must be stopped. However, Guba (1978) offers a set of criteria to assist the researcher in identifying a stopping point that includes: exhaustion of resources, emergence of regularities, and overextension, or going beyond the research boundaries (Hoepfl, 1997). This coding process yielded slightly fewer than 30 distinct CSFs that were pertinent in varying degrees to the study at hand. However, a few of the factors within this initial group of CSFs were "combination" factors that addressed more than a single concept, such as "*Developing New Corporate Values and Trust*". These were re-coded as two separate CSFs. Others were excluded from the final list because of limited empirical support within the particular source study where the CSF was identified. Finally, those factors that were most often cited in the research stream or demonstrated the strongest empirical support were likely to be considered for inclusion in the final set of factors.

In the development of the final set of CSFs examined presently, parsimony and completeness (or maximum "coverage"), were primary concerns. Given the posited interdependencies among not only the model's constructs, but also among individual factors, the model quickly becomes intractable once the interactions, bi-directionalities, and interdependencies are addressed. This reduction in the total number of CSFs investigated was a necessary process in respect to the chosen research methodology (ANP) because it reduced the number of pairwise comparisons. And while still a rather lengthy comparison process is involved, it is at least practical within a research environment to submit respondents to a large survey instrument. Since a primary

intention of this research is to identify a generalized set of CSFs and their impacts on various dimensions of the proposed KMS S/RS based on the judgment of experts, it is not required that individual organizations repeatedly engage in this time-consuming comparison process.

For this study, a taxonomy or classification framework proposed by Yeh et al. (2006) was employed. Subsequently, the four classes or clusters comprising this framework further served as a filter for grouping of the individual CSFs under consideration. Yeh et al.'s (2006) classification of success factors for knowledge management is an often cited KM success factor framework that consists of four clusters or classes: 1) Strategy and Leadership – executive level influences, 2) Corporate Culture (Culture) – the influence of organizational cultural, 3) People – individual and group characteristics' influence, and 4) Information Technology (Technology) – impact of technologies (see figure 7). Most importantly, underpinning this grouping of KM CSF clusters is a strong history of theoretical and practitioner support alike (Alavi and Leidner, 2001; Arthur Anderson

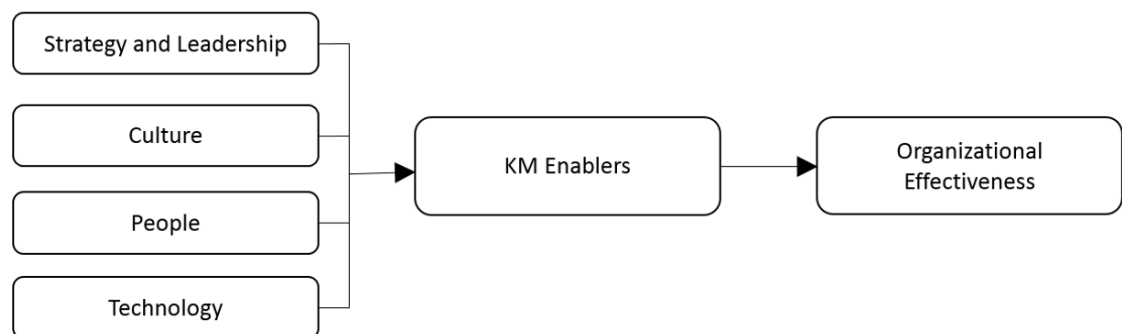


Figure 7. Yeh et al. (2006) Knowledge Management Enablers for Organizational Effectiveness

Business Consulting, 1999; Arthur Anderson and APQC, 1996; Beckman, 1999; Bennett and Gabriel, 1999; Bose, 2004; Chase, 1997; Davenport, 1997; Davenport et al., 1998; Demarest, 1997; Earl, 1997; Eisenhardt and Santos, 2002; Gold et al., 2001; Hauschild et

al., 2001; Holsapple and Joshi, 2000 and 2001; Jarvenpaa et al., 1998; Lee and Hong, 2002; Liebowitz, 1999; Long, 1997; Martensson, 2000; Massey et al., 2002; Ndlela and Toit, 2001; Nonaka and Takeuchi, 1995; O'Dell and Grayson, 1999; Pan and Scarbrough, 1998; Ruggles, 1998; Schultze and Leidner, 2002; Skyrme and Amidon, 1997; Wong, 2005; Zack, 1999).

Employing Yeh et al.'s taxonomy, each of the CSFs were subsequently mapped to one of four classification groups by this researcher and a colleague. In the event of a dispute, a third colleague was available to break a tie; however, it proved unnecessary in this study. This final selection of individual CSFs involved the identification of CSFs that had theoretical linkages to one of Yeh et al.'s factor classes and to the success of KM efforts. In particular, these items or factors had been shown in prior research to have both construct and content validity in respect to the storage/retrieval KMC dimension or be storage/retrieval-relevant, if a factor was identified with respect to the KMC's transference dimension. Additionally, CSFs identified from research that examined the KMC in its entirety were also considered for inclusion in the final set based on the underlying study's description of the factor and how and where it was expected to influence the KMC. For example, *Top Management Support* was one such factor that made the final list in this study. *Top Management Support* has been identified in the literature as an important success factor that transcends the entire KMC due to several factors such as setting the organizational tone, explicating its vision, and providing ongoing support that supports, enables, and encourages knowledge activities along the KMC including creation, sharing, transferring, and its ultimate application. Table 3 lists

the CSFs identified in the literature review and the corresponding cluster or factor class to which each CSF belongs.

A CSF Conceptual Framework model is next proposed (see figure 8), that combines the CSF framework of Yeh et al. (2006) – see figure 7 – with the proposed Conceptual

Cluster	Critical Success Factor	Definition
Strategy and Leadership		
	<i>Top management commitment and ongoing support</i>	top organizational leaders share a vision of knowledge management (KM) and provide the program with ongoing leadership support
	<i>Management understands the value of KM and articulates this view with the organization</i>	management values knowledge as an organizational asset and continually and consistently articulates this view.
	<i>Management's continuous commitment to necessary resources required for KM</i>	continued commitment to provide the necessary technical, human, and organizational resources necessary to sustain the knowledge management effort.
	<i>The knowledge management strategy is linked to organizational strategy</i>	the knowledge management strategy is aligned (mutually supportive) with the organizational strategy.
Corporate Culture		
	<i>Knowledge-friendly and open organizational culture</i>	a culture of openness to sharing and understanding of knowledge is inherent to the organization.
	<i>Incentives and reward system</i>	employees are rewarded for their KM contributions and incentivized to use the KM system as a platform for innovation.
	<i>Effective communicative environment</i>	communicative environment that encourages employees to openly share successes as well as mistakes in respect to KM initiatives.
	<i>Mutually trusting environment</i>	culture of trust and confidence – at all levels – that sharing of knowledge will be viewed positively by the organization.
People		
	<i>Employee training</i>	program for training employees on use of the KM system and KM principles.
	<i>Employee empowerment</i>	employees are encouraged and empowered to engage in KM activities.
	<i>Willingness to share knowledge</i>	degree to which participants are willing to share their knowledge with others.
	<i>Absorptive capacity of recipients</i>	refers to the ability to identify, assimilate, and exploit knowledge.
	<i>Status of the knower</i>	regard or respect for the source of the knowledge to be transferred.
	<i>Dedicated staff and leadership</i>	employees/staff/leadership specifically assigned duties and responsibilities related to KM activities.
Information Technology		
	<i>IT and organizational strategies aligned</i>	IT strategy is supportive of organizational strategies.
	<i>Competence of technology teams</i>	technology team's possession of experience, ability, and skill set needed to support the KM initiative.
	<i>Effective technological infrastructure</i>	the necessary technological infrastructure exists to support the KM system effort.
	<i>Usability</i>	friendly system to use and exchange knowledge.

Table 3. Classification of CSFs for KMS S/RS in respect to FEKT

KMS Storage/Retrieval System Success Model shown in Figure 5. This framework suggests that factor clusters – *Strategy and Leadership*, *Corporate Culture (Culture)*, *People*, and *Information Technology (Technology)* – are composed of individual CSFs

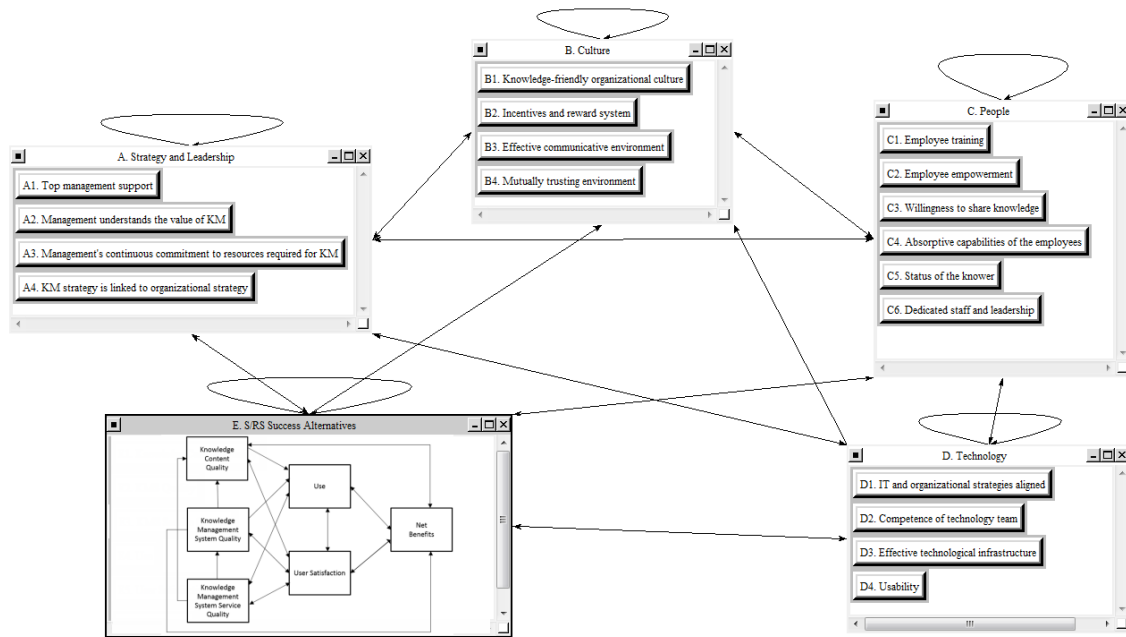


Figure 8. The CSF Conceptual Framework Model. The looping arc indicates inner node dependencies and the double-headed arrowed lines indicate bi-directional dependencies.

that influence each of the dimensions of the S/R/S success model (*Knowledge Content Quality, KMS Quality, KMS Service Quality, Use, User Satisfaction, and Net Benefits*). However, these CSFs not only directly influence each of the success constructs, but also, they indirectly influence each construct through their interactions with other CSFs. Also, the proposed interdependencies between the factor clusters and interdependencies among the model constructs add further complexity to this model. Ultimately, the ANP is employed as the research methodology to prioritize and weight the most influential factors affecting the model's success since there is posited a *interdependent* rather than independent relationship between CSFs, factor clusters, and success dimensions.

3.5 The Analytic Network Process (ANP)

Multiple Criteria Decision Making (MCDM) techniques assume that measurements are derived or subjectively interpreted as both indicators and strength of preference as opposed to traditional optimization methods that assume the pre-existence of metrics

(Saaty, 2013). Saaty (2009) points out that in particular, intangibles (e.g., user satisfaction or a supportive culture) can only be measured through the judgment of experts and are relative only to the goals of concern to particular situations. One such MCDM methodology is the ANP, developed by Thomas Saaty as a generalization of his Analytic Hierarchical Process (AHP) to include dependencies and feedback. In addition, the ANP method is capable of handling combinations of factors that are quantitative, qualitative, tangible, and intangible in nature. This method has been particularly successful due to the way that judgments are elicited and measured to derive absolute scales. Similar to the AHP, the ANP relies on the judgment, experience, and expertise of the evaluators to provide rational and consistent pairwise comparisons in respect to a control criterion based on a nine-point scale (see Table 4).

1	Equal Importance	Two activities contribute equally to the objective
3	Moderate importance of one over another	Experience and judgment slightly favor one activity over another
5	Essential or strong importance	Experience and judgment strongly favor one activity over another
7	Very strong importance	An activity is favored very strongly over another; its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8	Intermediate values between the two adjacent judgments	

Table 4. The nine-point scale for AHP/ANP (Saaty, 2009)

For researchers less familiar with the ANP, Saaty (2009) provides the following remarks in respect to priority measurement with the ANP: "One should not expect the concept of priority to apply to every measurement problem involving areas and volumes and other structured concerns of a quantitative nature in mathematics." He adds that the ANP,

"is intended to deal with the measurement of judgments and perceptions and not with every abstract numerical consideration simple examples of which are trigonometric and other kinds of functions of mathematical analysis. It works best when it is possible to associate the idea of importance with a measurement or a concept but not with a wholesale structure and its refinements that produce special outcomes in intricate mathematical ways" (Saaty, 2009).

While Saaty (2013) provides a detailed outline of the ANP (see Appendix C), much of the complexity of the ANP is hidden by the Super Decisions software used in this research to implement the ANP. Prior to beginning the ANP, experts must be recruited to:

- 1) participate in the identification of factors with expected influences on other factors,
- and 2) perform pairwise comparisons that establish the degree of impact that each factor (and cluster) will have on each other in respect to a control criterion. Thomas Saaty (personal communication, March 9, 2011) explains:

"Unlike statistical sampling one good expert is enough. If there are no experts then a group of a few people who know the subject may suffice. The inconsistency of a group is no worse than the inconsistency of the worst judge. Consistency or good near consistency is necessary for a valid result but it is not sufficient. A crazy person can be perfectly consistent but not valid. One needs knowledge and experience with the matter."

For this study, three experts with decades of combined academic research and practical experience in the field of KM were identified and subsequently agreed to participate in this rather time-consuming process (see Appendix D).

Strategy and Leadership	A1. Top management support A2. Management understands the value of KM A3. Management's continuous commitment to resources for KM A4. KM strategy is linked to organizational strategy	Technology	D1. IT and organizational strategies aligned D2. Competence of technology team D3. Effective technological infrastructure D4. Usability - friendly system to use & exchange knowledge
Culture	B1. Knowledge-friendly organizational culture B2. Incentives and reward system B3. Effective communicative environment B4. Mutually trusting environment	Alternatives (S/RS Success Constructs)	E1. Knowledge Content Quality E2. KMS Quality E3. KMS Service Quality E4. Use E5. User Satisfaction E6. Net Benefits (Individual Impact)
People	C1. Employee training C2. Employee empowerment C3. Willingness to share knowledge C4. Absorptive capabilities of the employees C5. Status of the knower C6. Dedicated staff and leadership		

Table 5. ANP Factor and Node Coding

The first steps of the ANP require the complete understanding of the problem at hand and all the actors, factors, clusters, alternatives, criteria, objectives, and goals, and the relationships between these. The overarching aim of this research is two-fold: to first identify and prioritize the constructs of success (*Use, User Satisfaction, etc.*) that are most important, influential, or relevant to the success of S/RS success in FEKT in a general sense (i.e., the unit of analysis here is *not* a specific organization's S/RS system but rather, the general case of S/RS); and second, to identify and prioritize the CSFs that are most influential in respect to these success constructs.

The experts were first charged with completing the influence matrix (see Figure 9). The influence matrix is built by listing all factors down one column and then listing the same factors across in a top row (see Table 5). In addition to listing the factors themselves, the cluster to which they belong is listed to the left of the item (in the case of rows) and above the item (in the case of columns). The experts then proceed down each row within one column and determine, based upon their expertise and experience, if a column factor is influenced by a row factor. If there exists an influence, the experts mark a "1" in the column/row intersecting cell and leave it blank if there is no expected influence and proceed down each subsequent row until reaching the last factor. The experts then move to the next column and repeat this exercise for every factor across the top, but exclude evaluations of the factors on the diagonal. The influence matrix provides rich information for the researcher. If there is a "1" marked in a cell where the column and row factors are within the same cluster (e.g., column A1 and row A2 are both in the Strategy and Leadership cluster), then there is inner dependency within that cluster. If there is a "1" marked in a cell where the column factor belongs to a different cluster than

the row factor (e.g., column A1 is in the Strategy and Leadership cluster and row B1 is in the Culture cluster), then there are outer dependencies. One last step was to further refine the matrix by replacing each "1" in a column/row cell with its corresponding row value (see Appendix E). This influence matrix defines the pairwise comparisons that will be generated by Super Decisions once the model is built and is extremely helpful in building the model by clearly marking the node connections that will be entered into the software.

As this is a group decision-making methodology, the logistics of managing the survey instrument and the actual process of assessing the pairwise comparisons within the instrument should be discussed. The elicitation of group responses for each of the pairwise comparisons can proceed in several ways: 1) all participants can be assembled together where they jointly judge each pairwise decision as a group and resolve discrepancies and inconsistencies as a group through discussion and decide on a collaborative response; 2) the participants can respond to the pairwise comparisons separate from each other and their judgments are then aggregated; or 3) the larger group of participants can be broken down into smaller groups and proceed as in the second case. For practical reasons, this research uses the second method where the instrument is completed by individuals and the comparisons are averaged using the geometric mean. Saaty (2009) explains that when dealing with group decision-making, the aggregation of individual judgments and constructing a group choice from individual choices need to be addressed. It has been formally proven that using the weighted geometric mean – where the weight is based on the level of expertise or power of individual judges – resolves problems of aggregation. Additionally, Arrow's Impossibility Theorem, which precludes constructing group choice from individual ordinal choices, is resolved because of

AHP/ANPs use of the absolute scale approach that is cardinal rather than ordinal (Saaty, 2009). In the study, since all three experts have nearly equal levels of expertise, their weighted judgments are then of equal weight (i.e., 1/n, where n is the number of judges); therefore, the geometric mean is used when aggregating the judgments.

		Strategy & Leadership				Culture				People						Technology				SIRS Success							
		A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	E1	E2	E3	E4	E5	E6		
Strategy & Leadership	A1		A1	A1	A1	A1		A1	A1		A1	A1			A1	A1							A1	A1			
	A2	A2		A2	A2	A2	A2	A2	A2	A2		A2			A2	A2									A2		
	A3		A3				A3		A3	A3	A3	A3			A3		A3	A3	A3	A3	A3					A3	
	A4			A4											A4	A4										A4	
Culture	B1	B1	B1				B1	B1	B1	B1	B1	B1										B1		B1	B1		
	B2									B2	B2	B2				B2		B2	B2	B2	B2	B2	B2	B2	B2		
	B3		B3			B3						B3		B3				B3	B3	B3	B3	B3	B3	B3	B3		
	B4			B4		B4	B4			B4	B4							B4				B4		B4			
People	C1										C1	C1	C1			C1	C1	C1	C1	C1	C1	C1	C1	C1	C1		
	C2					C2	C2					C2						C2	C2	C2	C2	C2	C2	C2	C2		
	C3			C3		C3	C3	C3	C3	C3						C3		C3	C3	C3	C3	C3	C3	C3	C3		
	C4				C4																			C4	C4	C4	
	C5																							C5	C5	C5	
	C6									C6								C6	C6	C6	C6	C6	C6	C6	C6		
Technology	D1			D1	D1										D1		D1							D1			
	D2									D2				D2				D2	D2	D2	D2	D2	D2	D2	D2		
	D3				D3					D3								D3	D3	D3	D3	D3	D3	D3	D3		
	D4										D4	D4	D4									D4	D4	D4	D4	D4	
SIRS Success	E1													E1										E1	E1	E1	
	E2																					E2		E2	E2	E2	
	E3											E3							E3	E3	E3	E3	E3	E3	E3		
	E4				E4																		E4	E4	E4	E4	
	E5				E5							E5										E5	E5	E5	E5	E5	
	E6				E6					E6	E6		E6									E6		E6	E6	E6	

Figure 9. The Influence Matrix

Next, the proposed Conceptual CSF Framework Model above (see Figure 8) was operationalized in the Super Decisions software to create the network structure and describe the relationships of factors (called "nodes" in Super Decisions) within the clusters (inner dependencies) and between nodes of one cluster and nodes of another cluster or outer dependencies (see Figure 10). As mentioned above, the influence matrix of expected influence pairs becomes beneficial in this step as it is used to both guide and verify the selection of node comparisons that are to be assessed within the Super

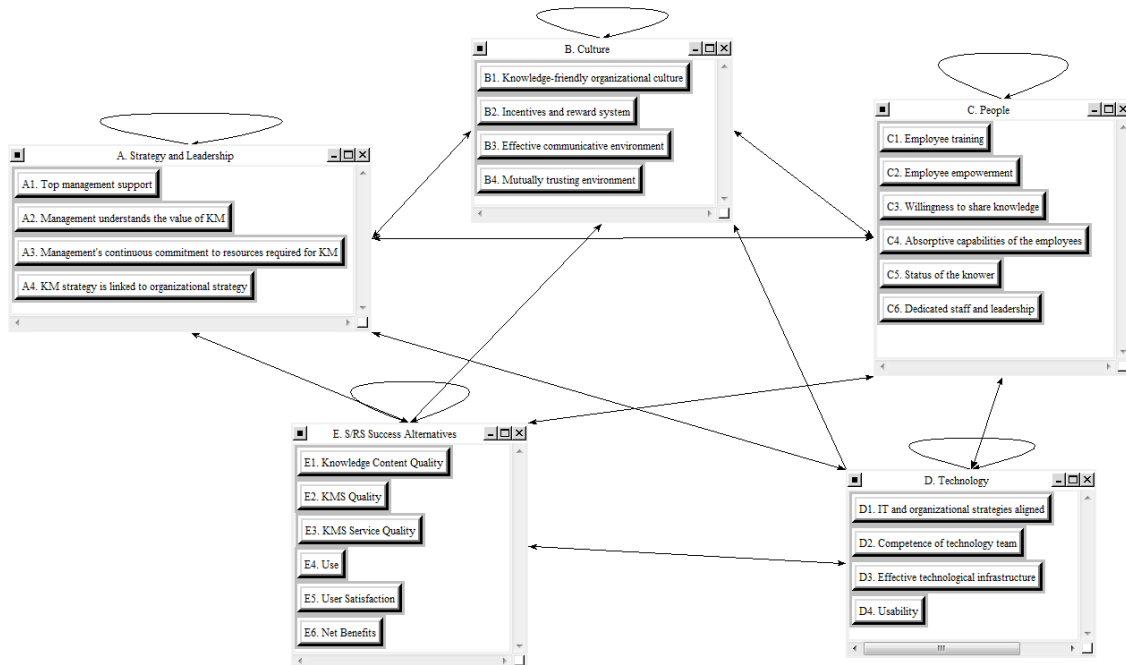


Figure 10. The ANP Model

Decisions software. In addition, the KM S/RS success model cluster is renamed to "S/RS Success alternatives", as the Super Decision software's model synthesis is dependent on one of the clusters having "alternatives" as part of its name. It associates the nodes within this alternatives cluster as those that are the globally prioritized solution alternatives. While this will be discussed in depth later, when all node and cluster comparisons are completed and the ANP model synthesized, the prioritization of the nodes within this alternatives cluster is in fact the ranking or prioritization of the S/RS success model's constructs.

The ANP addresses the pairwise judgments in respect to a control criterion between nodes within and outside of their cluster, and between clusters. Pairwise comparisons are used to capture the level of dominance or influence of one item over another in respect to a control criterion or of a cluster of elements over another cluster in respect to a control criterion. (Saaty, 2009). It is essential to maintain the consistency of the perspective of

dominance when asking the comparison questions. For example, if comparing ITEM1 to ITEM2 with respect to a control criterion C1, one may ask if C1 has more influence on ITEM1 or ITEM2. However, if the next comparison question asks if ITEM2 or ITEM3 influences C1 more, then there is a change in perspective of dominance that will undermine the entire process. The Super Decisions (2015) software guide suggests the following approach:

Use one of the following two questions throughout an exercise:

1. Given a parent element and comparing elements A and B under it, which element has greater influence *on* the parent element?
2. Given a parent element and comparing elements A and B, which element is influenced more *by* the parent element?

While the Super Decisions software allowed for direct entry of judgments through a GUI interface, it was not practical to install the software on each respondent's computer as the software requires licensing and setup for each of the three respondents. Therefore, the actual comparison prompts were transferred to a paper survey instrument and distributed to each of the respondents, who then complete the comparisons and return the instruments to this researcher. The paper survey instrument in this research has numerous function, as it: 1) explains the purpose of the study, 2) provides some background on knowledge storage/retrieval for context, 3) spells out what is expected of the respondents, and 4) provides detailed definitions for each of the items used in the comparisons. Sample responses and explanations of how to use the scale are also included on the first page. Additionally, a legend is placed atop each page (reflecting information shown in Table 4) that helps to equate the verbal judgments of respondents to numerical values. A

partial sample of the paper comparison instrument is shown in Figure 11. The entire survey is attached as Appendix B.

Respondents were asked to complete all pairwise comparisons with respect to a specific criterion, while keeping the overall goal of S/RS success in FEKT in mind.

In keeping the overall goal of the KMS storage/retrieval system facilitating and enabling knowledge transfer, please make the following comparisons.

1:Equally 3:Moderately 5:Strongly 7:Very Strongly 9:Extremely 2,4,6,8:In-between values																		
---	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Which item most influences **A1. TOP MANAGEMENT SUPPORT** and by how much?

<i>B1. Knowledge-friendly org. culture</i>	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	<i>B3. Effective communicative environment</i>
--	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--

Which item most influences **A2. MANAGEMENT UNDERSTANDINGS THE VALUE OF KM** and by how much?

<i>A1. Top management support</i>	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	<i>A3. Continuous KM resource commitment</i>
<i>B1. Knowledge-friendly org. culture</i>	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	<i>B4. Mutually trusting environment</i>

Which item most influences **A3. THE CONTINUOUS COMMITMENT TO RESOURCES NEEDED FOR KM** and by how much?

<i>A1. Top management support</i>	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	<i>A2. Mgmt. understands the value of KM</i>
<i>A1. Top management support</i>	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	<i>A4. KM strategy is linked to org. strategy</i>
<i>A2. Mgmt. understands the value of KM</i>	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	<i>A4. KM strategy is linked to org. strategy</i>
<i>C3. Willingness to share knowledge</i>	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	<i>C4. Employees absorptive capabilities</i>
<i>D1. IT and firms strategies aligned</i>	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	<i>D2. Competence of technology team</i>
<i>E4. Use</i>	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	<i>E5. User Satisfaction</i>
<i>E4. Use</i>	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	<i>E6. Net Benefits (Individual Impact)</i>
<i>E5. User Satisfaction</i>	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	<i>E6. Net Benefits (Individual Impact)</i>

Figure 11. Example pairwise comparisons on survey instrument

Because the Super Decisions software is designed for a single set of responses, each of the three respondents' paper responses were entered into Super Decisions in a separate instance of the model. The aggregate response model was similarly entered into the main instance of the model. The three individual response models are useful in respect to consistency, but the aggregate group choices are the primary analysis under study. Once the responses are input, each of the three respondents are evaluated for consistency using Super Decision. Saaty (2009) recommends an inconsistency ratio not to exceed 10%; and if a respondent is over this threshold, he/she should be contacted and asked to reconsider and reevaluate specific judgments in order to reduce the inconsistency to an acceptable level prior to any group aggregation (Karpak and Topcu, 2010). However, judges are

never forced to meet consistency by changing answers (Saaty, 2013). Following Toloie-Eshlaghy and Akbari-Yusefvand (2011), the aggregate response model was prepared in Microsoft® Excel where the geometric means of the responses was calculated prior to entering these into Super Decisions using its direct entry method, as there are non-integer calculated responses, which precludes the use of other verbal or graphic response methods. From these pairwise comparisons, an unweighted supermatrix containing the local priorities is derived (Super Decisions, 2015). For interested researchers, Appendix F details the aggregating of individual responses into final group decisions.

Included in the comparisons discussed above were the pairwise comparisons between all clusters that are connected to a specific cluster. Super Decisions uses these cluster-to-cluster influence comparisons to calculate and create the cluster matrix. When there are inner dependencies in a cluster, the cluster itself must also be compared with other clusters that influence it in respect to itself. These comparisons are necessary because the inner dependencies indicate that factors *within* the cluster are effecting the cluster itself and this effect needs to be evaluated by comparing this effect against the influence of other clusters. For example, the experts can be asked, "with respect to Culture, which is more influential: the Strategy and Leadership cluster or the effect of Culture itself"? This question directly addresses the principal concern as to whether the existing Culture has more or less effect on Culture than any influences stemming from the Strategy and Leadership cluster. Where inner dependency existed, it was extremely important that these complex cluster-to-cluster questions were carefully worded to convey a complete understanding of the comparison and elicit the proper responses from the experts. In practice, these types of comparisons can be especially difficult to both express and

understand and in lieu of actual elicited cluster pairwise self-comparisons, the Super Decision software can calculate these values through an internal algorithm that depends on other pairwise comparisons previously entered into the system.

A supermatrix "component" is defined by the block of elements defined by the cluster name to the left and the cluster name at the top of the matrix (e.g., Culture and People). Super Decisions use the cluster matrix described above to weight all elements for each of the unweighted supermatrix components by the corresponding cluster matrix cell and then normalize the column in order to make the supermatrix column stochastic (i.e., it sums to 1). This resulting matrix is known as the weighted supermatrix. Finally, the Limiting Matrix, which will be discussed in depth in the following Analysis chapter, is created by raising the weighted supermatrix to powers (multiplied by itself) until it stabilizes or converges (i.e., all columns in the matrix have the same values).

CHAPTER IV

THE ANP ANALYSIS

The ANP analysis addresses the primary research questions for this study. This research presents a model of storage/retrieval system (S/RS) success in facilitating and enabling knowledge transfer (FEKT). The following ANP analysis specifically addresses: 1) which of the S/RS success constructs are most important in FEKT, and 2) what is the relative importance of each of these S/RS success constructs in FEKT? Another primary research question addressed in this study deals with the critical success factors (CSFs) that influence the S/RS success constructs. Eighteen CSFs were identified in the literature as having influence on the success of the S/RS success in FEKT. The ANP analysis is used here to identify: 1) which CSFs are most influential on the S/RS success constructs with the goal of FEKT, and 2) what is the relative importance of each of these CSFs in the overall goal of supporting the S/RS success in FEKT?

The analysis begins with a discussion of the construction of the ANP components, which include the unweighted supermatrix, cluster matrix, weighted supermatrix, limit matrix, and synthesized model. In section 4.2.1, the S/RS synthesized priorities are discussed, addressing both the rank and relative influence of the S/RS success constructs. The following section, 4.2.2, addresses the global prioritization of the CSFs that influence the S/RS success constructs in respect to their overall ranking in importance and the relative weight of their influence. Section 4.3 introduces three ANP row-based sensitivity analyses. First, section 4.3.1 addresses the Influence Sensitivity analysis with both short-term and long-term analyses that examine the relative stability or robustness of the model to perturbations over a range of low to mid intensities, and then from a wide range of intensities. The second ANP sensitivity analysis, section 4.3.2, addresses the ANP model's sensitivity to extremely small changes to the importance of each of the nodes (CSFs). The third and final sensitivity analysis in section 4.3.3 is an ANP Perspective Sensitivity Analysis that examines the ANP model from the perspective of the nodes – rather than from the alternatives – and helps identify specific CSF that, when taken as being all-important, can most influence specific alternatives or in this case, the S/RS success constructs.

4.1 Construction of the Supermatrices

Following the conversion of the individual responses into a group aggregate response (as discussed in Appendix F), the calculated geometric mean for the pairwise comparisons were entered into the Super Decision software as described in Chapter 3. As noted by Saaty (2009), as long as each of the individual respondents' judgments are within the inconsistency tolerance of one order of magnitude (approximately 10%), the

aggregated response calculated from the weighted geometric mean will also remain within the inconsistency tolerances. In this study, each of the experts were well within the 10% tolerance range; therefore, inconsistency is not an issue in this study. In the first step of this process, the *unweighted supermatrix* was generated from the aggregate group raw scores of pairwise comparisons of nodes within the same cluster with respect to each control criterion specified in the influence matrix (Appendix E) – e.g., node A1 compared to node A3 with respect to control criterion A2. These raw column scores are normalized within the cluster with respect to a control criterion such that each column within each component of the supermatrix sums to one or zero (See Figure 12). In the case where

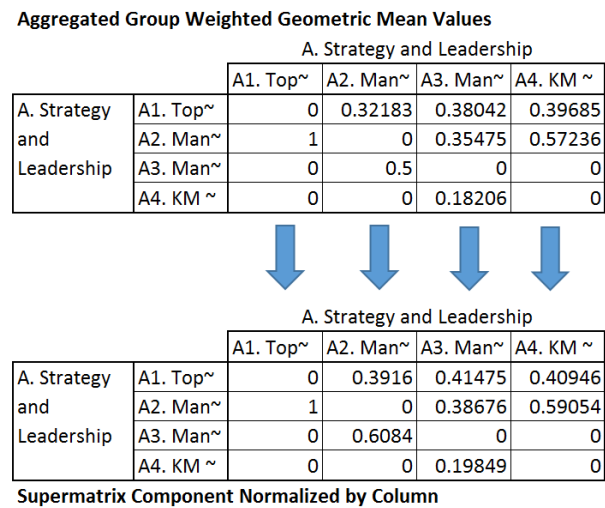


Figure 12: Normalization of group aggregate scores by supermatrix component

there is only a single node within a particular cluster that influences a control criterion, the node is assigned a value of one. All other nodes that have no influence in respect to a control criterion are assigned a zero value. The complete ANP model unweighted supermatrix is shown in Table 6. The unweighted supermatrix cells can be interpreted as the direct influence of a row node with respect to a particular column, within a row's

particular cluster. For example (see Table 6), with respect to the first column *A1. Top Management Support*, there is only one row (node) of possible influencers (A2, A3, and A4) in the Strategy and Leadership cluster that influences the *A1* column – A2. *Management Understands the Value of KM*; therefore, A2 is assessed as having 100% of the influence on A1 when compared to nodes A3 and A4. In a closer examination, it can be identified that, within the Culture cluster, both node *B1. Knowledge Friendly Organizational Culture* (with a value of .2885) and node *B3. Effective Communicative Environment* (with a value of .7115) directly influence column *A1. Top Management Support*. Therefore, it can be interpreted that within the Culture cluster, node B3 has approximately 2.5 times as much direct influence on column A1 as node B1. To complete the assessment of the unweighted supermatrix column A1, it is clear that there exist no nodes from the People, Technology, or alternatives clusters that influence column A1.

Yet, the unweighted supermatrix direct measures do not yield a most influential node with respect to a particular control criterion (column) because for each *cluster* that has a node (i.e., row value) influencing a control criterion, the row values within that column's cluster will sum to one. This is most easily observed in the People cluster column in Table 6 with *C4. Absorptive Capabilities of the Employees* as the control criterion. In this case, both node *C1. Employee Training* and node *D4. Usability* have values of one. It may appear from the unweighted supermatrix that these nodes have equal direct influence on C4. However, this is not the case when one considers that node C1 is a member node of the People cluster and node D4 is a member of the Technology cluster. As will be later identified, the People cluster is more influential on the People cluster than the Technology cluster is on the People cluster.

	Strategy and Leadership				Culture				People				Technology				Alternatives (S/RS Success Constructs)							
	A1. Top	A2. Mar	A3. Mar	A4. KM	B1. Know	B2. Ince	B3. Effe	B4. Mut	C1. Emp	C2. Emp	C3. Will	C4. Abs	C5. Stat	C6. Ded	D1. IT and	D2. Comp	D3. Effect	D4. Usabi	E1. Know	E2. KMS	E3. KMS	E4. Use	E5. User	E6. Net
Strategy and Leadership	A1. Top m 0.3916	A2. Mana 1 0.3868	A3. Mana 0 0.6084	A4. KM st 0 0.1985	B1. Knowl 0.2885	B2. Incent 0.347	B3. Effect 0 0.7115	B4. Mutua 0 0.653	C1. Emplo 0 0	C2. Emplo 0 0	C3. Willin 0 0.631	C4. Absor 0 0.369	C5. Status 0 0	C6. Dedic 0 0	D1. IT and 0 0.2195	D2. Comp 0 0.7806	D3. Effect 0 0.7806	D4. Usabi 0 0	E1. Knowl 0 0	E2. KMS C 0 0	E3. KMS S 0 0	E4. Use 0 0.4695	E5. User S 0 0.2051	E6. Net B 0 0.3255
Culture	B1. Knowl 0.1953	B2. Ince 0.25	B3. Effe 0.5905	B4. Mut 0.514	B1. Knowl 1 0.2762	B2. Incent 0 0	B3. Effect 0 0.401	B4. Mutua 0 0.7238	C1. Emplo 0 0	C2. Emplo 0 0.4328	C3. Willin 0 0.5672	C4. Absor 0 0	C5. Status 0 0	C6. Dedic 0 0	D1. IT and 0 0	D2. Comp 0 0	D3. Effect 0 0	D4. Usabi 0 0	E1. Knowl 0 0	E2. KMS C 0 0	E3. KMS S 0 0	E4. Use 0 0	E5. User S 0 0	E6. Net B 0 0
People	C1. Emp 0.3247	C2. Emp 0 0.4406	C3. Will 0.6753	C4. Abs 0.7806	C5. Stat 0.3706	C6. Ded 0 0.1903	D1. IT and 0.1971	D2. Comp 0.2498	D3. Effect 0 1	D4. Usabi 0 0	E1. Know 0 0.2008	E2. KMS 0 0.2918	E3. KMS 1 0.7992	E4. Use 0 0.5547	E5. User 0 0.2085	E6. Net 0 0.1508								
Technology	D1. IT and 0.5575	D2. Comp 0 0.6753	D3. Effect 0.4425	D4. Usabi 0 0.683	E1. Know 0 0.7115	E2. KMS 0 0	E3. KMS 0 0.3074	E4. Use 0 0	E5. User 0 0.3174	E6. Net 1 0.3752	F1. Know 0 0.1508	F2. KMS 0 0.2096	F3. KMS 0 0.4494	F4. Use 0 0.1903	F5. User 0 0.5531	F6. Net 0 0.5531								
Alternatives (S/RS Success Constructs)	E1. Know 0 0.3537	E2. KMS 0 0.2556	E3. KMS 0.168	E4. Use 0.2496	E5. User 0.4104	E6. Net 0.1855	F1. Know 0 0.185	F2. KMS 0.2108	F3. KMS 0.5337	F4. Use 0.2601	F5. User 0.1312	F6. Net 0.5	G1. Know 0.5	G2. KMS 0.1713	G3. KMS 0.2679	G4. Use 0.4663	G5. User 0.2947	G6. Net 0.5						

Table 6. Unweighted Supermatrix

In addition to node-to-node comparisons, the experts also made judgments on cluster-to-cluster comparisons with respect to a control cluster (as described previously). This was done while keeping the overall goal of S/RS success in FEKT in mind, when there existed at least one node in a cluster that influenced a node in another cluster. Further, in the case of inner dependencies (i.e., the nodes in a cluster influence other nodes within the same cluster), the pairwise cluster judgments included comparing a cluster with another cluster, with respect to itself. For example, the influence of the People cluster is compared to the influence of the Culture cluster, with respect to the People cluster. The completed cluster-to-cluster comparisons resulted in a *cluster matrix* (see Table 7). The first column of values in the cluster matrix can be interpreted as follows: with respect to the overall goal of S/RS success in FEKT, the Strategy and Leadership cluster (the first column of values in Table 7) is influenced by itself –Strategy and Leadership (.395967), by Culture (.126459), by People (.191309), by Technology (.121243), and by Alternatives (.165023).

Cluster Node Labels	A. Strategy and Leadership	B. Culture	C. People	D. Technology	E. S/RS Success Alternatives
A. Strategy and Leadership	0.395967	0.173539	0.234749	0.165832	0.093818
B. Culture	0.126459	0.386566	0.124509	0.117530	0.114913
C. People	0.191309	0.439895	0.241024	0.121967	0.092451
D. Technology	0.121243	0.000000	0.175825	0.274034	0.306023
E. S/RS Success Alternatives	0.165023	0.000000	0.223893	0.320637	0.392795

Table 7. The Cluster Matrix

Hence, this means that the influence of the Strategy and Leadership cluster on itself – with a value of .395967 – has at least twice as much direct impact on Strategy and

Leadership when compared to any other cluster impacting the Strategy and Leadership cluster. Observing the Culture column in Table 7, it can be seen that, in respect to this cluster, both the Technology and alternatives clusters have values of zero. This is because there are no node comparisons from either of these clusters to any node within the Culture cluster; more plainly, in the experts' judgments, neither the Technology-related CSFs nor the S/RS success constructs directly influence Culture. Furthermore, this can also be seen in the ANP model in Figure 10, where there are no arrow heads emanating from either the Technology or the alternatives clusters to the Culture cluster. In fact, the Culture cluster is the only cluster that does not have bi-directional influences with each of the other clusters. One final point of interest is that, in all but the Technology and Culture clusters, the primary influence on a cluster is from the cluster itself. However, in the case of Technology and Culture, it is actually the alternatives cluster and the People cluster that has the most impact, respectively.

Cluster Node Labels		A. Strategy and Leadership				B. Culture		
		A1. Top management support	A2. Management understands the value of KM	A3. Management's continuous commitment to resources required for KM	A4. KM strategy is linked to organizational strategy	B1. Knowledge-friendly organizational culture	B2. Incentives and reward system	B3. Effective communicative environment
A. Strategy and Leadership	A1. Top management support	0.000000	0.391602	0.414749	0.409458	0.195267	0.000000	0.400000
	A2. Management understands the value of KM	1.000000	0.000000	0.386762	0.590542	0.804733	0.250000	0.500000
	A3. Management's continuous commitment to resources required for KM	0.000000	0.608398	0.000000	0.000000	0.000000	0.750000	0.000000
	A4. KM strategy is linked to organizational strategy	0.000000	0.000000	0.198489	0.000000	0.000000	0.000000	0.000000
B. Culture	B1. Knowledge-friendly organizational culture	0.288499	0.346972	0.000000	0.000000	0.000000	1.000000	0.200000
	B2. Incentives and reward system	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	B3. Effective communicative environment	0.711501	0.000000	0.000000	0.000000	0.400994	0.000000	0.000000
	B4. Mutually trusting	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Figure 13. Supermatrix Component. The cells bordered by the thick dark lines on this partial recreation of the unweighted supermatrix define the A. Strategy and Leadership by A. Strategy and Leadership component.

As described in the previous chapter, a *component* of a supermatrix is defined by the intersection of cells that comprise all the nodes of a particular cluster down the left side of the supermatrix with the cells that comprise all the nodes of a particular cluster across the top of the supermatrix. In the example in Figure 13, the unweighted supermatrix component is comprised of all the cells bordered by the thick black lines and defines the Strategy and Leadership by Strategy and Leadership component of the supermatrix. To create a *weighted supermatrix*, each cell in the unweighted supermatrix is multiplied by the cluster matrix value that corresponds to the component in which the cell belongs. The Super Decisions software multiplies each cell that comprises a component with the cluster matrix value associated with the component. For example, each cell in the Strategy and Leadership by Strategy and Leadership component defined in Figure 13 is multiplied by the value .395967. After all cells are weighted by the corresponding cluster matrix value, each column is then normalized and the resulting matrix from this process is both weighted and column stochastic (sums to one). Figure 14 provides an example of

		A						B						C			
		Strategy and Leadership				Cluster Matrix		Strategy and Leadership				Column Normalized		Strategy and Leadership			
		A1. Top	A2. Man	A3. Man	A4. KM	Values		A1. Top	A2. Man	A3. Man	A4. KM			A1. Top	A2. Man	A3. Man	A4. KM
Strategy and Leadership	A1. Top m	0	0.3916	0.4148	0.4095	×	0.39597	=	0	0.1551	0.1642	0.1621	→	0	0.2968	0.188	0.3135
	A2. Manag	1	0	0.3868	0.5905				0.396	0	0.1531	0.2338		0.7579	0	0.1753	0.4521
	A3. Manag	0	0.6084	0	0				0	0.2409	0	0		0	0.4611	0	0
	A4. KM str	0	0	0.1985	0				0	0	0.0786	0		0	0	0.09	0
Culture	B1. Knowl	0.2885	0.347	0	0	×	0.12646	=	0.0365	0.0439	0	0	→	0.0698	0.084	0	0
	B2. Incent	0	0	0	0				0	0	0	0		0	0	0	0
	B3. Effect	0.7115	0	0	0				0.09	0	0	0		0.1722	0	0	0
	B4. Mutua	0	0.653	0	0				0	0.0826	0	0		0	0.1581	0	0
People	C1. Emplo	0	0	0	0	×	0.19131	=	0	0	0	0	→	0	0	0	0
	C2. Emplo	0	0	0	0				0	0	0	0		0	0	0	0
	C3. Willin	0	0	0.631	0				0	0	0.1207	0		0	0	0.1382	0
	C4. Absor	0	0	0.369	0				0	0	0.0706	0		0	0	0.0808	0
	C5. Status	0	0	0	0				0	0	0	0		0	0	0	0
	C6. Dedic	0	0	0	0				0	0	0	0		0	0	0	0
Technology	D1. IT and	0	0	0.2195	0.2195	×	0.12124	=	0	0	0.0266	0.0266	→	0	0	0.0305	0.0514
	D2. Comp	0	0	0.7806	0				0	0.0946	0	0		0	0.1083	0	
	D3. Effect	0	0	0	0.7806				0	0	0.0946	0		0	0	0.183	0
	D4. Usabil	0	0	0	0				0	0	0	0		0	0	0	0
Alternatives (S/RS Success Constructs)	E1. Knowl	0	0	0	0	×	0.16502	=	0	0	0	0	→	0	0	0	0
	E2. KMS C	0	0	0	0				0	0	0	0		0	0	0	0
	E3. KMS S	0	0	0	0				0	0	0	0		0	0	0	0
	E4. Use	0	0	0.4695	0				0	0	0.0775	0		0	0	0.0887	0
	E5. User S	0	0	0.2051	0				0	0	0.0338	0		0	0	0.0387	0
	E6. Net Be	0	0	0.3255	0				0	0	0.0537	0		0	0	0.0615	0

A. Unweighted Supermatrix Columns → Multiplied by Cluster Value → B. Intermediate Matrix → Normalized by Column → C. Weighted Supermatrix Columns

Figure 14. Creation of Weighted Supermatrix Columns from the Unweighted Supermatrix

the transformation of a portion of the unweighted supermatrix to the weighted supermatrix. Table 8 shows the complete weighted supermatrix for this study.

While the unweighted supermatrix represents the group's decision on the local priorities of node comparisons within a single cluster, the weighted supermatrix takes these local priorities and weights them by the importance placed on the cluster to which they belong, with respect to the cluster they are influencing and, in doing so, determines the direct influence down an entire column (i.e., control criterion) of the supermatrix. For example, it can be seen in the portion of the unweighted supermatrix "A" displayed in Figure 14 that factor B3 (.7115) is approximately 2.5 times more influential on A1 than is factor B1 (.2885) – both factors being members of the Culture cluster. Further, factor A2 (1.000) accounts for 100% of the influence on A1 attributable from the Strategy and Leadership cluster. However, to determine the overall direct influence of these three factors (A2, B1, and B3) on A1, the individual influences must be weighted according to the cluster to which it belongs. This is accomplished by multiplying B1 and B3 by .12646 and multiplying A2 by .39597, which results in the values seen in the intermediate "B" supermatrix in Figure 14: A2 (.396), B1 (.0365), and B3 (.09). Each column in the intermediate "B" supermatrix is then normalized to make the weighted "C" supermatrix column stochastic. It is now possible to interpret that A2 (.7579) is more than four times more influential on A1 than B3 (.1722), and nearly 11 times more influential on A1 as B1 (.0698) in respect to *direct* influence.

Next, the creation of the *limit matrix* is performed by raising the weighted supermatrix to powers (i.e., continually multiplying the matrix by itself) until the matrix converges or stabilizes; that is, all columns contain the same values for each row.

	Strategy and Leadership				Culture				People				Technology				Alternatives (S/RS Success Constructs)								
	A1. Top	A2. Man	A3. Man	A4. KM	B1. Know	B2. Ince	B3. Effe	B4. Mut	C1. Emp	C2. Emp	C3. Willi	C4. Absc	C5. Stat	C6. Ded	D1. IT	D2. Com	D3. Effe	D4. Usab	E1. Kno	E2. KMS	E3. KMS	E4. Use	E5. User	E6. Net	
Strategy and Leadership																									
A1. Top	0.2968	0.188	0.3135	0.0339	0	0.0711	0.0271	0	0.0883	0.0443	0	0	0.0862	0.1971	0	0	0	0	0	0.0188	0.0144	0	0	0	0
A2. Man	0.7579	0.1753	0.4521	0.1397	0.0775	0.1025	0.0892	0.0982	0	0.1034	0	0	0.1198	0.2498	0	0	0	0	0	0	0.0274	0	0	0	0
A3. Man	0	0.4611	0	0	0.2324	0	0.0573	0.2043	0.3142	0.087	0	0	0.2569	0	0.4091	0.1879	0	0.0938	0.0938	0.075	0	0.0938	0	0	0
A4. KM	0	0	0.09	0	0	0	0	0	0	0	0	0	0.1088	0.5531	0	0	0	0	0	0	0.052	0	0	0	0
Culture																									
B1. Know	0.0698	0.084	0	0	0.6902	0.1068	0.3866	0.0592	0.0652	0.0175	0	0	0	0	0	0	0	0	0.0299	0	0.0213	0.0242	0.0613	0	0
B2. Ince	0	0	0	0	0	0	0	0.1012	0.0387	0.0229	0	0	0	0	0.29	0	0	0	0.0151	0.0575	0.0197	0.0308	0.0536	0	0
B3. Effe	0.1722	0	0	0	0.155	0	0	0	0	0.0343	0	0.1627	0	0	0	0	0	0	0.0339	0.0575	0.0456	0.0321	0	0	0
B4. Mut	0	0.1581	0	0	0.2316	0.2798	0	0	0.1096	0.0499	0	0	0	0	0	0	0	0	0.0361	0	0.0284	0.0278	0	0	0
People																									
C1. Emp	0	0	0	0	0	0	0	0	0.1344	0.5782	0.315	0	0	0	0.064	0	0.0584	0.0107	0.0199	0.0148	0.0197	0.0195	0.06	0	0
C2. Emp	0	0	0	0	0.1904	0.1904	0	0	0.1067	0	0	0	0	0	0	0	0.0204	0.0107	0.0117	0.0107	0	0	0	0	0
C3. Willi	0	0.1382	0	0.2495	0	0.2495	0.4399	0.217	0	0	0	0	0	0	0.0337	0	0.0274	0.0249	0.0302	0.0216	0	0	0	0	0
C4. Absc	0	0.0808	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0218	0.0207	0.034	0	0
C5. Stat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0186	0.0178	0.0228	0
C6. Ded	0	0	0	0	0	0	0	0.0935	0	0	0	0	0	0	0	0.2033	0.1382	0.1118	0.034	0.037	0.0358	0	0.0344	0	0
Technology																									
D1. IT	0	0.0305	0.0514	0	0	0	0	0	0	0	0	0	0.1358	0	0.0577	0	0	0	0	0	0.0318	0.066	0	0	0
D2. Comp	0	0.1083	0	0	0	0	0	0.1263	0	0	0	0.1552	0	0	0.2528	0.1741	0	0.1364	0.1174	0.1325	0	0.0865	0	0	0
D3. Effe	0	0	0.183	0	0	0	0	0.1003	0	0	0	0.2925	0	0	0	0.2083	0	0.056	0.0799	0.0814	0	0.0547	0	0	0
D4. Usab	0	0	0	0	0	0	0	0	0.1758	0.4218	0.0746	0	0	0	0	0	0	0.1136	0.1087	0.0604	0.24	0.1648	0.3868	0	0
Alternatives (S/RS Success Constructs)																									
E1. Know	0	0	0	0	0	0	0	0	0	0	0	0.2082	0	0	0	0	0	0	0	0	0.1389	0.1152	0.1234	0	0
E2. KMS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1004	0.0579	0.0773	0	0
E3. KMS	0	0	0	0	0	0	0	0	0.0688	0	0	0	0	0	0.3633	0.4474	0	0.1057	0.3015	0.066	0.0474	0	0	0	0
E4. Use	0	0.0887	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2534	0.0981	0.2037	0	0	0
E5. User	0	0.0387	0	0	0	0	0	0	0.0711	0	0	0	0	0	0	0	0	0	0	0.1394	0.0266	0.0921	0	0	0
E6. Net	0	0.0615	0	0	0	0	0	0.3839	0.084	0.0844	0	0	0	0	0	0	0	0	0	0.0609	0.0743	0	0	0	0

Table 8. Weighted Supermatrix

	Strategy and Leadership			Culture			People			Technology			Alternatives (S/RS Success Constructs)											
	A1. Top m	A2. Manag	A3. Manag	A4. KM str	B1. Knowl	B2. Incent	B3. Effect	B4. Mutual	C1. Emplo	C2. Emplo	C3. Willing	C4. Absor	C5. Status	C6. Dedic	D1. IT and	D2. Comp	D3. Effect	D4. Usabil	E1. Knowl	E2. KMS C	E3. KMS S	E4. Use	E5. User S	E6. Net B
Strategy and Leadership	0.0903	0.1382	0.129	0.0231	0.0658	0.0216	0.0324	0.0555	0.0272	0.028	0.0765	0.0016	0.0234	0.0272	0.043	0.0293	0.0459	0.0107	0.0078	0.0429	0.0305	0.0216	0.0297	
Culture	0.0903	0.1382	0.129	0.0231	0.0658	0.0216	0.0324	0.0555	0.0272	0.028	0.0765	0.0016	0.0234	0.0272	0.043	0.0293	0.0459	0.0107	0.0078	0.0429	0.0305	0.0216	0.0297	
People	0.0903	0.1382	0.129	0.0231	0.0658	0.0216	0.0324	0.0555	0.0272	0.028	0.0765	0.0016	0.0234	0.0272	0.043	0.0293	0.0459	0.0107	0.0078	0.0429	0.0305	0.0216	0.0297	
Technology	0.0903	0.1382	0.129	0.0231	0.0658	0.0216	0.0324	0.0555	0.0272	0.028	0.0765	0.0016	0.0234	0.0272	0.043	0.0293	0.0459	0.0107	0.0078	0.0429	0.0305	0.0216	0.0297	
Alternatives (S/RS Success Constructs)	0.0903	0.1382	0.129	0.0231	0.0658	0.0216	0.0324	0.0555	0.0272	0.028	0.0765	0.0016	0.0234	0.0272	0.043	0.0293	0.0459	0.0107	0.0078	0.0429	0.0305	0.0216	0.0297	

Table 9. Limit Matrix

Super Decisions Main Window: Analysis 1 FINAL - 1... - [] X

Here are the priorities.

Icon	Name	Normalized by Cluster	Limiting
No Icon	A1. Top management support	0.23727	0.090334
No Icon	A2. Management understands the value of~	0.36309	0.138235
No Icon	A3. Management's continuous commitment to~	0.33889	0.129021
No Icon	A4. KM strategy is linked to organizational strate~	0.06075	0.023130
No Icon	B1. Knowledge-friendly organizational culture	0.37541	0.065805
No Icon	B2. Incentives and reward system	0.12322	0.021599
No Icon	B3. Effective communicative environment	0.18480	0.032394
No Icon	B4. Mutually trusting environment	0.31656	0.055490
No Icon	C1. Employee training	0.16065	0.027195
No Icon	C2. Employee empowerment	0.16535	0.027990
No Icon	C3. Willingness to share knowledge	0.45210	0.076529
No Icon	C4. Absorptive capabilities of the empl~	0.07414	0.012550
No Icon	C5. Status of the knower	0.00962	0.001628
No Icon	C6. Dedicated staff and leadership	0.13814	0.023384
No Icon	D1. IT and organizational strategies aligned	0.10162	0.013362
No Icon	D2. Competence of technology team	0.32689	0.042982
No Icon	D3. Effective technological infrastruc~	0.22251	0.029257
No Icon	D4. Usability - friendly system to use and exchan~	0.34899	0.045888
No Icon	E1. Knowledge Content Quality	0.07488	0.010725
No Icon	E2. KMS Quality	0.05435	0.007784
No Icon	E3. KMS Service Quality	0.29983	0.042944
No Icon	E4. Use	0.21287	0.030489
No Icon	E5. User Satisfaction	0.15073	0.021589
No Icon	E6. Net Benefits (0.20734	0.029697

Okay Copy Values

Figure 15. Global priorities from Super Decisions' model synthesis

Therefore, the weighted supermatrix (Table 8) is continually multiplied by itself until each row converges to a limit. This limit matrix is shown in Table 9. While the weighted supermatrix discussed above accounts for all direct comparison measurements between nodes, the limit matrix measures *all* possible defined and implied relationships between nodes, between alternatives (i.e., S/RS success constructs), and between nodes and alternatives (both direct and indirect). In the case of a simple ANP network model like that which is used to represent the problem structure in this research, the limit matrix is also the synthesized solution, yielding the overall global priorities. Figure 15 lists Super Decision’s overall ANP model computed global priorities and values normalized by cluster.

4.2 The ANP Model Analysis

The ANP analysis first examines the overall synthesized model and addresses the research questions specific to the S/RS success constructs ranking and level of importance in FEKT. The second half of this ANP model analysis section specifically answers the research questions that address the global prioritization of the CSFs that influence the S/RS success constructs and the specific degree of influence imparted by each of the individual CSFs.

4.2.1 Storage/Retrieval Success Synthesized Priority Analysis







Overall Synthesized Priorities for the Alternatives					
Node	Graphic	Ranking	Ideals	Normals	Raw
E3. KMS Service Quality		1	1.0000	0.2998	0.0429
E4. Use		2	0.7100	0.2129	0.0305
E6. Net Benefits		3	0.6915	0.2073	0.0297
E5. User Satisfaction		4	0.5027	0.1507	0.0216
E1. Knowledge Content Quality		5	0.2497	0.0749	0.0107
E2. KMS Quality		6	0.1813	0.0543	0.0078

Table 10. Super Decisions synthesized Alternatives

The global priorities shown in Figure 15 represent both the S/RS success model and the CSFs that impact the dimensions of S/RS success. The Super Decisions software synthesizes the ANP model with respect to the alternatives, which are, in the context of this research, the six interdependent success dimensions (i.e., a multidimensional dependent variable) of the S/RS success model. Therefore, the resulting priorities can be interpreted, first, as the ranking of the most important or influential S/RS success constructs on FEKT, and second, as the degree of importance of each construct with respect to success in FEKT as reflected by the strength of the constructs' influence (i.e., the weights as listed in the "Normals" column in the alternatives cluster – see Table 10). In terms of the S/RS success constructs under study here, the priority ranking answers the following research question: *given that there are six dimensions that describe S/RS success in FEKT – Knowledge Content Quality, KMS Quality, KMS Service Quality, Use, User Satisfaction, and Net Benefits – which one of these constructs is most important in order to enable and facilitate knowledge transfer?* As will be discussed shortly, *KMS Service Quality* emerged as the most important dimension of success in this study. A follow-up research question next concerns the relative weighting of the six S/RS success constructs and answers the following: *How much more important is this top influential success construct (i.e., KMS Service Quality) than the other success constructs in ensuring S/RS success in FEKT?*

Table 10 presents the ANP model's synthesized priorities. Working right to left in Table 10, the "Raw" score column consists of the overall synthesized global priorities, which are in fact, the corresponding values from the limit matrix (Table 9) for the alternatives cluster's nodes. According to Saaty (2010), it is necessary to use the limit

matrix to capture influence transmissions across all possible paths within the supermatrix. This is because an element can indirectly influence a second element by its influence on a third element, where the third element influences the second. There can be many third elements; and each of these influences must be considered and measured. Further, an element may influence a fourth element, which then influences the second element, and so on and so forth. All such influences are obtained by raising the supermatrix to powers and thus, there is an infinite sequence of influence matrices. As explained by Saaty (2010), “If we take the limit of the average of a sequence of N of these powers of the supermatrix (known as the Cesaro sum) $\lim_{k \rightarrow \infty} \left(\frac{1}{N}\right) \sum_{k=1}^N W^k$, does the result converge and is the limit unique? How do we compute this limit to obtain the desired priorities?” As Saaty points out, in mathematical analysis, if a sequence converges to a limit, then its Cesaro sum converges to this same limit and since the sequence is defined by the powers of the matrix, it is sufficient to find the limit of these powers and the Cesaro sum is still unique, even if the sequence itself does not converge to a unique limit (May et al., 2013; Saaty, 2010).

Next, the values from the limit matrix are normalized for the alternatives cluster and shown in the “Normals” column in Table 10. The “Ideals” column is computed by taking the highest ranking node’s value – in this case, “*E3. KMS Service Quality*” value of 0.2998 – and dividing each “Normals” value by this number. For the sake of clarity in this analytical discussion, the values normalized for the alternative cluster will be used rather than the Ideals. Generally, the Ideal mode of synthesis is used to prevent rank reversals of the original set of alternatives when a new dominated alternative is added. However, the alternatives (or the S/RS success constructs in this study) are a closed set

(i.e., no new alternative or S/RS success construct is to be added in this study); further, Saaty (2009) states that it is established that even when a new dominated alternative is added in the distributive mode, 92% of the time, it results in no rank reversal. In fact, the Ideal mode synthesis was generated in Super Decisions software and compared with the distributive mode for this study and is simply a mathematically equivalent representation of the normalized values. Therefore, the normalized values are used in this research (unless otherwise stated). Finally, the “Ranking” column lists the relative order of importance of each node. Caution should be used to not interpret the ranks too literally as some values may be near equivalent and should be consider as such.

The prioritization of the success constructs for S/RS success in FEKT is a primary objective for this research. It is important to note that this S/RS success model, like the original DeLone and McLean (2003) model, posits that KMS success is described as a multidimensional interrelated dependent variable consisting of six constructs: *Knowledge Content Quality*, *KMS Quality*, *KMS Service Quality*, *Use*, *User Satisfaction*, and *Net Benefits*. Not only does each of these dimensions or constructs individually define KMS success, but also, each of these dimensions is interrelated and interdependent with one or more of the other dimensions that define KMS success. For example, *KMS Service Quality* is not only a direct measure of KMS S/RS success (e.g., are those servicing the S/RS empathetic to KM users, responsive to users’ needs, able to maintain the KMS system performance level, etc.), but also, *KMS Service Quality* influences *Use* and *User Satisfaction*. *Use* and *User Satisfaction* in turn influence *KMS Service Quality*, and *KMS Service Quality* also influences *KMS Quality* and *Knowledge Content Quality*, which in turn influence *Use* and *User Satisfaction*, which again influence *KMS Service Quality*,

and so on. Therefore, there is a need to analyze this multidimensional dependent variable with an analytic technique, such as the ANP, that measures the combined effect of both direct and indirect influences.

With the knowledge as to which S/RS success constructs are most important in FEKT, an organization can focus its resources and efforts on those success constructs that experts identify as being most influential and impactful to FEKT, perhaps allocating less resources on areas that do not impact success as much. It can be seen in the “Ranking” column in Table 10, that *E3. KMS Service Quality* (with a cluster normalized value of 0.2998) emerged as the top ranked S/RS success construct (i.e., the most significant dimension of success for KMS S/RS in FEKT). It should be noted that the cluster normalized values used in Table 10, such as .2998 for *E3. KMS Service Quality*, are best understood when used in comparisons to other success constructs. For example, based on the Rankings column, the next two most influential dimensions of success following E3 are *E4. Use* (0.2129) and *E6. Net Benefits* (0.2073). It can be seen that E4 ($.2129/.2998=.7100$) and E6 ($.2073/.2998=.6915$) are both approximately 70% of the importance in FEKT when compared to E3 (.2998), and are essentially tied for the second most influential success construct. Next, the fourth most influential S/RS success construct in FEKT is *E5. User Satisfaction* (.1507), which influences success only about half as much as top influencer *E3. KMS Service Quality* and about 29% less than both *E4. Use* and *E6. Net Benefits*. The fifth most influential success construct, *E1. Knowledge Content Quality* (.0749), has an influence that is four times less than that of the top ranked construct *E3. KMS Service Quality*, three times less than either *E4. Use* or *E6. Net Benefits*, and half the influence of *E5. User Satisfaction*. Finally, *E2. KMS Quality*

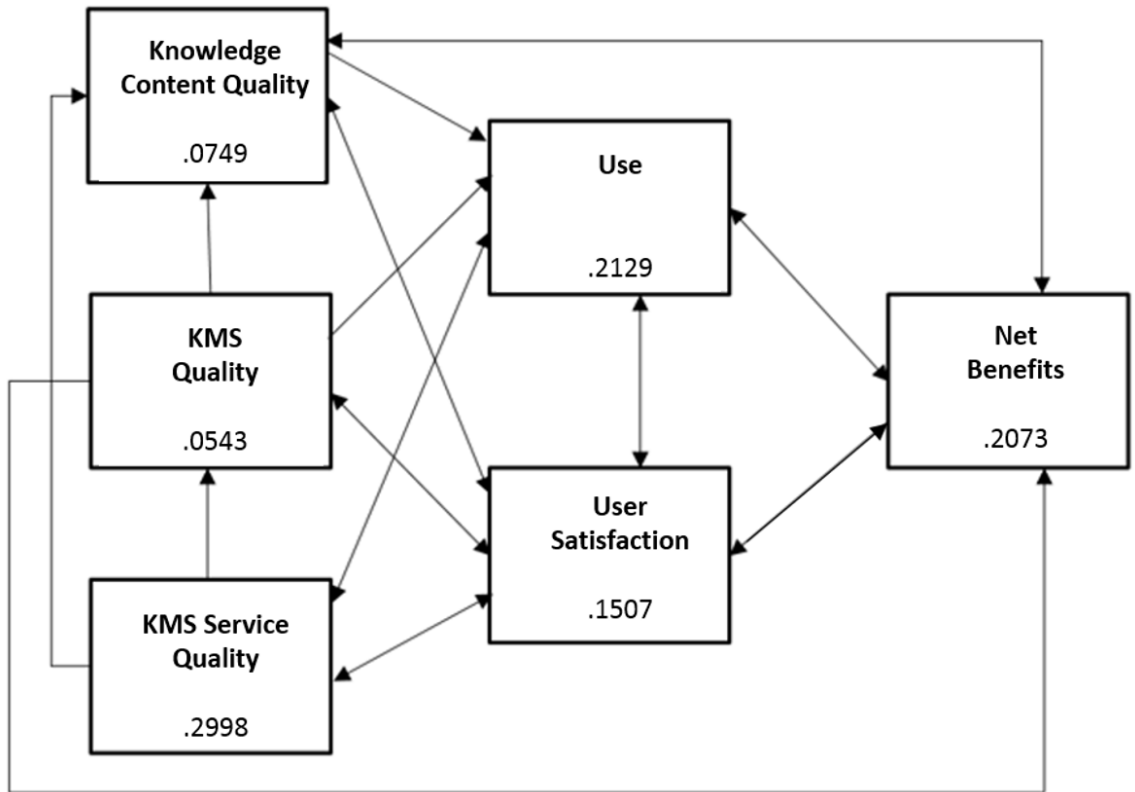


Figure 16. Overall ANP synthesized priorities for KMS Storage/Retrieval System Success Model (.0543) exhibits the least amount of influence on S/RS success and is only one-sixth the influence of *E3. KMS Service Quality* on S/RS success. Figure 16 depicts the S/RS success model and its associated normalized priorities, indicating strength of influence.

4.2.2 Global CSF Priority Analysis

The second major objective of this study is the prioritization of CSFs for achieving the overall goal of S/RS success with respect to FEKT. Identification of the CSFs that most positively impact S/RS success enables organizational leaders and managers to focus their resources, attention, strategy, and tactics on factors most critical to the success of their KM S/RS effort.

Synthesized Global Critical Success Factors				Ranking	Ideals	Normalized	Limiting
Cluster	Critical Success Factor	Graphics					
A.Strategy and Leadership	A2. Management understands the value of KM		1	1.0000	0.1613	0.1382	
A.Strategy and Leadership	A3. Management's continuous commitment to resources...		2	0.9333	0.1506	0.1290	
A.Strategy and Leadership	A1. Top management support		3	0.6535	0.1054	0.0903	
C.People	C3. Willingness to share knowledge		4	0.5536	0.0893	0.0765	
B.Org. Culture	B1. Knowledge-friendly organizational culture		5	0.4760	0.0768	0.0658	
B.Org. Culture	B4. Mutually trusting environment		6	0.4014	0.0648	0.0555	
D.Technology	D4. Usability - friendly system to use and exchange know...		7	0.3320	0.0536	0.0459	
D.Technology	D2. Competence of technology team		8	0.3109	0.0502	0.0430	
B.Org. Culture	B3. Effective communicative environment		9	0.2343	0.0378	0.0324	
D.Technology	D3. Effective technological infrastructure		10	0.2116	0.0341	0.0293	
C.People	C2. Employee empowerment		11	0.2025	0.0327	0.0280	
C.People	C1. Employee training		12	0.1967	0.0317	0.0272	
C.People	C6. Dedicated staff and leadership		13	0.1692	0.0273	0.0234	
A.Strategy and Leadership	A4. KM strategy is linked to organizational strategy		14	0.1673	0.0270	0.0231	
B.Org. Culture	B2. Incentives and reward system		15	0.1562	0.0252	0.0216	
D.Technology	D1. IT and organizational strategies aligned		16	0.0967	0.0156	0.0134	
C.People	C4. Absorptive capabilities of the employees		17	0.0908	0.0146	0.0126	
C.People	C5. Status of the knower		18	0.0118	0.0019	0.0016	

Table 11. ANP-derived Global Priorities of CSFs for Storage/Retrieval System Success in FEKT

The ANP synthesis determines the overall global priorities for both the alternatives and the CSFs. In the case of a simple network structure like that used in this research, the global priorities are taken directly from the limit supermatrix. As previously discussed in section 4.2.1, the limit matrix considers all possible direct and indirect paths of influence by taking the weighted supermatrix to powers. The problem solving power of the ANP lies in its ability to account for not only the direct influences such as node A2 influencing E3, but also the endless possibility of indirect influences. A hypothetical example of this would be A2 influencing A3, which in turn A3 influences E3 directly; and A3 also influences C6 that influences E3, and so on. With the synthesized global priorities, it is possible to see the aggregate effect of the influences of a particular node upon the overall goal of S/RS success with respect to FEKT. Most importantly for this study, the global priorities of the CSF answer the research question: *having identified 18 CSFs from the literature that impact KMS storage/retrieval systems, which of these factors are most important to the success of a storage/retrieval system in facilitating and enabling knowledge transfer?* From the ANP perspective, this research question is equally asking the following: *which nodes are most influential in influencing the priorities of the*

alternatives? Again, an additional research question concerns the relative weighting of these CSFs and answers the following question: ***how much more important are these top influential CSFs when compared to the other CSFs in supporting S/RS success in FEKT?***

Table 11 provides information relative to the synthesized global priorities for the 18 CSFs investigated in this study. The far right column, identified as "Limiting", represents the individual CSF values taken directly from limit supermatrix. Within the limit supermatrix (refer to Table 9), the values for each row are the same in each of the columns and the columns are stochastic. The limit supermatrix also contains the prioritization of the alternatives cluster. While there are obviously influences of the CSFs on the alternatives (see the weighted supermatrix, Table 8) – and in some cases, influences from the alternatives to CSFs – these influences are already accounted for in the calculation of the limit matrix. Therefore, the alternatives are not used in this CSF synthesized priority analysis. The limiting values are normalized across all four CSF clusters (i.e., the alternatives cluster is excluded) and are displayed in the "Normalized" column of Table 11. The "Ideals" represent each CSF in comparison to the top-most influential CSF, giving a sense of its influence compared to the most influential CSF, and is computed by taking a CSF's normalized value and dividing it by the normalized value of the top-ranked CSF. For example, A3 is divided by A2 and results in an Ideal value of 0.9333 ($.1506/.1613 = .9333$). This means that A3 has about 93% of the influence of A2 in FEKT. However, for the remainder of this portion of the analysis, only the normalized values will be used in the discussion unless otherwise noted. The "Ranking" column lists the order of strength of influence – from strongest to weakest – for the CSFs across *all*

clusters (i.e., disregarding cluster membership). Finally, the “Graphics” column reveals that there are three CSFs (A2, A3, and A1) that stand out as particularly strong global influencing factors, five other CSFs (C3, B1, B4, D4, and D2) that have moderate levels of influence (at a much lower level than that of the first group) and then the rest of the CSFs that range from relatively low to essentially insignificant in their strength of global influence.

The *A2. Management Understands the Value of KM and Articulates this View with the Organization* CSF emerged as the single most influential CSF for S/RS Success in FEKT. Overall, the most influential CSFs for achieving the overall goal are: *A2. Management Understands the Value of KM ...* (.1613), *A3. Management’s Continuous Commitment to Resources Required for KM* (.1506), and *A1. Top Management Commitment and Ongoing Support* (.1054). These top three most influential CSFs account for 41.73% of the success in achieving the overall goal. The next most influential group of CSFs are: *C3. Willingness to Share Knowledge* (.08930), *B1. Knowledge-Friendly Organizational Culture* (.0768), *B4. Mutually Trusting Environment* (.0648), *D4. Usability* (.0536), and *D2. Competence of Technology Team* (.0502). Together, these five CSFs account for 33.47% of the overall success but individually, are between two to three times less influential on success when compared to CSF A2. Moreover, these first eight most influential CSFs account for slightly over 75% of the success in achieving the goal, with the remaining ten CSFs being accountable for only 25%. The next group of CSFs – *B3. Effective Communicative Environment* (.0378), *D3. Effect Technological Infrastructure* (.0341), *C2. Employee Empowerment* (.0327), *C1. Employee Training* (.0317), *C6. Dedicated Staff and Leadership* (.0273), and *A4. KM Strategy is Linked to*

Organizational Strategy (.0270) – are within about 1% of each other and their influences on goal success are essentially equivalent. It should also be noted that each CSF within this group has only around one-fifth the influence on success when compared to top CSF A2 and collectively, these six CSFs account for 19% of the overall success. The final group of CSFs – *B2. Incentives and Reward Systems* (.0252), *D1. IT and Organizational Strategies are Aligned* (.0156), *C4. Absorptive Capabilities of the Employees* (0.146), and *C5. Status of the Knower* (.0019) – are accountable for the remaining 6% of the overall success. When compared to the highest influencer CSF A2, the CSFs in this last group vary from seven times (CSF A4) to one-hundred times (CSF C5) less influential, globally.

Cluster	Summed Limit	Normalized Cluster Influence
A.Strategy and Leadership	0.3807	0.4444
B.Org. Culture	0.1753	0.2046
C.People	0.1693	0.1976
D.Technology	0.1315	0.1535

Table 12. Aggregate global cluster priority

Also of interest to the analysis of the global priorities for the CSFs is the influence imparted by the clusters as a sum of their individual CSFs. Table 12 displays the overall influence for each of the CSF clusters, calculated by summing the priorities (or limit matrix values) for each CSF within a cluster and then normalizing the summed priorities (or limit values) to include only the CSF clusters (i.e., exclude the Alternatives cluster). It can be seen that cluster A.Strategy and Leadership (.4444) has more than twice the impact of both B.Organizational Culture (.2046) and C.People (.1976), and almost three times the influence as D.Technology (.1535). Table 13 summarizes the CSFs influence

within their clusters by normalizing the limiting values and then ranking the CSF within the cluster to which they belong.

Global CSF Priorities Normalized by Cluster

Cluster	Critical Success Factor	Normalized By Cluster	Cluster Rank	Limiting
A.Strategy and Leadership	A1. Top management support	0.2373	3	0.0903
	A2. Management understands the value of KM	0.3631	1	0.1382
	A3. Management's continuous commitment to resources...	0.3389	2	0.1290
	A4. KM strategy is linked to organizational strategy	0.0608	4	0.0231
B.Org. Culture	B1. Knowledge-friendly organizational culture	0.3754	1	0.0658
	B2. Incentives and reward system	0.1232	4	0.0216
	B3. Effective communicative environment	0.1848	3	0.0324
	B4. Mutually trusting environment	0.3166	2	0.0555
C.People	C1. Employee training	0.1607	3	0.0272
	C2. Employee empowerment	0.1654	2	0.0280
	C3. Willingness to share knowledge	0.4521	1	0.0765
	C4. Absorptive capabilities of the employees	0.0741	5	0.0126
	C5. Status of the knower	0.0096	6	0.0016
	C6. Dedicated staff and leadership	0.1381	4	0.0234
D.Technology	D1. IT and organizational strategies aligned	0.1016	4	0.0134
	D2. Competence of technology team	0.3269	2	0.0430
	D3. Effective technological infrastructure	0.2225	3	0.0293
	D4. Usability - friendly system to use and exchange know...	0.3490	1	0.0459

Table 13. CSFs' global priority normalized by cluster

4.3 Sensitivity Analyses

ANP's network structure presents a particular challenge for researchers wishing to measure the sensitivity of the model to node perturbation. While the ANP model allows the researcher to break down large decisions into smaller, more manageable ones, the nodes in a typical ANP model are connected to each other without regard to any hierarchy to represent the interrelationships between these smaller decisions. Therefore, each of these connections representing smaller decisions are ultimately synthesized to arrive at the final decision. However, because a simple tree structure like that used in the AHP is not used in the ANP, the effects of a change in one node and how it impacts interrelated smaller decisions and further, how it may or may not affect the overall decision is much more difficult to obtain in the ANP (Adams and Saaty, 2012b).

The sensitivity analysis carried out in this study relies upon a relatively new sensitivity calculation methodology – ANP Row Sensitivity – that shares similar qualities of the AHP sensitivity analysis (Adams, 2014; Adams and Saaty, 2012a). The notion behind the ANP row sensitivity is to choose a node (i.e., an entire row) in a network and adjust its weight globally prior to the limit matrix (i.e., using the weighted supermatrix). This is accomplished by changing the weight of the node with respect to all nodes that are connected to it, while still preserving the ANP structure, and then recalculating the alternative values (Adams and Saaty, 2012b). In preserving the ANP structure, as much as possible, no new connections to nodes are made nor are any existing node connections removed; thus, the sensitivity analysis reflects the actual ANP structure of the model and not the previously synthesized outcome (Adams, 2014). In the following sections, three types of ANP sensitivity analyses are carried out: the influence analysis, the marginal sensitivity analysis, and the perspective sensitivity analysis; however, a brief discussion of the ANP Row Sensitivity process is important, as it is the basis for all three of the analyses which follow.

The ANP row sensitivity works on the weighted supermatrix. For a chosen row, there is a single parameter P that is between 0 and 1, which controls how important the sensitivity of the row is. There is also a parameter value P_0 (referred to as the fixed point) that represents the value when the node is returned to its original weight (i.e., the parameter's original value). For values of P larger than P_0 , the influence of the node increases and conversely; if P is smaller than P_0 , then the influence of the node decreases. Once a value of P is chosen, the appropriate rows are scaled to a value dependent on P and on whether P is greater or less than P_0 , then the weighted supermatrix is made

column stochastic and raised to powers; that is, the limit matrix is created and the solution resynthesized.

The mechanics of the ANP Row Sensitivity are as follows:

- 1) From the weighted supermatrix, a sensitivity row (node) is chosen to analyze.
- 2) Trivial columns are left unchanged. These are defined as columns that have a row value of zero or one for the row being analyzed.
- 3) A parameter P with a value between 0 and 1 is chosen, which controls how important the sensitivity row is.
- 4) A fixed point value P_0 is chosen, with a default value of 0.5 that represents the original weight.
- 5) Where $P < P_0$ – i.e., push down priorities – the sensitivity row is scaled by $\frac{P}{P_0}$ and the remainder of the columns are then normalized so that the weighted supermatrix is column stochastic. For this research, the symbol “ P^- ” represents a parameter where $P < P_0$. Note that $P_0 \neq 0$.
- 6) Where $P > P_0$ – i.e., push up priorities – all rows except the sensitivity row are scaled by $\frac{1-P}{1-P_0}$ and the sensitivity row value normalizes each column so that the weighted supermatrix is column stochastic. For this research, the symbol “ P_+ ” represents a parameter where $P > P_0$. Note that $P_0 \neq 1$.
- 7) Take the weighted supermatrix to powers to create the limit matrix and resynthesize the solution.

4.3.1 Influence Sensitivity Analysis

The idea behind the ANP Influence Sensitivity Analysis is to combine the ANP Row Sensitivity with some type of distance metrics that reveal how much the alternative

values move in the process of performing row sensitivity. This is accomplished by moving each node up a fixed amount and then the change in the alternatives scores are analyzed. Similarly, each node is moved down by a fixed amount and the alternatives are likewise evaluated. There are several distance metrics that can be used, such as rank distance, Euclidean distance, and taxicab distance. This research employs all three metrics at various points throughout the sensitivity analysis process.

Rank distance is the summation of the degree of changes in rank (i.e., rank reversals) from the original synthesized ANP model to the model after perturbation. Rank distance can be generalized as: $\sum_{i=1}^n |R_o^i - R_p^i|$, where R_o^i the original rank of the i^{th} alternative, R_p^i is the rank of the i^{th} alternative after perturbation, and n is the number of alternatives.

Euclidean distance is the ordinary straight-line distance between two points and calculate here as: $\sqrt{\sum_{i=1}^n (V_o^i - V_p^i)^2}$, where V_o^i is the original value for the i^{th} alternative, n is the number of alternatives, and V_p^i is the value after perturbation for the i^{th} alternative.

Taxicab distance or city block distance is the distance between two points given as the sum of the absolute value of the differences of their Cartesian coordinates and calculated here as: $\sum_{i=1}^n |V_o^i - V_p^i|$, where V_o^i is the original value for the i^{th} alternative, n is the number of alternatives, and V_p^i is the value after perturbation for the i^{th} alternative.

The ANP Influence Sensitivity Analysis gives information on medium to long term changes in node influence that affects the alternatives' scores (Adams and Saaty, 2014c).

In this study, two levels of influence sensitivity analyses are undertaken: 1) a short-term analysis (where the nodes' lower parameter are asymmetrically set at a lower parameter value of 0.3 and the upper parameter set at 0.6, with $P_o = 0.5$) and 2) a wide ranged analysis with equidistant lower and upper parameters (where the nodes' lower parameter P_- are set to close to 0.1 and the upper parameter P_+ set to 0.9, with $P_o = 0.5$).

The notion of using parameter values that are non-equidistant from P_o (i.e., asymmetric distances from P_o , where P_- is farther away from P_o than is P_+) takes into account the fact that lower parameter values are, by their nature, less influential than upper parameter values. This is because, as the parameter value of a node approaches 0 and becomes essentially of no consequence to the model, it proportionately redistributes its influence to the rest of the nodes. This proportionate redistribution of influence results in much less a change when compared to a parameter approaching 1, which becomes extremely important as it takes away priority from all the other nodes.

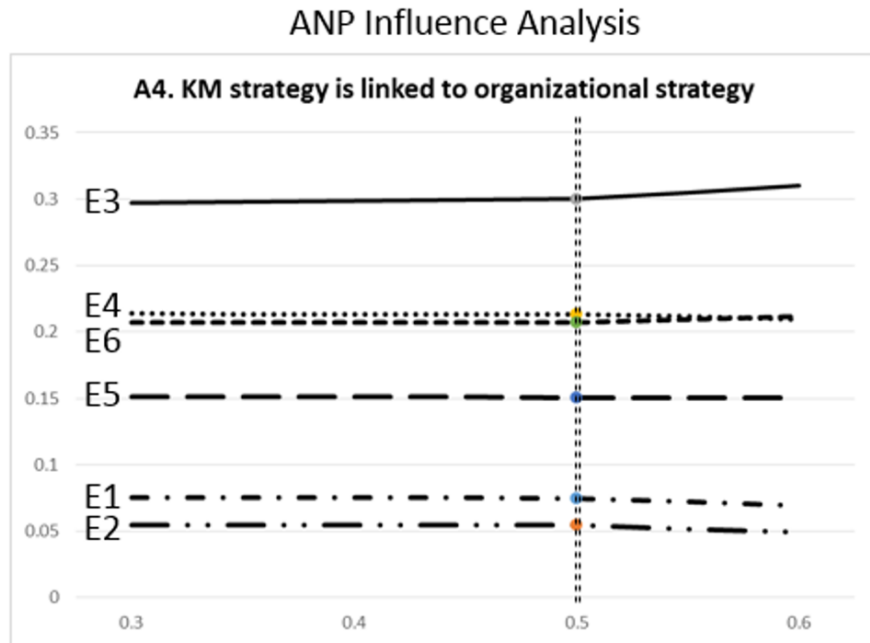
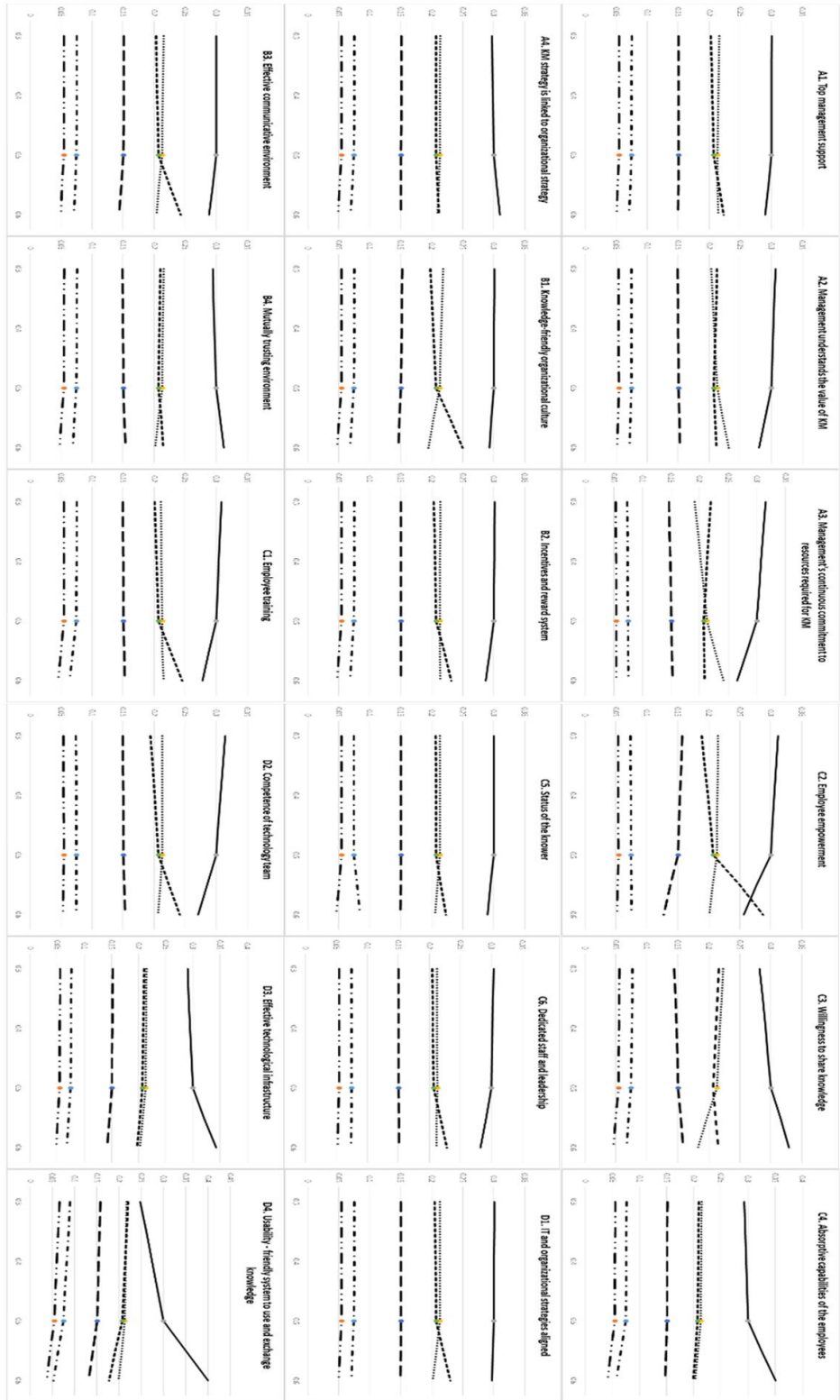


Figure 17. Example node influence sensitivity analysis for $P_- = 0.3$, $P_o = 0.5$, $P_+ = 0.6$

In this short-term influence sensitivity analysis, each of the 18 nodes are individually set to an initial starting value of $P_o = 0.5$ – representing the initial state of the ANP model. This means that if the parameter was not to change, this is the synthesized results from the global ANP analysis for the alternatives previously discussed in section 4.2.1 above. Observing the example node influence sensitivity analysis in Figure 17, along the x-axis, are the range of parameter values the node can take on with the lowest point (P_-) set at 0.3 and the highest point (P_+) set at 0.6. Along the y-axis are the values that reflect the strength of influence of the node on the alternatives. Each of the lines represents the values that each of the six alternatives (E1 through E6) takes on as the node's parameter changes in strength. Starting at the $P_o = 0.5$ point (a double-dotted vertical line helps pinpoint this on the graph), it can be observed that the value for each of the alternatives are precisely that which is shown in Table 10 (E3 = .2998, E4 = .2129, etc.) and are the original values of the alternatives from the synthesized ANP model. The example influence analysis of node A4, shown in Figure 17, can be interpreted to mean that as the value of the parameter for A4 is decreased by moving the parameter to the left of P_o – i.e., as the importance of *A4. KM Strategy is linked to Org. Strategy* becomes less and less important – this decrease in A4's influence is reflected in the change in the values of each of the alternatives. Similarly, moving the parameter value to the right of P_o increases the importance of A4 and any change in the alternatives are a result of this increased importance. In the example case of node A4, it be seen that decreasing the importance of A4 changes the alternatives very little and increasing the importance of A4 brings *E4. Use* and *E6. Net Benefits* even closer together. Still, there is relatively little impact on the alternatives. This short-term influence sensitivity analysis helps



ANP Influence Analysis
 $P = 0.3, P_0 = 0.5, P_+ = 0.6$

ANP Influence Analysis
 $P = 0.3, P_0 = 0.5, P_+ = 0.6$

- - - E1. Knowledge Content Quality - - - E2. KMS Quality - - - E3. KMS Service Quality
 E4. Use - - - E5. User Satisfaction - - - E6. Net Benefits (Individual Impact)

Figure 18. Influence Analysis: $P = 0.3, P_0 = 0.5, P_+ = 0.6$

demonstrate the robustness of the ANP model when there are relatively minor changes in the values of the nodes. Figure 18 (see Appendix G for more detail) illustrates this influence sensitivity analysis for all nodes (CSFs) in the ANP model. Overall, the short-term influence sensitivity analysis reveals that the ANP model is relatively stable with short to medium changes in the nodes. As discussed in section 4.2.1 above, the *E4. Use* and *E6. Net Benefits S/RS* success constructs were very close in the overall influence. It is evident from this short-term influence analysis that there are rank reversals between *E4* and *E6* on 12 of the 18 nodes (CSFs). This analysis illuminates those CSFs (e.g., *A2*, *A3*, *B1*, etc.) where only a small increase in their level of importance can result in rank reversals between the *E4. Use* and *E6. Net Benefits S/RS* success constructs. Also, node *C2. Employee empowerment* is of significant interest in that a small increase in its importance from a $P_0 = 0.5$ to $P_+ = 0.6$ caused a rank reversal between the top S/RS success constructs *E3. KMS Service Quality*, *E4. Use*, and *E6. Net Benefits*. This interesting node influence from the *C2* CSF will be further investigated in the marginal sensitivity analysis section that follows this influence sensitivity analysis section.

The second influence sensitivity analysis examines at a wider range of values for the nodes' parameter, with a minimum parameter value of $P^- = 0.1$ on the decreasing side of $P_0 = 0.5$ and the maximum increasing parameter value set at $P_+ = 0.9$. This analysis examines the changes in the ANP model's alternatives when a much larger change in a node's parameter has occurred. The analysis, using a larger range, gives insight into how the model might change if there is a rather large change in one of the node's parameter value. Table 14 provides a summary view of the change that would occur in the ANP model's alternatives values – and possibly, subsequent rank changes – when each of the

model's nodes is taken, individually, and the parameter for that node has its value set to 0.9. In Table 14, the original un-perturbed ANP model's alternative values and rank are given on the first line of data titled "Original Values". The table is then sorted in decreasing order of the magnitude (distance) in respect to the change in the values of the alternatives caused by the perturbation of individual nodes from the original ANP synthesized alternatives values. As presented here, all three distance metrics previously mentioned (rank distance, Euclidean distance, and taxicab distance) are computed for each node's influence on the alternatives. As can be seen in Table 14, node *D4. Usability*, has a greater change in Euclidean distance (1.356729) and taxicab distance (.813574) than any other CSF. Examining the first node row (D4), the interpretation would be as follows: as the *D4. Usability* CSF becomes an increasingly important factor (with a

Nodes	Param	Eucl. Dist.	Taxicab Dist.	Rank Dist.	E1	E1 Rank	E2	E2 Rank	E3	E3 Rank	E4	E4 Rank	E5	E5 Rank	E6	E6 Rank
Original Values	0.5	0	0	0	0.074880	5	0.054348	6	0.299829	1	0.212869	2	0.150734	4	0.207341	3
D4	0.9	1.356729	0.813574	0	0.007250	5	0.004808	6	0.706616	1	0.116386	2	0.061194	4	0.103746	3
C2	0.9	1.152033	0.477727	4	0.072481	5	0.044655	6	0.169655	3	0.181872	2	0.085134	4	0.446204	1
B3	0.9	0.853452	0.353910	4	0.065465	5	0.041131	6	0.212803	2	0.189319	3	0.106986	4	0.384296	1
D2	0.9	0.849447	0.382902	6	0.073373	5	0.048873	6	0.171810	2	0.156418	4	0.166060	3	0.383465	1
C4	0.9	0.842620	0.452196	0	0.011858	5	0.008553	6	0.525927	1	0.163125	2	0.132935	4	0.157603	3
C1	0.9	0.774597	0.333347	4	0.018590	5	0.012250	6	0.243091	3	0.250675	2	0.139186	4	0.336208	1
D3	0.9	0.725744	0.435198	2	0.044003	5	0.029297	6	0.517428	1	0.144891	3	0.101199	4	0.163182	2
B1	0.9	0.710600	0.294672	4	0.052949	5	0.033164	6	0.273914	2	0.151594	3	0.133702	4	0.354677	1
C5	0.9	0.590920	0.220567	4	0.115602	5	0.022233	6	0.261878	2	0.177660	3	0.145726	4	0.276902	1
D1	0.9	0.552757	0.229218	6	0.062235	5	0.042770	6	0.293913	2	0.135023	4	0.144109	3	0.321950	1
C3	0.9	0.540996	0.314585	4	0.054845	5	0.032251	6	0.396805	1	0.097708	4	0.167562	3	0.250829	2
C6	0.9	0.516335	0.288508	6	0.077044	5	0.050968	6	0.158954	4	0.229254	2	0.169382	3	0.314398	1
A3	0.9	0.490604	0.249280	4	0.077110	5	0.052301	6	0.177236	3	0.317304	1	0.156967	4	0.219082	2
A2	0.9	0.485609	0.265810	4	0.057214	5	0.039490	6	0.199448	3	0.316240	1	0.159850	4	0.227758	2
B2	0.9	0.469887	0.269860	4	0.045484	5	0.028810	6	0.219832	3	0.285327	1	0.158562	4	0.261984	2
B4	0.9	0.425204	0.126171	2	0.052715	5	0.031239	6	0.341146	1	0.195057	3	0.164535	4	0.215308	2
A4	0.9	0.365605	0.165383	2	0.050430	5	0.034478	6	0.370592	1	0.180750	3	0.144481	4	0.219269	2
A1	0.9	0.304919	0.186885	4	0.058917	5	0.040692	6	0.241116	3	0.243090	2	0.145622	4	0.270563	1

Table 14. Summary view of ANP Influence Sensitivity for $P_+ = 0.9$

parameter value of 0.9), it influences the alternatives – i.e., the S/RS Success constructs – such that the value of *E3. KMS Service Quality* (0.706616) has more than doubled from its original value of 0.2998 and in turn, the value of the other five S/RS Success constructs have greatly diminished. Interestingly, examining the Rank Distance for the D4 row, reveals a zero value. This indicates there was no rank reversal in light of this

rather large change in the alternatives values. This can be verified visually by looking at the graph of D4 in Figure 19 below (also, see Appendix G for more detail). Exactly

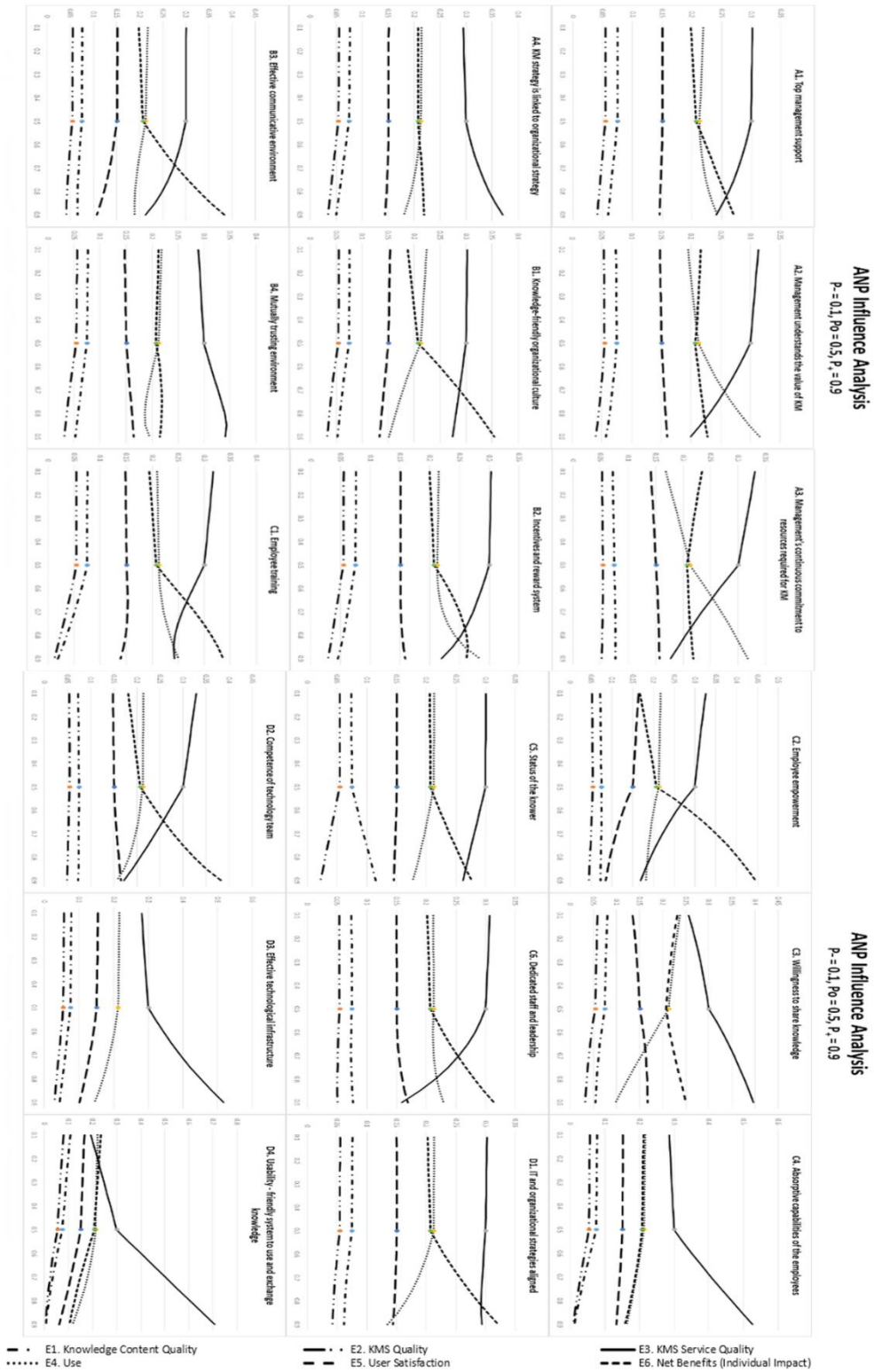


Figure 19. Influence Analysis: P- = 0.1, Po = 0.5, P+ = 0.9

which of the distance metrics to use is a matter that is defined by the nature of the study.

Examining the C2 node row, the Euclidean distance is quite large (1.152033), which indicates significant changes in the intensity of the alternatives from the original model's values. In the case of the C2 node – unlike the influence change caused by increasing the parameter value of D4 that more than doubled the importance of the E3 alternative while leaving the other alternatives' rank in place – the P₊ value of 0.9 caused rank reversal between the E3 and E6, which shifted *E3. KMS Service Quality* to the third rank and moved *E6. Net Benefits* up to the top-ranked alternative. This can be interpreted as a major increase in the importance of *C2. Employee empowerment* caused *E6. Net Benefits* to become the most important of the S/RS Success constructs – shifting the importance upward from 0.207341 to 0.446204 – and significantly reduced the importance of *E3. KMS Service Quality* – (from 0.299829 to 0.181872). Again, the C2 chart in Figure 19 provides a visual confirmation of these changes. Typically, one would also be interested in this same analysis, but where the P₋ parameter value is set to 0.1 and the effects from a major decrease in a node's influence on the alternatives is then studied. However, Figure 19 (Appendix G) is extremely informative in illustrating the relative of the ANP model in respect to large decreasing shifts in the parameters values to the left of P_o = 0.5. From the charts in Figures 19 and the data in Table 15, only four of the nodes (CSFs) – *A2. Management understands the value of KM...*, *A3. Management's continuous commitment to resources...*, *C2. Employee empowerment*, and *D4. Usability* – have any notable consequence to the alternatives. In A2, there is a rank reversal between *E4. Use* and *E6. Net Benefits*, but the weights of these two alternatives still remain fairly close. In A3, there is, again, a rank reversal between E4 and E6, but its effect on these two

Full ANP Influence Sensitivity

Node	P	Dist: Euclid	Dist: Taxicab	Dist: Rank	E1	E2	E3	E4	E5	E6	E1 rank	E2 rank	E3 rank	E4 rank	E5 rank	E6 rank
Orig.	0.5	0	0	0	0.07488	0.05435	0.29983	0.21287	0.15073	0.20734	5	6	1	2	4	3
A1	0.9	0.304919	0.186885	4	0.058917	0.040692	0.241116	0.243090	0.145622	0.270563	5	6	3	2	4	1
A2	0.9	0.485609	0.265810	4	0.057214	0.039490	0.199448	0.316240	0.159850	0.227758	5	6	3	1	4	2
A3	0.9	0.490604	0.249280	4	0.077110	0.052301	0.177236	0.317304	0.156967	0.219082	5	6	3	1	4	2
A4	0.9	0.365605	0.165383	2	0.050430	0.034478	0.370592	0.180750	0.144481	0.219269	5	6	1	3	4	2
B1	0.9	0.710600	0.294672	4	0.052949	0.033164	0.273914	0.151594	0.133702	0.354677	5	6	2	3	4	1
B2	0.9	0.469887	0.269860	4	0.045484	0.028810	0.219832	0.285327	0.158562	0.261984	5	6	3	1	4	2
B3	0.9	0.853452	0.353910	4	0.065465	0.041131	0.212803	0.189319	0.106986	0.384296	5	6	2	3	4	1
B4	0.9	0.425204	0.126171	2	0.052715	0.031239	0.341146	0.195057	0.164535	0.215308	5	6	1	3	4	2
C1	0.9	0.774597	0.333347	4	0.018590	0.012250	0.243091	0.250675	0.139186	0.336208	5	6	3	2	4	1
C2	0.9	1.152033	0.477727	4	0.072481	0.044655	0.169655	0.181872	0.085134	0.446204	5	6	3	2	4	1
C3	0.9	0.540996	0.314585	4	0.054845	0.032251	0.396805	0.097708	0.167562	0.250829	5	6	1	4	3	2
C4	0.9	0.842620	0.452196	0	0.011858	0.008553	0.525927	0.163125	0.132935	0.157603	5	6	1	2	4	3
C5	0.9	0.590920	0.220567	4	0.115602	0.022233	0.261878	0.177660	0.145726	0.276902	5	6	2	3	4	1
C6	0.9	0.516335	0.288508	6	0.077044	0.050968	0.158954	0.229254	0.169382	0.314398	5	6	4	2	3	1
D1	0.9	0.552757	0.229218	6	0.062235	0.042770	0.293913	0.135023	0.144109	0.321950	5	6	2	4	3	1
D2	0.9	0.849447	0.382902	6	0.073373	0.048873	0.171810	0.156418	0.166060	0.383465	5	6	2	4	3	1
D3	0.9	0.725744	0.435198	2	0.044003	0.029297	0.517428	0.144891	0.101199	0.163182	5	6	1	3	4	2
D4	0.9	1.356729	0.813574	0	0.007250	0.004808	0.706616	0.116386	0.061194	0.103746	5	6	1	2	4	3
A1	0.1	0.043191	0.018080	0	0.075004	0.054566	0.302109	0.219286	0.150649	0.198385	5	6	1	2	4	3
A2	0.1	0.082649	0.045392	2	0.073774	0.053413	0.313606	0.195276	0.147672	0.216260	5	6	1	3	4	2
A3	0.1	0.207772	0.116264	2	0.072310	0.052512	0.330761	0.168641	0.141236	0.234540	5	6	1	3	4	2
A4	0.1	0.024599	0.010587	0	0.076541	0.055685	0.294536	0.214621	0.151242	0.207377	5	6	1	2	4	3
B1	0.1	0.093058	0.038589	0	0.076027	0.055443	0.302145	0.224335	0.154005	0.188046	5	6	1	2	4	3
B2	0.1	0.036257	0.015267	0	0.075820	0.055139	0.303446	0.215154	0.150618	0.199823	5	6	1	2	4	3
B3	0.1	0.042077	0.017448	0	0.075818	0.055158	0.300514	0.217643	0.152251	0.198616	5	6	1	2	4	3
B4	0.1	0.035207	0.028410	0	0.076617	0.056035	0.289273	0.218166	0.147085	0.212824	5	6	1	2	4	3
C1	0.1	0.060270	0.036160	0	0.075444	0.054296	0.317345	0.209483	0.148588	0.194844	5	6	1	2	4	3
C2	0.1	0.192905	0.088671	0	0.072325	0.052563	0.325757	0.217551	0.164460	0.167344	5	6	1	2	4	3
C3	0.1	0.145011	0.117256	0	0.080260	0.059000	0.256351	0.237229	0.135584	0.231576	5	6	1	2	4	3
C4	0.1	0.045497	0.027283	0	0.077667	0.056384	0.286188	0.216364	0.152207	0.211191	5	6	1	2	4	3
C5	0.1	0.011569	0.004150	0	0.074097	0.054976	0.300578	0.213479	0.150821	0.206048	5	6	1	2	4	3
C6	0.1	0.026185	0.014775	0	0.074498	0.054246	0.307217	0.212106	0.150021	0.201911	5	6	1	2	4	3
D1	0.1	0.023601	0.010614	0	0.075994	0.055327	0.302571	0.213341	0.150320	0.202447	5	6	1	2	4	3
D2	0.1	0.123495	0.060652	0	0.073190	0.053860	0.328587	0.214437	0.148191	0.181735	5	6	1	2	4	3
D3	0.1	0.062533	0.037498	0	0.077527	0.056538	0.281080	0.216267	0.154474	0.214114	5	6	1	2	4	3
D4	0.1	0.455663	0.214573	4	0.107641	0.079112	0.192542	0.220516	0.166274	0.233914	5	6	3	2	4	1

Table 15. Complete ANP Influence Sensitivity Detail

alternative nodes is much larger as A3 moves to $P^- = 0.1$. Moving the C2 node's parameter value toward 0.1 does not create a rank reversal, but it does lower the E6. *Net Benefits* and increase E5. *User Satisfaction* alternatives. Finally, as the parameter value of from the D4. *Usability* is decreased to $P^- = 0.1$, the E3. *KMS Service Quality* alternative becomes increasingly less important and ultimately results in rank reversals with E4. *Use* and E6. *Net Benefits*.

4.3.2 Marginal Sensitivity Analysis

ANP Marginal Sensitivity Analysis informs the researcher as to how much affect a very small change of the nodes' importance have on the scores of the model's alternatives. This can help, for example, identify which nodes (and their connections) in

the model must be best understood and which nodes can be approximated. The foundational idea behind the marginal sensitivity analysis is to change a particular node in the model very slightly, recalculate the new alternatives scores, and ultimately determine the change in the scores in respect to the amount of change in the node's influence. The marginal influence is, in essence, the derivative of a node at a fixed point of P_0 (the original value). However, because of the way that ANP row sensitivity is defined in order to preserve the ANP structure (see discussion above), the derivative does not exist at P_0 ; rather, the left and right derivatives do exist on either side of P_0 and the marginal sensitivity analysis is, therefore, based on the left and right derivatives.

With the marginal sensitivity analysis, the focus is on the instantaneous influence caused by very small changes in the node parameter. The resulting change in the alternatives score is divided by the amount of change in the node parameter, which provides the rate of change. In practical terms, this tells the researcher which nodes to pay special attention to because the higher the marginal influence is for a particular node, the more sensitive that node is to small perturbations, and the more it can impact the alternatives scores. Rank change is omitted from the marginal sensitivity analysis because the tiny changes caused by the marginal influences should not cause any rank changes. Table 16 includes the Marginal Sensitivity Influence analysis information for all the nodes (CSFs) generated from the Super Decision software. The first row of values are the original ANP model's synthesized values for the alternatives. The first column lists the node whose marginal influence is being calculated and the second column titled "Marginal Influences" lists if this node's marginal influence is being made more important (the right

Node	Marginal Influence	D(norm)E1	D(norm)E2	D(norm)E3	D(norm)E4	D(norm)E5	D(norm)E6	Total
Original Synthesized Values		0.07488	0.054348	0.299829	0.212869	0.150734	0.207341	0
A1. Top management support	:upper	-0.0401470	-0.0345330	-0.0854760	0.0026350	-0.0096260	0.1671470	0.1953160
A2. Management understanding	:upper	-0.0280010	-0.0237960	-0.1854990	0.1754430	0.0185770	0.0432770	0.2622180
A3. Management's continuous	:upper	0.0107850	-0.0007940	-0.3424680	0.2893750	0.0238010	0.0193010	0.4495310
A4. KM strategy is linked	:upper	-0.0589700	-0.0484570	0.0905100	-0.0239780	-0.0007230	0.0416170	0.1277690
B1. Knowledge-friendly or	:upper	-0.0724770	-0.0722050	-0.0629260	-0.1975070	-0.0472390	0.4523540	0.5101870
B2. Incentives and reward	:upper	-0.0650110	-0.0647690	-0.1177430	-0.0112770	-0.0077370	0.2665370	0.3058010
B3. Effective communication	:upper	-0.0425680	-0.0505330	-0.0924580	-0.0942810	-0.0605900	0.3404310	0.3759880
B4. Mutually trusting environment	:upper	-0.0613960	-0.0682690	0.1197690	-0.1095910	0.0292190	0.0902680	0.2092530
C1. Employee training	:upper	-0.1026260	-0.0889300	-0.2145280	0.0058290	0.0241650	0.3760900	0.4544490
C2. Employee empowerment	:upper	0.0040440	-0.0180230	-0.4892580	-0.1428100	-0.2649950	0.9110430	1.0771870
C3. Willingness to share	:upper	-0.0859120	-0.0895960	0.3287720	-0.3143910	0.0963150	0.0648120	0.4856110
C4. Absorptive capabilities	:upper	-0.1745220	-0.1273040	0.4865010	-0.0932200	-0.0274070	-0.0640490	0.5448770
C5. Status of the knower	:upper	0.0964790	-0.0773800	-0.0930390	-0.0693510	-0.0082840	0.1515750	0.2276080
C6. Dedicated staff and leadership	:upper	-0.0139630	-0.0225490	-0.1367230	-0.0223130	-0.0007580	0.1963060	0.2417260
D1. IT and organizational	:upper	-0.0472690	-0.0409710	-0.0272160	-0.0933930	-0.0104010	0.2192510	0.2481030
D2. Competence of technology	:upper	-0.0031450	-0.0127600	-0.2840530	-0.0543770	0.0223840	0.3319510	0.4410310
D3. Effective technology	:upper	-0.0705140	-0.0627280	0.3994540	-0.0904350	-0.0813850	-0.0943920	0.4383860
D4. Usability - friendly	:upper	-0.2299730	-0.1784040	0.9994690	-0.0998060	-0.1807630	-0.3105230	1.1057640
A1. Top management support	:lower	-0.0005920	-0.0007800	-0.0031070	-0.0190620	-0.0002260	0.0237670	0.0306410
A2. Management understanding	:lower	0.0028740	0.0025080	-0.0357190	0.0539550	0.0101590	-0.0337770	0.0737950
A3. Management's continuous	:lower	0.0062320	0.0043590	-0.0778890	0.1024220	0.0198560	-0.0549790	0.1415330
A4. KM strategy is linked	:lower	-0.0042000	-0.0033760	0.0138740	-0.0046650	-0.0013720	-0.0002600	0.0156600
B1. Knowledge-friendly or	:lower	-0.0025880	-0.0025010	0.0072650	-0.0271880	-0.0085550	0.0480970	0.0564930
B2. Incentives and reward	:lower	-0.0023630	-0.0019770	-0.0087690	-0.0053810	0.0003980	0.0180910	0.0210420
B3. Effective communication	:lower	-0.0022870	-0.0019680	-0.0018780	-0.0116060	-0.0038030	0.0215430	0.0250180
B4. Mutually trusting environment	:lower	-0.0043510	-0.0042020	0.0268330	-0.0125950	0.0094750	-0.0151590	0.0351400
C1. Employee training	:lower	-0.0013890	0.0001700	-0.0457940	0.0095770	0.0052240	0.0322120	0.0570590
C2. Employee empowerment	:lower	0.0055030	0.0037800	-0.0564110	-0.0103010	-0.0298690	0.0872980	0.1088390
C3. Willingness to share	:lower	-0.0097470	-0.0085950	0.0765470	-0.0480990	0.0261550	-0.0362620	0.1016900
C4. Absorptive capabilities	:lower	-0.0069510	-0.0050780	0.0344250	-0.0088370	-0.0037370	-0.0098220	0.0380490
C5. Status of the knower	:lower	0.0019590	-0.0015740	-0.0018730	-0.0015330	-0.0002210	0.0032410	0.0047680
C6. Dedicated staff and leadership	:lower	0.0012000	0.0004270	-0.0208440	0.0022770	0.0021660	0.0147740	0.0257730
D1. IT and organizational	:lower	-0.0027820	-0.0024450	-0.0068210	-0.0012290	0.0010350	0.0122430	0.0145850
D2. Competence of technology	:lower	0.0044730	0.0013610	-0.0749210	-0.0034000	0.0071740	0.0653120	0.0998180
D3. Effective technology	:lower	-0.0068900	-0.0056450	0.0497630	-0.0093610	-0.0099180	-0.0179490	0.0553520
D4. Usability - friendly	:lower	-0.0755390	-0.0565980	0.2526500	-0.0192900	-0.0371710	-0.0640520	0.2803530

Table 16. Full Marginal Sensitivity Analysis from Super Decisions software

side derivative at P_0 , for example) and is labeled as “:upper”; if the node is being made less important (the left side derivative at P_0 , for example) is labeled as “:lower”. The columns denoted “D(norm)E1”, “D(norm)E2”, etc. represent the changes in priorities in each corresponding alternative given a small change in the priority of the node – i.e., this is a derivative. The “Total” column is the total marginal influence expressed as the Euclidean distance of the D(norm) vectors (six elements in this case).

Adams and Saaty (2012b) formally define the upper marginal influence of node r on alternative i as:

$$S'_{r,i}{}^+ = \lim_{h \rightarrow 0^+} \frac{S_{r,i}(Po+h) - S_{r,i}(Po)}{h};$$

and the lower marginal influence of node r on alternative i as:

$$S'_{r,i}{}^- = \lim_{h \rightarrow 0^-} \frac{S_{r,i}(Po+h) - S_{r,i}(Po)}{h};$$

where r is the fixed node,

i is the alternative node which is scored,

$S'_{r,i}{}^+$ is a total upper marginal influence vector,

$S'_{r,i}{}^-$ is a total lower marginal influence vector,

h is a predetermined amount by which the importance of the fixed node was changed, and

Po is a parameter value which represents returning the node importance to its original weight.

Further, Adams and Saaty describe the measurement of the instantaneous rate of change. First, they calculate the alternative scores of the fixed node using a changed importance of the node; second, they calculate the change in the calculated alternative scores over an amount by which the importance of the fixed node was changed (Adams and Saaty, 2012b).

The marginal sensitivity analysis begins by sorting the Super Decisions output table (Table 16) in descending order in an effort to quickly identify the nodes that exhibit the highest total marginal influence. Table 17 provides a portion of the sorted marginal influence table. By looking at the Total column, it is relatively easy to identify which

Node	Marginal Influence	D(norm)E1	D(norm)E2	D(norm)E3	D(norm)E4	D(norm)E5	D(norm)E6	Total
Original Synthesized Values		0.07488	0.054348	0.299829	0.212869	0.150734	0.207341	0
D4. Usability - friendly	:upper	-0.2299730	-0.1784040	0.9994690	-0.0998060	-0.1807630	-0.3105230	1.1057640
C2. Employee empowerment	:upper	0.0040440	-0.0180230	-0.4892580	-0.1428100	-0.2649950	0.9110430	1.0771870
C4. Absorptive capability	:upper	-0.1745220	-0.1273040	0.4865010	-0.0932200	-0.0274070	-0.0640490	0.5448770
B1. Knowledge-friendly or	:upper	-0.0724770	-0.0722050	-0.0629260	-0.1975070	-0.0472390	0.4523540	0.5101870
C3. Willingness to share	:upper	-0.0859120	-0.0895960	0.3287720	-0.3143910	0.0963150	0.0648120	0.4856110
C1. Employee training	:upper	-0.1026260	-0.0889300	-0.2145280	0.0058290	0.0241650	0.3760900	0.4544490
A3. Management's continuoc	:upper	0.0107850	-0.0007940	-0.3424680	0.2893750	0.0238010	0.0193010	0.4495310

Table 17. Portion of the Marginal Influence table (sorted by Total Euclidean distance)

nodes have the most marginal influence in the ANP model. In the example in Table 17, *D4. Usability* and *C2. Employee empowerment*, the two highlighted nodes, are the most marginally influential. This means that very small changes to either D4 or C2, relative to the other nodes, has the most impact on the alternatives. First looking at D4, it can be observed that *D4. Usability* positively impacts the *E3. KMS Service Quality* alternative, such that a small change in the global priority of D4 has a 0.9995 impact on E3. This can be interpreted to mean that a 1% increase in the influence of D4 results in a 0.9995% increase in E4. Similarly, *C2. Employee empowerment* has a major influence on *E6. Net Benefits*, where a small change in C2 results in a 0.911 change in E6. At the very least, this informs the researcher as to the sensitivity of the model to even very small changes to nodes *D4. Usability* and *C2. Employee empowerment*. This is particularly interesting in this study because these top two marginal influencers (D4 and C2) display consistency in that they appear to have their influence scale up as demonstrated by their impact on the alternatives in the long-term Influence Sensitivity Analysis in the previous section (see Table 14 in section 4.3.1).

Looking at the weighted supermatrix in Table 18, the highlighted rows and columns define the nodes and alternatives that create part of the structure of the ANP model. As described in previous sections, the direct influence of nodes on other nodes, nodes on alternatives, and alternatives on nodes are generally of not much use to the analysis

	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	E1	E2	E3	E4	E5	E6
A1.		.2968	.1880	.3135	.0339	.0000	.0711	.0271	.0000	.0883	.0443	.0000	.0000	.0862	.1971	.0000	.0000	.0000	.0000	.0000	.0188	.0144	.0000	.0000
A2.	.7579		.1753	.4521	.1397	.0775	.1025	.0892	.0982	.0000	.1034	.0000	.0000	.1198	.2498	.0000	.0000	.0000	.0000	.0000	.0000	.0274	.0000	.0000
A3.	.0000	.4611		.0000	.0000	.2324	.0000	.0573	.2043	.3142	.0870	.0000	.0000	.2569	.0000	.4091	.1879	.0000	.0938	.0938	.0750	.0000	.0938	.0000
A4.	.0000	.0000	.0900		.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.1088	.5531	.0000	.0000	.0000	.0000	.0000	.0000	.0520	.0000	.0000
B1.	.0698	.0840	.0000	.0000		.6902	.1068	.3866	.0592	.0652	.0175	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0299	.0000	.0213	.0242	.0613	.0000
B2.	.0000	.0000	.0000	.0000	.0000		.0000	.0000	.1012	.0387	.0229	.0000	.0000	.0000	.0000	.2900	.0000	.0000	.0151	.0575	.0197	.0308	.0536	.0000
B3.	.1722	.0000	.0000	.0000	.1550	.0000		.0000	.0000	.0000	.0343	.0000	.1627	.0000	.0000	.0000	.0000	.0000	.0339	.0575	.0456	.0321	.0000	.0000
B4.	.0000	.1581	.0000	.0000	.2316	.0000	.2798		.0000	.1096	.0499	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0361	.0000	.0284	.0278	.0000	.0000
C1.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000		.0000	.1344	.5782	.3150	.0000	.0000	.0640	.0000	.0584	.0107	.0199	.0148	.0197	.0195	.0600
C2.	.0000	.0000	.0000	.0000	.1904	.0000	.1904	.0000	.0000		.1067	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0204	.0107	.0117	.0107	.0000	.0000
C3.	.0000	.0000	.1382	.0000	.2495	.0000	.2495	.4399	.2170	.0000		.0000	.0000	.0000	.0000	.0337	.0000	.0000	.0274	.0249	.0302	.0216	.0000	.0000
C4.	.0000	.0000	.0808	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000		.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0218	.0207	.0340
C5.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000		.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0186	.0178	.0228	
C6.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0935	.0000	.0000	.0000	.0000		.0000	.2033	.1382	.1118	.0340	.0370	.0358	.0000	.0344	.0000
D1.	.0000	.0000	.0305	.0514	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.1358		.0000	.0577	.0000	.0000	.0000	.0318	.0660	.0000	.0000
D2.	.0000	.0000	.1083	.0000	.0000	.0000	.0000	.0000	.1263	.0000	.0000	.0000	.1552	.0000	.0000		.2528	.1741	.1364	.1174	.1325	.0000	.0865	.0000
D3.	.0000	.0000	.0000	.1830	.0000	.0000	.0000	.0000	.1003	.0000	.0000	.0000	.0000	.2925	.0000	.0000		.2083	.0560	.0799	.0814	.0000	.0547	.0000
D4.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.1758	.4218	.0746	.0000	.0000	.0000	.0000		.1136	.1087	.0604	.2400	.1648	.3868
E1.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.2082	.0000	.0000	.0000	.0000		.0000	.0000	.1389	.1152	.1234	
E2.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.1098		.0000	.1004	.0579	.0773
E3.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0688	.0000	.0000	.0000	.0000	.0000	.0000	.3633	.4474	.1057	.3015		.0660	.0474	.0000
E4.	.0000	.0000	.0887	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.2534		.0981	.2037
E5.	.0000	.0000	.0387	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0711	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0849	.0913	.1394	.0266		.0921
E6.	.0000	.0000	.0615	.0000	.0000	.0000	.0000	.0000	.0000	.3839	.0840	.0000	.0844	.0000	.0000	.0000	.0000	.0000	.0923	.0000	.0000	.0609	.0743	

Table 18. Weighted supermatrix

because they only capture first-order influences. However, investigating the nature of these connections can illuminate, in part, how the model is composed structurally, and possibly, alert the researcher as to where there is a deeper understanding needed with respect to some nodes as compared to other nodes. For example, the D4 node is one of only two nodes (the other being C1) that directly connects to all six of the alternatives. Furthermore, while this must be taken into consideration cautiously, the E3 alternative is the highest direct influencer of D4, and in fact, the direct influence from E3 to D4 (.4474) is the highest direct influence from any alternative back to a CSF. The weighted supermatrix also highlights some interesting structural network connections associated with C2 node's influence on E6. First, the direct influence from alternative E6 to the C2 node (.3839) is the second highest of all the direct influences from alternatives to nodes. Secondly, there is no direct influence from C2 to E6! All influences from C2 to E6 are indirect. It should be noted that, in the ANP network structure used in this research, all nodes connect directly to at least one of the alternatives. This was part of the criteria for

inclusion of a CSF in this research; however, direct influence *from* an alternative to a node (CSF) is present in only six of the 18 nodes.

4.3.3 Perspective Sensitivity Analysis

Node	Param	Dist:Euclid	Dist:Taxi	E1	E2	E3	E4	E5	E6	Dist:Rank	Rank E1	Rank E2	Rank E3	Rank E4	Rank E5	Rank E6
Original Values	0.5	0	0	0.0749	0.0543	0.2998	0.2129	0.1507	0.2073	0	5	6	1	2	4	3
A1. Top management sup	0.998437	0.13083	0.2614	0.0541	0.0366	0.2143	0.2629	0.1440	0.2880	4	5	6	3	2	4	1
A2. Management underst	0.999219	0.208689	0.374681	0.0496	0.0331	0.1591	0.3603	0.1630	0.2350	6	5	6	4	1	3	2
A3. Management's contin	0.998437	0.195055	0.302683	0.0771	0.0513	0.1515	0.3381	0.1575	0.2244	6	5	6	4	1	3	2
A4. KM strategy is linked	0.998437	0.124122	0.233538	0.0448	0.0300	0.4047	0.1614	0.1399	0.2192	2	5	6	1	3	4	2
B1. Knowledge-friendly c	0.998437	0.198571	0.35412	0.0494	0.0298	0.2668	0.1402	0.1295	0.3844	4	5	6	2	3	4	1
B2. Incentives and rewar	0.999609	0.239491	0.454416	0.0305	0.0184	0.1529	0.3895	0.1711	0.2376	6	5	6	4	1	3	2
B3. Effective communica	0.999219	0.299592	0.503449	0.0664	0.0404	0.1535	0.1967	0.0840	0.4591	4	5	6	3	2	4	1
B4. Mutually trusting env	0.999902	0.183101	0.320066	0.0463	0.0258	0.1968	0.3583	0.1533	0.2194	4	5	6	3	1	4	2
C1. Employee training/gup	0.998437	0.180144	0.388167	0.0003	0.0002	0.2661	0.2713	0.1191	0.3430	4	5	6	3	2	4	1
C2. Employee empowerm	0.998437	0.323303	0.548623	0.0709	0.0417	0.1499	0.1792	0.0766	0.4817	4	5	6	3	2	4	1
C3. Willingness to share	0.998437	0.194714	0.375352	0.0537	0.0301	0.4146	0.0706	0.1671	0.2639	4	5	6	1	4	3	2
C4. Absorptive capabilit	0.999219	0.315528	0.571372	0.0001	0.0001	0.5855	0.1486	0.1270	0.1388	0	5	6	1	2	4	3
C5. Status of the knower	0.996875	0.129121	0.281337	0.1261	0.0142	0.2526	0.1665	0.1439	0.2968	4	5	6	2	3	4	1
C6. Dedicated staff and le	0.999219	0.26494	0.437845	0.0805	0.0521	0.0831	0.2483	0.1843	0.3516	6	5	6	4	2	3	1
D1. IT and organizational	0.999219	0.200031	0.321676	0.0628	0.0429	0.3060	0.0878	0.1384	0.3620	6	5	6	2	4	3	1
D2. Competence of techn	0.999609	0.34304	0.590232	0.0730	0.0470	0.1285	0.0984	0.1726	0.4806	8	5	6	3	4	2	1
D3. Effective technologic	0.999219	0.327562	0.590101	0.0357	0.0231	0.5949	0.1145	0.0813	0.1506	2	5	6	1	3	4	2
D4. Usability	0.999219	0.561733	1.017323	0.0000	0.0000	0.8085	0.0736	0.0322	0.0856	2	5	6	1	3	4	2

Table 19. Super Decision Perspective Sensitivity Analysis

The idea of the Perspective Sensitivity Analysis is to push the overall importance of a particular node toward a value of one using the ANP Row Sensitivity discussed above. The new limit matrix is then resynthesized and the new priorities of the alternatives are computed. The perspective analysis also determines where the alternatives converge as the weight of the node under investigation approaches one. This adopts the perspective of a node under study when it is made almost all-important and reveals its influence on all the alternatives. Moreover, this answers the question: *what would the effect on the alternatives be if node X was made all important?* This illuminates the effect of a single node, when made all powerful, in influencing the model's alternatives.

Table 19 displays the output from the Super Decisions software's Perspective Analysis. The first row of "Original Values" is the original synthesized ANP model's alternatives scores and ranks when $P_0 = 0.5$ (i.e., prior to any analysis). The first column "Node" is the CSF that is under analysis with respect to its impact on the alternatives as

the parameter value of the CSF approaches one. Adams and Saaty (2012a) provide a formal definition of the synthesized value of alternative i from the perspective of node r as, $P_{r,i} = \lim_{P \rightarrow 1} S_{r,i}(P)$ and the total synthesized vector is denoted as, $P_{r,i} = (P_{r,1}, P_{r,2}, P_{r,3}, \dots, P_{r,n})$. The “Param” column indicates the parameter value at which convergence occurred (the limit). The Euclidean distance and the taxicab distances indicate the distance of the newly resynthesized alternatives from the original value indicated in the first row. The next six columns display the values of the six alternatives (S/RS Success constructs E1 through E6) after making the node indicated in a particular row nearly all important. The alternatives’ highest score is highlighted to assist in identifying which alternative becomes most important when the node influence is at a maximum value. The rank distance (as discussed above) sums the total absolute rank change distances from the original synthesized model ranking to that caused by taking the node to a parameter value of nearly one. In summary, Table 19 is presented from the perspective of a node and illustrates which alternative it will most positively influence. It is interesting to note that only the top three S/RS success constructs from the original model – *E3. KMS Service Quality*, *E6. Net Benefits*, and *E4. Use* – can be influenced enough by any CSF to raise its importance to the number one ranked position. Also, rank reversals at this extreme value of P_+ for all CSFs only occur between nodes E3, E4, E6, and E5; *E1. Knowledge Content Quality* and *E2. KMS Quality* never change rank.

Another way of viewing the information in Table 19 is from the perspective of the alternatives or S/RS success constructs. Table 20 provides a summary of this alternate view of the perspective analysis output. The weight value in Table 20 represents the value of the success construct for a column given the node is made most important. The

Summary - Perspective Sensitivity Analysis for each Alternative (Storage/Retrieval Success Construct)

$$P_{r,i} = \lim_{p \rightarrow 1} S_{r,i}(P)$$

	E1. Knowledge Content Quality (node : weight)	E2. KMS Quality (node : weight)	E3. KMS Service Quality (node : weight)	E4. Use (node : weight)	E5. User Satisfaction (node : weight)	E6. Net Benefits (node : weight)
Node Rank - 1	C5 : 0.126099	C6 : 0.052136	D4 : 0.808490	B2 : 0.389474	C6 : 0.184275	C2 : 0.481652
2	C6 : 0.080541	A3 : 0.051349	D3 : 0.594879	A2 : 0.360262	D2 : 0.172613	D2 : 0.480578
3	A3 : 0.077096	D2 : 0.047028	C4 : 0.585515	B4 : 0.358266	B2 : 0.171062	B3 : 0.459065
4	D2 : 0.072970	D1 : 0.042903	C3 : 0.414606	A3 : 0.338122	C3 : 0.167071	B1 : 0.384401
5	C2 : 0.070894	C2 : 0.041736	A4 : 0.404716	C1 : 0.271280	A2 : 0.163034	D1 : 0.361977
6	B3 : 0.066355	B3 : 0.040381	D1 : 0.306031	A1 : 0.262877	A3 : 0.157507	C6 : 0.351596
7	D1 : 0.062849	A1 : 0.036626	B1 : 0.266758	C6 : 0.248334	B4 : 0.153289	C1 : 0.343013
8	A1 : 0.054141	A2 : 0.033099	C1 : 0.266148	B3 : 0.196677	A1 : 0.144025	C5 : 0.296790
9	C3 : 0.053703	C3 : 0.030106	C5 : 0.252564	C2 : 0.179206	C5 : 0.143909	A1 : 0.288033
10	A2 : 0.049567	A4 : 0.030007	A1 : 0.214299	C5 : 0.166487	A4 : 0.139852	C3 : 0.263902
11	B1 : 0.049360	B1 : 0.029790	B4 : 0.196841	A4 : 0.161419	D1 : 0.138406	B2 : 0.237615
12	B4 : 0.046344	B4 : 0.025839	A2 : 0.159050	C4 : 0.148581	B1 : 0.129491	A2 : 0.234988
13	A4 : 0.044783	D3 : 0.023144	B3 : 0.153513	B1 : 0.140201	C4 : 0.127003	A3 : 0.224440
14	D3 : 0.035653	B2 : 0.018403	B2 : 0.152943	D3 : 0.114453	C1 : 0.119076	B4 : 0.219422
15	B2 : 0.030502	C5 : 0.014151	A3 : 0.151486	D2 : 0.098355	B3 : 0.084009	A4 : 0.219222
16	C1 : 0.000293	C1 : 0.000190	C2 : 0.149916	D1 : 0.087835	D3 : 0.081268	D3 : 0.150603
17	C4 : 0.000085	C4 : 0.000061	D2 : 0.128457	D4 : 0.073581	C2 : 0.076596	C4 : 0.138756
18	D4 : 0.000038	D4 : 0.000025	C6 : 0.083118	C3 : 0.070611	D4 : 0.032220	D4 : 0.085646

Critical Success Factors (Nodes)	
A1. Top management support	B1. Knowledge-friendly organizational culture
A2. Management understands the value of KM	B2. Incentives and reward system
A3. Management's continuous commitment...	B3. Effective communicative environment
A4. KM strategy is linked to org. strategy	B4. Mutually trusting environment
C1. Employee training	D1. IT and organizational strategies aligned
C2. Employee empowerment	D2. Competence of technology team
C3. Willingness to share knowledge	D3. Effective technological infrastructure
C4. Absorptive capabilities of the employees	D4. Usability - friendly system to use
C5. Status of the knower	
C6. Dedicated staff and leadership	

Table 20. Perspective Sensitivity by alternatives

perspective analysis discussed above addressed the question as to which alternative is most influenced by a specific node when the node parameter value approaches one. This alternate view of the perspective analysis data enables researchers to address the question as to *which specific nodes most influence an alternative (or S/RS Success construct) when its parameter value is raised to nearly one*. This can also be helpful for practitioners answering the question as to which node(s) must be increased in importance to raise the relative importance of a particular S/RS success construct. In examining Table 20, it can be observed that, when increased toward a parameter value of one, C5. Status of the Knower and C6. Dedicated Staff and Leadership most influence E1. Knowledge Content Quality and that D4. Usability and C4. Absorptive Capabilities of the Employees have the least impact on E1. Interestingly, the D4 and C2 nodes, as discussed

in the marginal influence analysis above, are also quite important in the perspective influence analysis. Examining the *E3. KMS Service Quality S/RS* success construct in Table 20 reveals that when the parameter value approaches one, the impact of *D4. Usability* on this alternative is quite extraordinary, raising E3 to a value of over .80. In a similar manner, the *C2. Employee Empowerment* CSF is significantly impactful on *E6. Net Benefits*.

CHAPTER V

DISCUSSIONS

5.1 Intro to Discussion

The results from the ANP analysis are discussed in the following sections. This study was driven by questions that are similarly of interest to practitioners and researchers; thus, the analyses and discussions are relevant to both. The overall goal of this research was to identify and prioritize CSFs that influence the success of the S/RS in FEKT, as well as to define, measure, and prioritize the S/RS success constructs in FEKT through the lens of a methodology that allowed for the complexity that is inherent in such a system. Having presented a model of S/RS success with respect to FEKT, prioritized the success constructs, and both identified and prioritized CSFs that impact these success constructs, this chapter is able to discuss some of the more interesting findings that emerged from the analysis. Section 5.2.1 discusses *KMS Service Quality*, which emerged

as the most important dimension of success for the S/RS in FEKT. In section 5.2.2, the *KMS Quality* and *Knowledge Content Quality* success constructs are discussed, which are the two lowest ranked S/RS success constructs in this study. Section 5.2.3 examines the Strategy and Leadership cluster of CSFs, which surfaced as the group of CSFs that most strongly influence success of the S/RS in FEKT. Rank reversal between the S/RS success constructs and the stability of the model to perturbation is addressed in Section 5.2.4. In Section 5.2.5, two particularly interesting CSFs in respect to the model stability are examined relative to their impact on the success model. Finally, Section 5.2.6 examines the role of the Perspective Sensitivity Analysis in altering the strength of a particular S/RS success construct.

5.2 Implications for Research and Practice

5.2.1 KMS Service Quality

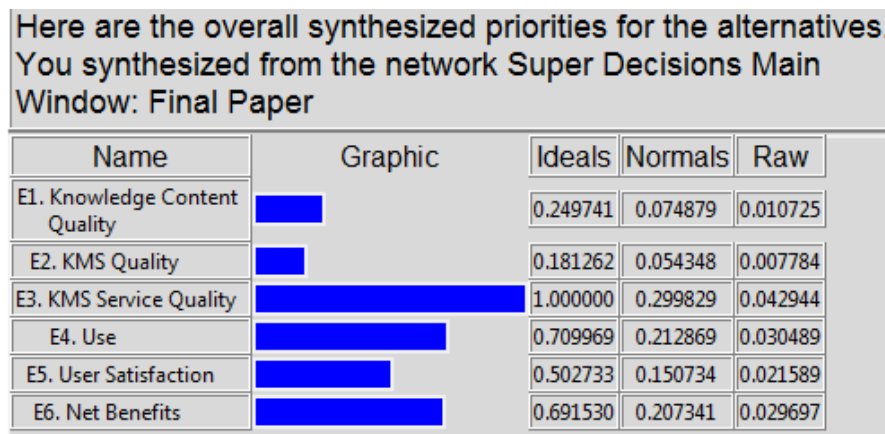


Figure 20. Synthesized S/RS Success Construct Priorities

As discussed in chapter four, *KMS Service Quality* significantly emerged from the ANP analysis as the most influential success construct for KMS S/RS in FEKT (see Figure 20). This is particularly significant given that the literature has failed to gather a universal acceptance of *Service Quality* as a success construct in both IS and KMS

research. In fact, several models of KMS success used by researchers, such as Gable et al. (2008), Jennex and Olfman (2004), Karlinsky-Shichor and Zviran (2016), Kulkarni et al. (2007), Qian and Bock (2005), Wu and Wang (2006), and Yu et al. (2007), have outright excluded the DeLone and McLean (2003) *Service Quality* construct from their models for various reasons, such as inconclusive results from prior research (Karlinsky-Shichor and Zviran, 2016), confusion related to whether *Service Quality* is a dependent or independent variable (Wu and Wang, 2006), or the focus of the study excluded the role of IT service (Gable et al, 2008). In a panel discussion at the 2011 Pacific Asia Conference on Information Systems, Ephraim McLean personally acknowledged that some of the issues that researchers have had with the *Service Quality* construct over the years were caused by researchers interpreting this construct much further from its initial intent. However, McLean maintains the importance of this construct in capturing the success with respect to the service provided by IT departments and posited that this construct would become even more important in the future than previously, as users become customers. Furthermore, Tate et al. (2011) point to the increasing importance of the agility and responsiveness of the IS function, suggesting that these should be included as new success measures. As previously pointed out in this research, KMS are by their nature emergent, necessitating a flexibility in the system design (Meihami and Meihami, 2014). Germane to the *KMS Service Quality* construct as defined in this research, McLean stated that the notion of capturing how easily organizations' IS can be changed to meet new demands was implied in DeLone and McLean's (2003) addition of the *Service Quality* construct, i.e., agility and responsiveness (Tate et al., 2011). Moreover, the operationalized definition for the *KMS Service Quality* construct used in this study is

congruent with both the stated and implied notions of the DeLone and McLean *Service Quality* construct. In this study, *KMS Service Quality* first refers to how the end users of the S/RS are supported in their actual use of the S/RS and second, how the KMS (and IT) professionals are able to service both the knowledge contained with the S/RS and the system itself (given that requirements are fluid and may need to change as the system emerges).

There may be other factors at play that contributed to *KMS Service Quality* being assessed as the most important S/RS success construct in this study. For example, unlike traditional statistical methods, the use of the ANP as a research methodology accounts for all direct and indirect relationships between constructs and factors. The ANP also allows a network research model that is more rich and complex than traditional CFA- or SEM-based modeling in terms of bidirectional relationships and thereby captures more of the real-world interactions, interrelations, and interdependencies amongst constructs and factors. Finally, while the majority of KMS success research has examined the KMS in total, this research employed a micro level analysis of the KMC and focuses on only the S/RS of the KMS, where there is a very strong intersection with IT/IS. Furthermore, when compared to other micro-level success studies such as knowledge creation or knowledge transfer, the intersection of IT/IS and S/RS is arguably much stronger than the intersection of IT/IS and knowledge creation, transfer, or usage. Therefore, the success of the S/RS is more dependent on the continued support from IT and KMS professionals.

5.2.2 Significance of Knowledge Content Quality and KMS Quality

Both *Knowledge Content Quality* (Information Quality) and *KMS Quality* (System Quality) constructs used in this study are consistently seen in most KMS success models

based on either of the DeLone and McLean models or those from Seddon's (1997) IS success model. According to DeLone and McLean (1992, 2003) these two constructs are, individually, indicators of success for IS, but also influence *IS Use* and *User Satisfaction*. Conversely, other researchers such as Qian and Bock (2005) have treated these two constructs more like independent variables that are antecedents of *Use* and *User Satisfaction*. However, there is very strong support in the literature for *System Quality* and *Information/Knowledge Quality* as dependent variables for IS/KMS success (DeLone and McLean, 1992; Jennex and Olfman, 2006; Petter et al., 2008). Addressing some of the additional complexities inherent in KMS, some researchers have extended both the DeLone and McLean (1992, 2003) and the Seddon (1997) models with additional "connectivity" between the *System Quality* and *Knowledge Quality* constructs and other success constructs. For example, the relationships from *Knowledge Quality* to *Net Benefits* and from *KMS Quality* to *Net Benefits* (Karlinsky-Shichor and Zviran, 2016; Kulkarni et al., 2007; Wu and Wang, 2006), from *KMS Quality* to *Knowledge Quality* (Yu et al., 2007), and from *Net Benefits* to *Knowledge Quality* (Jennex and Olfman, 2006) are all extensions of the original IS success models. Also, as previously discussed, this research posits new construct connections from *KMS Service Quality* to *KMS Quality*, from *KMS Service Quality* to *Knowledge Content Quality*, from *User Satisfaction* to *KMS Quality*, and from *User Satisfaction* to *Knowledge Content Quality*. No prior KMS research model has included all of the paths of influence between success constructs mentioned above; however, they are all included in the structure of the KMS S/RS success model presented in this study. Since the ANP methodology is used to capture all direct and indirect relationships between constructs and factors, all possible

paths with either empirical or theoretical KMS research support are considered in the model. The ANP methodology, by way of the judgment of the experts, determines the aggregate strength of influence from all direct and indirect relationships, which are reflected in the synthesized priorities.

Even with the direct and indirect influences from these additional relationships between the *KMS Quality* and *Knowledge Content Quality* constructs and the other four success constructs, the *KMS Quality* and *Knowledge Content Quality* constructs are significantly less influential than the other four success constructs in FEKT (see Figure 20). Prior research is useful in proposing possible explanations as to why both *KMS System Quality* and *Knowledge Content Quality* are the least influential S/RS success constructs. For example, Kulkarni et al. (2007) offer that, in respect to *Knowledge Quality*, "the mere existence of reusable knowledge may be adequate for some employees who are willing to examine and adapt such shared knowledge for their own work situation..." With respect to *KMS Quality*, they also posit that the mere existence of any type of knowledge base or repository/retrieval system is enough to motivate its usage, regardless of the actual quality of the system. Gunning (2013) acknowledged the social quality of a KMS – what Alavi and Leidner (2001) referred to as a socially enacted system – by referencing what he called "lead users." Lead users are identified as employees who are technologically savvy and able to work around the limitations of a KMS – limitations which may include bad user interfaces, poorly structured data, or inadequate knowledge tagging. Other users then follow lead users in order to benefit from the KMS. As a result, this work structure diminishes the importance of *KMS Quality* and *Knowledge Content Quality* with respect to successfully FEKT. The final salient feature,

in respect to *KMS Quality* and the use of limited organizational resources is financially related. The fact that *KMS Quality* impacts S/RS success the least should reinforce for organizational leaders the idea that paying for more KMS technology in the hope that the technology will cause a troubled KMS to become successful may be a tremendous waste of valuable organizational resources.

5.2.3 Strategy and Leadership Cluster’s CSFs

Synthesized Global Critical Success Factors				
Critical Success Factor	Graphics	Overall Ranking	Normalized	Limiting
A1. Top management support		3	0.1054	0.0903
A2. Management understands the value of KM		1	0.1613	0.1382
A3. Management’s continuous commitment to resources...		2	0.1506	0.1290
A4. KM strategy is linked to organizational strategy		14	0.0270	0.0231

Table 21. Strategy and Leadership Cluster overall synthesized priority

The ANP methodology synthesizes the nodes (which in this case are the CSFs) and alternatives (which are the S/RS success constructs), providing an overall prioritization and weighting of the nodes and alternatives based on all the direct and indirect influences imparted by the node. The prioritization of the CSFs is especially informative for practitioners in that it focuses management’s attention on those factors that are most important in contributing to success of the S/RS and perhaps, away from those factors that provide much less impact on overall S/RS success.

Table 21 highlights the priorities of the CSFs that comprise the Strategy and Leadership cluster. The four CSFs belonging to the Strategy and Leadership cluster account for more than 44.4% of the influence on S/RS success. Referring back to Table 12, Strategy and Leadership has more than twice the influence on success as either Culture or People, and nearly thrice the influence of Technology. While there is no other research relative to S/RS success to directly compare with this result, it is aligned with prior KMS success research that transcends the entire KMS (Kazemi and Allahyari,

2010; Wong and Aspinwall, 2005). In particular, Kazemi and Allahyari's (2010) study is perhaps most similar to this study (at least from a methodological perspective), as it is one of the only other MCDM-based KMS success analyses. While their empirical study's CSFs and "main factors" (i.e., clusters) vary slightly from this study's CSFs and clusters (Kazemi and Allahyari used a much larger set of clusters and CSFs and performed a macro-level analysis of the complete KMS), they achieved very similar results with respect to this study's Strategy and Leadership CSFs. Aggregating the CSFs in Kazemi and Allahyari's study that were closely aligned with this study's Strategy and Leadership CSFs reveal that their Strategy and Leadership-related CSF accounts for 45.8% of the overall influence on success, compared to 44.4% in this study.

The highest influencing CSF for the entire S/RS success model is *A2. Management Understands the Value of KM and Articulates this View with the Organization*. Yeh et al. (2006) explain that this understanding and appreciation for the value of knowledge as an organizational asset must proceed management's involvement or buy-in for KM initiatives. It is only when there is this understanding at the executive level, or top management, of an organization – and only when top management consistently articulates this view within the entire organization – that executives will commit to the necessary levels of resources for ongoing support (e.g., intellectual, physical, monetary, technological, and time) to continually support the KM efforts within the organization, which happens to be the definition of *A3. Management's Continuous Commitment to Resources Required for KM*. Similarly, it is this same understanding of the value of knowledge as an asset that fosters *A1. Top Management Commitment and Ongoing Support*, where executives share a common vision of the KM effort and provide ongoing

leadership and lead by example by expounding their understanding of the role of KM in their organization. These three factors (A2, A3, and A1) are the most influential of all the CSFs in this study. The fourth Strategy and Leadership CSF, *A4. Knowledge Management Strategy is Linked to the Organizational Strategy*, is much less impactful and accounts for only 2.7% of the overall success. This knowledge is particularly useful for practitioners as it illuminates the important role of top management in maintaining a high level of understanding, a continuous commitment to resources, and the leadership support to enable the success of the S/RS. It appears from this analysis that leadership from the highest level of an organization is much more important in supporting S/RS success than an organization's strategy.

5.2.4 Rank Reversals

The rank reversals discussed here are hypothetical and can only be seen through the lens of the sensitivity analysis. Because the set of success constructs are a closed set defined by the original DeLone and McLean (2003) success model, the introduction of a new success construct is beyond the scope of this research, which negates the possibility of rank reversals resulting from new alternatives. However, what the sensitivity analyses do permit are opportunities to observe "what-if" scenarios – those that speak to the structure of the overall ANP model and the robustness of the results as expressed by the experts' judgments.

In examining the highlighted cells in the Perspective Analysis in Table 19, it can be seen that no single CSF, even when made nearly all-important (i.e., approaches a parameter limit of one), can influence the success model enough to push the S/RS success constructs *Knowledge Content Quality*, *KMS Quality*, or *User Satisfaction* up to a

position of being most influential in the model. In fact, *Knowledge Content Quality* and *KMS Quality* never change rank in the Perspective Sensitivity Analysis, regardless of which CSF is made all-important. However, this is not the case with the *KMS Service Quality*, *Use*, and *Net Benefits* constructs; depending on the degree of change to a CSF's parameter value (i.e., how important a CSF becomes), there can be some rank reversal between the success constructs.

In examining the short-term Influence Analysis (see Figure 18), it is clear that in all but one case (node *C2. Employee Empowerment*), the success constructs *Knowledge Content Quality*, *KMS Quality*, *User Satisfaction*, and *KMS Service Quality* maintain their rank positions. However, there *are* rank reversals between the *Use* and *Net Benefits* S/RS success constructs caused by 12 of the 18 CSFs; and in the case of *C2. Employee Empowerment*, the rank reversal extends to include *KMS Service Quality*. Further, all four CSFs in the Culture cluster (*B1. Knowledge-Friendly Culture*, *B2. Incentives and Reward System*, *B3. Effective Communicative Environment*, and *B4. Mutually Trusting Environment*) have an immediate impact on the reversal of *Use* and *Net Benefits* constructs, where *Net Benefits* rises to the number two spot in the S/RS success model. However, from the short-term influence analysis, it is apparent that *Incentives and Rewards* and *Mutually Trusting Environment* have much less impact on this reversal (e.g., *Use* and *Net Benefits* are still relatively close to each other in their influence on success) when compared with the larger effect from *Knowledge-Friendly Culture* or *Effective Communicative Environment*. Perhaps an explanation for rank reversals attributed to the Culture cluster's CSFs may be that as an organization's culture becomes increasingly receptive to, and supportive of, the KMS effort its *Use* becomes less of an

issue as employees realize the *Net Benefits* from, or perceive the usefulness of, the S/RS by way of enhancing their ability to transfer knowledge, or become more productive in transferring knowledge because of the S/RS.

With respect to the larger scale Influence Analysis (Figure 19), as CSFs are pushed toward the very high parameter value of 0.9, rank reversals between *Use*, *Net Benefits*, and *KMS Service Quality* appear to be the rule rather than the exception. The top three CSFs – those associated with Strategy and Leadership A2, A3, and A1 – are the only CSFs that, when pushed to a high parameter value, seem to influence an increase in the importance of *Use* and generally decrease the importance of *KMS Service Quality*. This may suggest that leadership most affects *Use*. In this large scale influence analysis, the Culture CSFs exhibit similar results to that of the short-term influence analysis, where they tend to increase the importance of *Net Benefits* and reduce the importance of *KMS Service Quality*. This may suggest that Culture most influences *Net Benefits*. The effect of the People cluster's CSFs influences on the S/RS success constructs are not as homogenous as either the Strategy and Leadership's or Culture's CSFs. To varying degrees, the C1. *Employee Training*, C2. *Employee Empowerment*, C5. *Status of the Knower*, and C6. *Dedicated Staff and Leadership* CSFs increase the importance of the *Net Benefits* success construct and decrease the importance of *KMS Service Quality*. As users are better trained (C1), feel emancipated in system use (C2), and have more confidence in the results of the system (C5), the dependence (from an end user's perspective) on the personnel servicing the KMS may be reduced as knowledge workers enjoy the *Net Benefits* gained from using the system to help transfer knowledge. C3. *Willingness to Share Knowledge* greatly reduces the importance of *Use* and pushes the

KMS Service Quality construct even higher in its importance as a success construct. This may be due to the fact that as more users are willing to share their knowledge, more knowledge artifacts must be processed by those servicing the repository and thus, there is an increased importance on the *KMS Service Quality*. Similarly, willingness to share knowledge can also imply a willingness to share opinions on the quality of knowledge retrieved from the KMS, which are expressed by feedback ratings and rankings that, again, are within the scope of those servicing the KMS.

5.2.5 The *D4. Usability* and *C2. Employee Empowerment* CSFs

The *D4. Usability* and the *C2. Employee Empowerment* CSFs are perhaps the most intriguing success factors in this study and require some further analyses. In the overall synthesized priorities, D4 was the seventh ranked CSF and C2 the eleventh most influential CSF. However, these two CSFs have consistently stood out in the sensitivity analyses as "interesting" factors.

Starting with *D4. Usability*, this CSF describes how easy the system is for the knowledge workers to use and exchange knowledge. It refers to ease of use, absence of non-value-adding steps, ease of extracting knowledge or sharing knowledge, interface and tools that are non-cumbersome and not complicated to use, and the use of technology is easily understood/operated by employees (Ajmal et al., 2010; Kaiser et al., 2009; Wiig, 1997). Similar to the narrower short-term Influence Sensitivity Analysis, the summary view of the complete ANP Influence Sensitivity analysis (Table 14) reveals that *D4. Usability* has by far the greatest Euclidean or taxicab distance associated with it, which is interpreted to mean that increasing *D4. Usability* to a very high level of influence resulted in the largest change in the values of the alternatives. What remains of particular interest

is that, while there is a dramatic change in the strength of success constructs in the S/RS success model, there is no rank reversal – *D4. Usability* appears to have a 1:1 linear influence on *KMS Service Quality*. This is understood to mean that as *Usability* increases in importance, so does the *KMS Service Quality* construct.

The marginal sensitivity analysis permits researchers to investigate how infinitesimal perturbations of specific nodes affect alternatives. In this study, *D4. Usability* was one of only two such CSFs (the other being *C2. Employee Empowerment*) that caused significant change to an alternative, thus revealing the success constructs that are hypersensitive to miniscule changes in the CSFs' importance. In examining the Totals column in Table 17, it is clear that *D4. Usability* remains the most marginally influential of the CSFs – where an extremely small changes in its parameter value (i.e., its importance) created a significant change in the alternatives. Further looking across the *D4. Usability* row, it is clear that the *E3. KMS Service Quality* is the alternative (S/RS success construct) most impacted by this change. *D4. Usability* has a near linear influence (1:0.999469) on *E3. KMS Service Quality*. Adams and Saaty (2012b) suggest that, at the very least, the researcher or practitioner take a careful look at such nodes and how they fit into structure of the model when this type of marginal sensitivity is seen. This relationship of D4 with the model was previously discussed in Section 4.3.2. Finally, while it will be discussed in the following section, the perspective sensitivity analysis reveals that if one would want to maximize the strength of the *KMS Service Quality* in the success model, then the influence of *D4. Usability* should be maximized.

The second unique CSF investigated here is *C2. Employee Empowerment*, which relates to how employees are emancipated, empowered, encouraged, authorized, and

given freedom and autonomy to participate in KM activities. Empowering knowledge workers gives them a sense of power and authority that allows them the opportunity to innovate and explore (Kazemi and Allahyari, 2010; Wong and Aspinwall, 2005).

The *C2. Employee Empowerment* CSF was the only factor to cause a three-way rank reversal in the short-term influence sensitivity analysis (see Figure 18). As the importance of C2 was increased, the importance of *Net Benefits* sharply increased and the *KMS Service Quality* and *Use* constructs decreased to cause the three-way reversal. Even more so in the wide range ANP influence analysis shown in Figure 19, the effect of increasing the parameter value of C2 to 0.9 shows a dramatic increase in the importance of *Net Benefits*, and *KMS Service Quality* is pushed down below *Use* in overall importance to success of the S/RS. Kazemi and Allahyari (2010) suggest that these empowered employees have a sense of ownership in the overall goals of the organization's KM efforts. This perhaps provides more freedom from existing pressures of *Use*, permits them to challenge existing practices, and liberates them from reliance on others to service them and the system (*KMS Service Quality*). Also, empowered users may feel a sense of self-determination and therefore, are more inclined to work around issues and limitations encountered in the KMS. Moreover, this autonomy may allow the knowledge worker to directly enjoy the benefits offered by the KMS (e.g., the ability to more easily transfer knowledge through use of the KMS) while feeling less encumbered by formalized processes and procedures.

Regarding the marginal sensitivity analysis, *C2. Employee Empowerment* is the second CSF where extremely small perturbation of its influence reveals hypersensitivity in alternatives. In this case, it is the *E6. Net Benefits* success construct that is very much

affected by the small change in importance of the *C2. Employee Empowerment* CSF, and like the D4 CSF discussed above, there is almost a 1:1 relationship in the increase of *Net Benefits* as the importance of *Employee Empowerment* is marginally increased (1:911043). What is extremely interesting is that there is no direct connection in the ANP model **from C2. Employee Empowerment to E6. Net Benefits**: all influences from C2 to E6 are indirect. However, there *is* a rather strong direct connection from E6 to C2, which may account for this degree of sensitivity. Finally, as will be discussed in the next section, *C2. Employee Empowerment* emerges as the CSF that should be increased to its maximum parameter value (i.e., made most important) in order to increase the *E6. Net Benefits* success construct to its highest impact in the overall success of the S/RS in FEKT.

5.2.6 Influencing the Strength of S/RS Success Constructs

The Perspective Sensitivity Analysis of the ANP allows researchers and practitioners to take an alternative view of the ANP model and examine the effect on alternatives (or S/RS success constructs) caused by maximizing the importance of a specific CSF. The complexity of the ANP model makes it very difficult to directly view paths of influence created by changes in the importance of individual CSFs. Furthermore, the ANP is used

Node	Param	Dist:Euclid	Dist:Taxi	E1	E2	E3	E4	E5	E6	Dist:Rank	Rank E1	Rank E2	Rank E3	Rank E4	Rank E5	Rank E6
Original Values	0.5	0	0	0.0749	0.0543	0.2998	0.2129	0.1507	0.2073	0	5	6	1	2	4	3
A1. Top management sup	0.998437	0.13083	0.2614	0.0541	0.0366	0.2143	0.2629	0.1440	0.2880	4	5	6	3	2	4	1
A2. Management underst	0.999219	0.208689	0.374681	0.0496	0.0331	0.1591	0.3603	0.1630	0.2350	6	5	6	4	1	3	2
A3. Management's contin	0.998437	0.195055	0.302683	0.0771	0.0513	0.1515	0.3381	0.1575	0.2244	6	5	6	4	1	3	2
A4. KM strategy is linked	0.998437	0.124122	0.233538	0.0448	0.0300	0.4047	0.1614	0.1399	0.2192	2	5	6	1	3	4	2
B1. Knowledge-friendly c	0.998437	0.198571	0.35412	0.0494	0.0298	0.2668	0.1402	0.1295	0.3844	4	5	6	2	3	4	1
B2. Incentives and rewar	0.999609	0.239491	0.454416	0.0305	0.0184	0.1529	0.3895	0.1711	0.2376	6	5	6	4	1	3	2
B3. Effective communica	0.999219	0.299592	0.503449	0.0664	0.0404	0.1535	0.1967	0.0840	0.4591	4	5	6	3	2	4	1
B4. Mutually trusting env	0.999902	0.183101	0.320066	0.0463	0.0258	0.1968	0.3583	0.1533	0.2194	4	5	6	3	1	4	2
C1. Employee training/up	0.998437	0.180144	0.388167	0.0003	0.0002	0.2661	0.2713	0.1191	0.3430	4	5	6	3	2	4	1
C2. Employee empowerm	0.998437	0.323303	0.548623	0.0709	0.0417	0.1499	0.1792	0.0766	0.4817	4	5	6	3	2	4	1
C3. Willingness to share k	0.998437	0.194714	0.375352	0.0537	0.0301	0.4146	0.0706	0.1671	0.2639	4	5	6	1	4	3	2
C4. Absorptive capabilitie	0.999219	0.315528	0.571372	0.0001	0.0001	0.5855	0.1486	0.1270	0.1388	0	5	6	1	2	4	3
C5. Status of the knowler	0.996875	0.129121	0.281337	0.1261	0.0142	0.2526	0.1665	0.1439	0.2968	4	5	6	2	3	4	1
C6. Dedicated staff and k	0.999219	0.26494	0.437845	0.0805	0.0521	0.0831	0.2483	0.1843	0.3516	6	5	6	4	2	3	1
D1. IT and organizational	0.999219	0.200031	0.321676	0.0628	0.0429	0.3060	0.0878	0.1384	0.3620	6	5	6	2	4	3	1
D2. Competence of techn	0.999609	0.34304	0.590232	0.0730	0.0470	0.1285	0.0984	0.1726	0.4806	8	5	6	3	4	2	1
D3. Effective technologic	0.999219	0.327562	0.590101	0.0357	0.0231	0.5949	0.1145	0.0813	0.1506	2	5	6	1	3	4	2
D4. Usability	0.999219	0.561733	1.017323	0.0000	0.0000	0.8085	0.0736	0.0322	0.0856	2	5	6	1	3	4	2

Table 22. Reproduction of Table 19

for prioritization of nodes and alternatives to solve complex network-based problems and does not address traditional path coefficients used in statistical methods. However, the perspective sensitivity analysis can be used here to determine which CSFs have the potential to most influence specific S/RS success constructs and thereby inform practitioners where to focus their attention in order to effect the desired change. For example, a practitioner questioning which CSF must be made most important to increase the importance of *E4. Use* can view Table 20 to identify that *B2. Incentives and Rewards* is most influential on increasing the priority of *Use* as a success construct.

If a CSF has any influence (direct or indirect) on the overall synthesized model, it is then truly a zero-sum game with respect to changes to the overall model resulting from the effect of an increase (or decrease) in the importance of a specific CSF. Therefore, it is also important for practitioners and researchers to examine the influence on the other success constructs created by the increase of a single CSF as it approaches its maximum parameter value (i.e., made most important). The information contained within Table 19 (reproduced above as Table 22 for convenience) highlights this information for the practitioner and researcher. Continuing with the example of increasing *E4. Use* so that it is the most influential success construct in the model, Table 22 reveals four cells in the *E4 (Use)* column which are highlighted. Each CSF in the row corresponding to the highlighted cell can, when the node value is maximized, increase *Use* to be the top-most influential success construct. Therefore, in addition to *B2. Incentives and Rewards*, the *A2. Management Understands the Value of KM...*, *B4. Mutually Trusting Environment*, and *A3. Management's Continued Commitment to Resources...* CSFs each have the ability to influence the model such that *Use* becomes the most important construct for

success. This is especially informative for practitioners because they now become aware of the set of CSFs which may be manipulated to bring about an increased importance of *Use* in respect to S/RS success. Furthermore, practitioners can evaluate which of these four CSFs to manipulate based on, perhaps, alignment with the organization's goals, strategy, mission, timeframe, and available resources. For example, managers and leaders may choose to develop a *Mutually Trusting Environment* that may take a protracted period of time to realize, but monetarily cost less. Or, they may opt to develop and implement an *Incentives and Rewards* system that may potentially materialize much faster but then requires a much heavier financial investment from the organization, if the incentives and rewards are financial-based.

Finally, like all ANP row influence sensitivity analyses, the perspective sensitivity analysis has the effect of keeping *all* nodes (CSFs) as-is except for the node under investigation. In the perspective sensitivity analysis, the node under investigation is pushed to its maximum level to view the impact on the alternatives (S/RS success constructs). In the example case of *E4. Use* discussed above, there is a choice between four CSFs to impact or influence the *Use* success construct. While the ultimate decision that is made should be tied to managerial and strategic goals, the distance metrics in Table 22 can be particularly useful in examining other consequences of change in the model that result from the ultimate choice of which CSF was selected to effect the desired change in *Use*. For example, it can be seen in the *B2. Incentives and Rewards* row in Table 22 that of the four CSFs under consideration here, it has the greatest Euclidean, taxicab, and rank distances associated with it. This can be confirmed by comparing the *B2* row with the *Original Values* row at the top of the table. Conversely, the choice of *B4*.

Mutually Trusting Environment has the least impact in terms of rank reversals and degree of change in the "distance" metrics of the other success constructs on the model when compared to the original state of the S/RS success model.

CHAPTER VI

CONCLUSION

6.1 Summary

The Alavi and Leidner (2001) KM framework describes the flow of knowledge in an organization from creation, to storage and retrieval, to transference, and ultimately to its application. This study examined a portion of this knowledge chain – the storage/retrieval system – in supporting the facilitation and enabling of knowledge transfer. This model of success concerns the flow of knowledge from the storage/retrieval dimension to the knowledge transfer dimension of the KMC and specifically addresses the research gap identified by Alavi and Leidner. Additionally, the results from this study add to the general body of knowledge for KM research and help organizations continue the flow of knowledge along the knowledge chain. Further, this research has assumed the position that real-world constructs used to measure success for systems, such as the S/RS, are interrelated, intertwined, and interdependent. The DeLone and McLean (1992, 2003) IS

success models have similarly offered this same perspective and posit that IS success is not simply a single dependent variable, but rather a multidimensional dependent variable, where the interdependencies between success constructs should be considered and accounted for. The DeLone and McLean (2003) model was chosen for this study as the theoretical foundation for success because of its parsimony, long history of validation, relative ease of understanding, and wide use as a basis for modification to accommodate KMS success idiosyncrasies. Following in the footsteps of other successful KMS researchers, this study embraces (and incorporates into an S/RS success model) prior KMS-specific extensions to the DeLone and McLean model to address the complexity that differentiates KMS from traditional IS. To develop this further, additional complexities related to S/RS were considered in this study and new relationships between success constructs, when theoretical support existed, were included in this study's proposed S/RS success model. In summary, the S/RS success model developed in this study included: 1) all paths (and directions of influence) between the six success constructs as specified in the original DeLone and McLean (2003) model, 2) additional paths (and direction of influence) specific to other KMS success models from the literature, and 3) six new paths between constructs that were original to this research (but based on theoretical support from the literature).

In addition to putting forth an S/RS success model, another objective of this study was to identify factors of success (i.e., CSFs) that influence the success of the S/RS in FEKT. As a result, 18 CSFs were identified from the literature that were of significant relevance to KMS success in respect to the S/RS in FEKT. These CSFs were then mapped to one of four categories based on the classification scheme from Yeh et al. (2006) for enabling

KM success. This research proposes that, like the success constructs, interrelationships and interdependencies exist among the CSFs, and between the CSFs and the S/RS success constructs.

Another goal of this research was to prioritize and determine the strength of influence of both the success constructs and the CSFs as they related to S/RS success in FEKT. An analysis methodology that allowed for the interdependence among CSFs and S/RS constructs was required to properly model and analyze these relationships between and among success constructs. Here, a rather novel use of such a methodology – the analytic network process (ANP), one of the most frequently used multi-criteria decision-making (MCDM) methodology – was used. Instead of prioritizing and weighting alternative solutions to a problem, in this study, the S/RS success constructs were the alternative solutions. In solving typical ANP problems, the best solution is that which has the highest weighted priority among the alternatives; however, in this research, the highest weighted priority actually identified which of the success constructs had the most influence on the success of the S/RS with respect to FEKT. In this case, the *KMS Service Quality* was identified as the single most-influential construct of S/RS success in FEKT. Furthermore, in the process of determining the most influential success construct, the overall priority of the CSFs were calculated; thus, the CSFs were ordered by their influence in affecting the S/RS success constructs. More clearly, the CSFs impacting the S/RS success constructs were prioritized and weighted according to their influence on success. Ultimately, the factors that emerged as the most influential of the CSFs related to Strategy and Leadership, which were shown to be affected predominantly by: 1) senior management's understanding of KM and knowledge as an organizational asset, 2) support from senior

management to continuously supply the necessary resources to sustain KM initiatives, and 3) the overall commitment from senior management as demonstrated by their leadership. Following directly behind these Strategy and Leadership CSFs' influence on success, the next group of CSFs involved the organization's knowledge workers' willingness to share knowledge – supported by a knowledge friendly organizational culture and an environment of trust – through the use of an S/RS that is usable in respect to exchanging knowledge. It is of interest that five out of six of the People cluster CSFs – which are related to characteristics associated with individuals or groups of individuals – had minimal influence on the overall success of S/RS in FEKT. Also of interest was the finding that the *Incentive and Rewards* CSF had minimal impact on S/RS success, which may imply that employees are more self-motivated and less influenced by external incentives in respect to use of the KMS's S/RS to help them transfer knowledge.

Methodologically, the ANP offers both IS and KMS researchers a tool that allows for the analysis of complexity and interdependence that is not atypical of real-world systems. This research has demonstrated that the ANP is useful in the prioritization and weighting of success factors for the S/RS success in FEKT; but more generally, it offered researchers the ability to uncover the true degree of influence between nodes (or factors) and alternatives in complex models when there are direct and potentially hundreds or thousands of indirect connections within a model. Based on the recently developed ANP Row Sensitivity algorithm (which has addressed deficiencies in prior node perturbation analysis), this study uniquely performs several sensitivity analyses. To this researcher's knowledge, this is the first KMS study to use both of the influence sensitivity analyses (short-term and wide range influence) within an empirical KMS study to address

perturbation effects on the model. In addition, this study's use of both the marginal sensitivity analysis and the perspective analysis is of interest not only to KMS researchers, but MCDM research in general, as it is the first published work to incorporate these recently developed and implemented sensitivity analyses. This is particularly important in that these sensitivity analyses provide a deeper look inside the complex network of direct and indirect influences that constitute the structure of the model and suggest both practical and research implications related to the model.

Complex systems such as a KMS remain a challenge for any organization to design, implement, use, maintain, and (most importantly) derive expected benefits. Knowledge as to which factors are most important to enable success of such systems, how to realistically measure success, and what dimensions of success are most important to the initiative, offers practitioners deep insight into what and where to focus attention and the organizational resources to fully maximize success of such efforts for the organization. Also, understanding what experts have jointly determined to be most influential to success of the S/RS in FEKT can serve as a baseline for organizations to evaluate their own S/RS and detect areas where senior management may need to strengthen and influence to achieve success.

6.2 Limitations

Perhaps more of a challenge than a limitation, this study's use of the ANP as a research methodology may be quite unfamiliar to those outside of the MCDM community, where it is actually one of the most frequently used of the multi-criteria decision analysis (MCDA) methods (Kashi and Franek, 2014; Taha and Daim, 2013). To properly perform the ANP model evaluation necessitates the identification and

participation of a true expert in the domain under study, as the results are only as good as the judgments elicited from the expert. Absent the securing of an expert, it is also possible to achieve these results from aggregate group responses derived from a small group of people who are knowledgeable in and experienced with the topic at hand. Also related to the ANP methodology, the total number of nodes and alternatives that are to be compared can be quite large, presenting a true challenge for the researcher. In this study, there were in excess of 200 pairwise comparisons, which was fatiguing for the expert participants to complete; this researcher was very fortunate to secure three experts willing to participate in such a time-consuming task where critical thinking was constantly involved. Fortunately, the ANP Super Decisions software has a built-in consistency mechanism to identify when the experts' responses exceed one order of magnitude of inconsistency. The sheer number of comparisons was a true limitation to the number of constructs or nodes and the number of connections between the nodes that could be simultaneously evaluated. However, there are techniques to address this issue and there are a significant number of extremely large ANP models that have been executed. In fact, the one other KMS ANP study (Kazemi and Allahyari, 2010) used 45 CSFs; however, their study does not detail the relationships and comparisons evaluated in their model, and therefore, they may have had less total comparisons than in this study.

Other limitations related to research design include: 1) the study is limited to experts with US-only experience in implementing KMS (the results may not be generalizable to other countries where, for example, more emphasis is placed on organizational culture than individuals, or vice versa); 2) this study's scope defines success only with respect to facilitating knowledge transfer but S/RS repositories are increasingly being mined to

create new organizational knowledge artifacts; 3) it assumes a micro-level of analysis and the results do not transcend the entire KMS; and 4) the relationships in the influence matrix (Appendix E) for the S/RS success model were predefined from prior research and theory and not by the experts. With respect to the ANP, while the methodology identifies the direct influence of a node or construct upon another node or construct (and the overall influence of a node on the synthesized solution), there is no mechanism to identify the overall influence of a node upon another node. Finally, there was a paucity of ANP-based KMS research that was relevant to this study (other than the Kazemi and Allahyari (2010) CSF study at a macro level) that could be used for partial validation of this model.

6.3 Future Research

The ANP methodology used in this study provides great possibilities for researchers in investigating problems where alternatives and/or factors (criteria) have complex interdependent relationships. While other IS/KMS research has used the ANP to prioritize success factors, this study offered a novel use of the ANP to prioritize multidimensional dependent variables as alternatives within the ANP model. This approach can be extended to additional areas of IS or KMS success research, such as DSS, CRM, SCM, and ERP success.

Because the scope of this study was limited to the forward flow of knowledge along the knowledge chain (that is, from knowledge stored in a repository to knowledge consumers in order that they may use the system to transfer the knowledge at a future time), it did not examine how S/RS support new knowledge creation by way of data mining, machine learning, autonomous epistemic agents, or other such technologies. This is important for both practitioners and KM researchers because organizations are

increasingly looking at mining knowledge and information stored in repositories to maximize the value of such assets; senior management personnel have identified that knowing what factors and success constructs support these processes prove useful in optimizing organizational resources. The ANP is particularly useful for capturing both direct and indirect influences of nodes (or factors) on alternatives. This entire research approach can be used to examine each of the dimensions of the Alavi and Leidner framework in order to provide a deeper perspective of what makes a KMS successful. Additionally, this study pre-defined the influences between the constructs (influence matrix) that constituted the S/RS success model based on theoretical support from prior empirical research and literature review. Another approach to developing this influence matrix would allow experts to specify the connections between constructs based on their experience and expertise and then compare the results with this study. Also, because this research was limited to the examination of US-based KMS S/RS and was evaluated by US-based experts, the results might not be generalizable to other nations where there may be a difference in importance of individuals or cultural issues from that of the US. As a result, this study can be replicated in other countries by appropriate experts.

Finally, there are several interesting topics that emerged from this study that may benefit from further in-depth research, such as: 1) possible explanations and construct/factor relationships that resulted in the particularly strong ranking of *KMS Service Quality* in the S/RS success model, 2) reasons for the very low importance placed on *KMS Quality* in respect to S/RS success, and 3) causes of the rank reversals in *Use* and *Net Benefits* as illuminated in the sensitivity analyses. The relationship between specific CSFs (or clusters of CSFs) and specific success constructs may also be further

investigated, as much could be identified. Discoveries therein may include the strong role that Strategy and Leadership CSFs play on the overall success of the S/RS, the changes on the success model's constructs ranking caused by perturbations to the *Usability* and *Employee Empowerment* success factors, and the generally low overall performance of CSFs from the People cluster (individual and group characteristics) on the overall success model. Further research is also suggested for each of the six newly proposed influence relationships between the success constructs to further examine and test the strength of influences between these constructs. Future researchers using the ANP are also encouraged to use the newer ANP row sensitivity analyses that are demonstrated in this research, which resolve many technical issues from prior sensitivity measures for the ANP. This study was the first to use both the marginal sensitivity analysis and the perspective analysis in any research, and was the first known to use the influence sensitivity analysis in KMS research, demonstrating the power of such analytic tools in peering through the entanglement of the direct and indirect influences in order to identify factors of interest to practitioners and researchers alike and address the robustness of the ANP model.

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APPENDICES

APPENDIX A

KMS/IS SUCCESS DIMENSION METRICS FROM PRIOR EMPIRICAL STUDIES

Knowledge Content Quality: accuracy • precision • currency • timeliness • reliability • completeness • conciseness • relevance • preferred format • sufficiency • understandability • freedom from bias • relevance to decisions • comparability • quantitiveness • usability • meeting the needs of end users • comprehensive • output format • easy to understand output • easy to apply • adequacy to complete work tasks • importance • uniqueness • clarity • readability • report appearance • interpretability • informativeness • content • sufficiency • helpful in resolving questions • volume • extent of insight • presentation formats • availability of expertise and advice • comprehensibility • information/knowledge richness • information/knowledge linkages • scope (Balasubramanian et al., 2015; Brown and Jayakody, 2008; Clay et al., 2006; DeLone and McLean, 1992; DeLone and McLean, 2003; Gable et al., 2008; Iivari, 2005; Jennex and Olfman, 2003; Jennex and Olfman, 2006; Kulkarni et al., 2007; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Resatsch and Faisst, 2004; Sedera et al., 2004; Sirsat and Sirsat, 2016; Urbach and Muller, 2012; Zaied, 2012).

KMS Quality: access • convenience • customization • data accuracy • data currency • ease of learning • ease of use • perceived ease of use • efficiency • flexibility • integration • interactivity • navigation • reliability • response time • sophistication • system accuracy • system features • turnaround time • realization of user expectations • privacy • security • system features • intuitiveness • portability • user friendliness • understandability • maintainability • verifiability • stability • usefulness • user-friendly interface • system trust • availability • functionality • documentation quality • program code quality •

realization of user requirements • resource utilization • level of frustration • quality of navigation structure • quality of search engine • quality of expert search • number of software errors • ability of system to recover from errors • search capability • output flexibility • input flexibility • ability to add useful information • system supports search tools that allow multiple criteria • system is assessable anywhere by anyone • availability of tools to locate knowledge • how much OM is represented within KMS • system support for KM tools/architecture/life-cycle • infrastructure capacity (Balasubramanian et al., 2015; Brown and Jayakody, 2008; Clay et al., 2006; DeLone and McLean, 1992; DeLone and McLean, 2003; Gable et al., 2008; Iivari, 2005; Jennex and Olfman, 2006; Kim and Lee, 2014; Kulkarni et al., 2007; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Resatsch and Faisst, 2004; Sedera et al., 2004; Sirsat and Sirsat, 2016; Urbach and Muller, 2012; Zaied, 2012).

KMS Service Quality: assurance • empathy • flexibility • interpersonal quality • intrinsic quality • IS training • reliability • responsiveness • tangibles • accuracy • technical competence • skill/experience/capabilities of support staff • SERVQUAL metrics • adjustment to new work demands • data integration skills • knowledge representation skills • awareness of users knowledge requirements • ability to implement knowledge taxonomies/ontologies/ maps • the ability to maintain KMS components • building and maintenance of infrastructure to support KMS • knowledge to answer users' questions • response time • efficiency of knowledge sharing • right knowledge to right person at right time • maintenance of knowledge base • ensuring availability/reliability/security of KMS • integrity (Balasubramanian et al., 2015; Brown and Jayakody, 2008; DeLone and McLean, 2002; DeLone and McLean, 2003; Jennex and Olfman, 2005; Jennex and

Olfman, 2006; Kim and Lee, 2014; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Resatsch and Faisst, 2004; Sirsat and Sirsat, 2016; Urbach and Muller, 2012; Zaied, 2012).

Use: level of sophistication of usage • self-reported use • actual use • daily use • frequency of use • intention to use or reuse • nature of use • navigation patterns • number of sites visited • number of transactions • frequency of specific use • frequency of general use • motivation to use • amount of use • appropriateness of use • extent of use • purpose of use • effects of use • knowledge sourcing • knowledge sharing • extent to which individuals access others expertise/experience/insight/opinions • extent to which individuals share their expertise/experience/insight/opinions • KMS use to help make decisions • KMS use to record knowledge • KMS use to communicate knowledge and information with colleagues • KMS use to share general knowledge • full functionality of the system used • connect time • duration of use • number of functions used • number of records accessed • number of reports generated • use for intended purpose • recurring use • loyal use (recurring use) • use of KMS as part of normal work routine • institutionalization/routinization of use • percentage used vs opportunity for use • voluntarism of use • continuation of use • reference shared knowledge • use shared knowledge as part of work flow • number of software packages used (Balasubramanian et al., 2015; Brown and Jayakody, 2008; Clay et al., 2006; DeLone and McLean, 1992; DeLone and McLean, 2002; DeLone and McLean, 2003; Iivari, 2005; Jennex and Olfman, 2003; Jennex and Olfman, 2004; Jennex and Olfman, 2005; Kulkarni et al., 2007; Maier, 2002; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Sirsat and Sirsat, 2016; Urbach and Muller, 2012; Velasquez et al., 2009).

User Satisfaction: adequacy, effectiveness • efficiency • enjoyment • information satisfaction • overall user satisfaction with system • system satisfaction • decision-making satisfaction • level of satisfaction with reports • satisfaction with support services • system meets expectation • KMS meets information or knowledge processing needs • satisfaction with KMS • feeling of pleasure or displeasure with KMS • self-efficacy • repeated visits • personalization • perceived risk • pleasure with experience using system • belief that the KMS is successful • approval or likeability of an IS or its output • satisfaction with specifics • overall system ease or difficulty • system was dull vs stimulating • system was rigid vs flexible • satisfaction with available knowledge from system to do job • knowledge available to user meets needs adequately • easy to get information/knowledge needed to do job • satisfaction with content/accuracy/format/ease-of-use/timeliness (Balasubramanian et al., 2015; Brown and Jayakody, 2008; DeLone and McLean, 1992; Iivari, 2005; Jennex and Olfman, 2003; Lai et al., 2008; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Sirsat and Sirsat, 2016; Urbach and Muller, 2012).

Net Benefits (Individual Impact): individual learning • problem understanding • information recall • decision effectiveness • user productivity • user confidence in productivity • improved decision-making • awareness/recall • perceived usefulness • usefulness • task performance • improved work accuracy • improved work-life quality • helps acquire new knowledge • effectively manages and store needed knowledge • eased ability to do job • useful in individual's job • effect on work practices • produced a change in user's activity • perceived benefits from use • information understanding • decision quality • correctness of decision or problem solution • better understanding of

decision context • timeliness in task completions and doing them right the first time • task innovation • job simplification (Balasubramanian et al., 2015; Brown and Jayakody, 2008; Clay et al., 2006; DeLone and McLean, 1992; DeLone and McLean, 2002; DeLone and McLean, 2003; Gable et al., 2008; Iivari, 2005; Jennex and Olfman, 2003; Jennex and Olfman, 2004; Jennex and Olfman, 2006; Kulkarni et al., 2007; Lai et al., 2008; Nattapol et al., 2010; Petter et al., 2008; Petter and McLean, 2009; Sedera et al., 2004; Sirsat and Sirsat, 2016; Urbach and Muller, 2012; Velasquez et al., 2009; Zaied, 2012).

APPENDIX B

THE RESEARCH INSTRUMENT

INTRODUCTION TO THE RESEARCH:

Your expert views and experiences are requested for this research. This research focuses on the Knowledge Storage/Retrieval (S/R) System, which is a component of a larger knowledge management system (KMS). The S/R system is comprised of business processes and technologies that primarily support the storage of knowledge within a repository and that provides the means to access this knowledge. Other functions associated with the S/R system include: a locator of knowledge experts for tacit knowledge, search capabilities, processing users' ratings/rankings/comments that influence the future quality of the S/R system, updating knowledge content, knowledge life-cycle management, ontology, presentation, etc. (see figure 1).

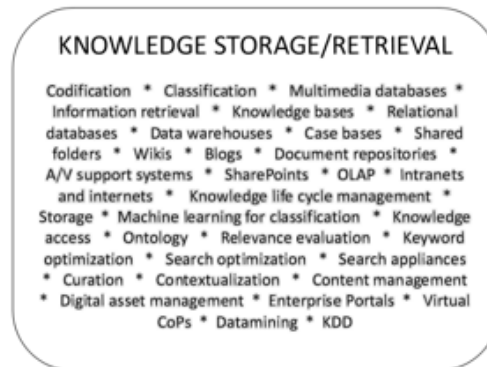


Figure 1. Storage/Retrieval technologies and processes

This research presents two major ideas on which you will exercise your judgment: 1) a multidimensional definition of KMS success comprised of six interrelated constructs and 2) a set of critical success factors (CSF) that influence or impact each of the success constructs and in some cases, impact and influence other CSFs. Importantly, for this research, ***the overall success of the S/R system will be viewed in respect to the S/R system facilitating or enabling knowledge transfer.*** It should be noted that no S/R system or any other technology can force knowledge transfer on individuals. However, for this current research, the overall goal of the S/R system is to help knowledge consumers transfer knowledge stored in a knowledge repository by getting the correct knowledge artifacts/content to the correct users, in the correct format, in the correct place, at the correct time.

I need your expert opinion to judge the degree of impact of factors and constructs by performing pairwise comparisons among success constructs and CSFs, with respect to another factor or construct – all the while, keeping in mind ***the overall goal of facilitating and enabling knowledge transfer.***

This methodology contends that peoples' minds are able to judge two factors at a time but not able to compare so many factors simultaneously and come to an accurate result especially if there are interdependences among them.

The following questionnaire has been prepared to elicit your judgments. Though you don't need to answer all questions at one session, answering all of them at once is most efficient. There are no right or wrong answers. Please fill out the first answer that comes to your mind; quite probably that is the correct answer. It is important for the reliability of the study to answer all questions.

Thank you for taking the time to complete this instrument: It is greatly appreciated!

If you have any questions whatsoever, please contact directly.

Steve Taraszewski
sataraszewski@gmail.com

A. STRATEGY AND LEADERSHIP

A1. TOP MANAGEMENT COMMITMENT AND ONGOING SUPPORT: TOP ORGANIZATIONAL LEADERS SHARE A VISION OF KNOWLEDGE MANAGEMENT AND PROVIDE THE KM PROGRAM WITH ONGOING LEADERSHIP SUPPORT, WHICH IS EXHIBITED VIA THEIR UNDERSTANDING OF THE ROLE OF KM IN BUSINESS, STRATEGY, AND GOALS SET WITH RESPECT TO KM AND LEAD BY EXAMPLE.

A2. MANAGEMENT UNDERSTANDS THE VALUE OF KM AND ARTICULATES THIS VIEW WITH THE ORGANIZATION: MANAGEMENT UNDERSTANDS AND VALUES KNOWLEDGE AS AN ORGANIZATIONAL ASSET AND CONTINUALLY AND CONSISTENTLY ARTICULATES THIS VIEW.

A3. MANAGEMENT'S CONTINUOUS COMMITMENT TO NECESSARY RESOURCES REQUIRED FOR KM: THERE IS A CONTINUOUS COMMITMENT BY TOP MANAGEMENT TO PROVIDE THE NECESSARY TECHNICAL, MONETARY, TIME, HUMAN, AND OTHER ORGANIZATIONAL RESOURCES TO ACHIEVE AND SUSTAIN THE SUCCESS OF KM EFFORTS.

A4. KNOWLEDGE MANAGEMENT STRATEGY IS LINKED TO ORGANIZATIONAL STRATEGY: THE KM STRATEGY IS ALIGNED (MUTUALLY SUPPORTIVE) WITH THE ORGANIZATION'S OVERALL STRATEGY. KNOWLEDGE CAPITAL IS TIED TO SPECIFIC BUSINESS GOALS

B. ORGANIZATIONAL CULTURE

B1. KNOWLEDGE-FRIENDLY AND OPEN ORGANIZATIONAL CULTURE: A CULTURE OF OPENNESS TO SHARING AND UNDERSTANDING OF KNOWLEDGE IS INHERENT TO THE ORGANIZATION. REFERS TO ORGANIZATIONAL SHARED VALUES, CORE BELIEFS, AND BEHAVIORAL MODELS THAT SUPPORT KM ACTIVITIES.

B2. INCENTIVES AND REWARD SYSTEM: EMPLOYEES ARE REWARDED FOR THE KM CONTRIBUTIONS AND INCENTIVIZED TO USE THE KM SYSTEM AS A PLATFORM FOR INNOVATION.

B3. EFFECTIVE COMMUNICATIVE ENVIRONMENT: AN OPEN ORGANIZATIONAL ENVIRONMENT THAT ENCOURAGES COMMUNICATIONS AMONG ALL PARTICIPANTS THAT ENCOURAGES EMPLOYEES TO OPENLY COMMUNICATE AND SHARE SUCCESSSES AS WELL AS FAILURES IN RESPECT TO KM INITIATIVES AMONG ALL PARTICIPANTS.

B4. MUTUALLY TRUSTING ENVIRONMENT: CULTURE OF TRUST AND CONFIDENCE – AT ALL LEVELS – THAT SHARING OF KNOWLEDGE WILL BE VIEWED POSITIVELY BY THE ORGANIZATION. EACH MEMBER AND PARTY TRUSTS, RELIES ON, AND UNDERSTANDS THE OTHER PARTIES' DECISIONS.

C. PEOPLE

C1. EMPLOYEE TRAINING: PROGRAM FOR TRAINING AND AWARENESS WORKSHOPS FOR EMPLOYEES ON USE OF THE KM SYSTEM AND KM PRINCIPLES ARE OFFERED AND PARTICIPATION IS ENCOURAGED.

C2. EMPLOYEE EMPOWERMENT: EMPLOYEES ARE ENCOURAGED AND EMPOWERED TO ENGAGE IN KM ACTIVITIES.

C3. WILLINGNESS TO SHARE KNOWLEDGE: DEGREE TO WHICH PARTICIPANTS ARE WILLING TO SHARE THEIR KNOWLEDGE WITH OTHERS. EMPLOYEES ARE FREED FROM THE KNOWLEDGE-HOARDING OR "KNOWLEDGE IS POWER" MINDSET.

C4. ABSORPTIVE CAPACITY OF RECIPIENTS: REFERS TO THE ABILITY OF KMS USERS TO IDENTIFY, ASSIMILATE, AND EXPLOIT KNOWLEDGE.

C5. STATUS OF THE KNOWER: THE REGARD FOR, RESPECT OF, AND CONFIDENCE IN THE SOURCE OF KNOWLEDGE TO BE TRANSFERRED.

C6. DEDICATED STAFF AND LEADERSHIP: EMPLOYEES, STAFF, AND LEADERSHIP ARE SPECIFICALLY ASSIGNED DUTIES AND RESPONSIBILITIES RELATED TO KM ACTIVITIES TO ENSURE CONSISTENCY IN MANAGING THE KMS.

D. INFORMATION TECHNOLOGY

D1. IT AND ORGANIZATIONAL STRATEGIES ALIGNED: IT STRATEGY IS SUPPORTIVE OF THE ORGANIZATION'S OVERALL STRATEGY.

D2. COMPETENCE OF TECHNOLOGY TEAM: TECHNOLOGY TEAM POSSESSES THE EXPERIENCE, ABILITY, AND SKILL SET REQUIRED TO SUPPORT THE KMS.

D3. EFFECTIVE TECHNOLOGICAL INFRASTRUCTURE: THE NECESSARY TECHNICAL INFRASTRUCTURE EXISTS TO SUPPORT THE KMS.

D4. USABILITY: THE KMS IS A FRIENDLY SYSTEM TO USE AND EXCHANGE KNOWLEDGE.

KNOWLEDGE MANAGEMENT SYSTEM (KMS) STORAGE/RETRIEVAL SYSTEM (S/R) SUCCESS CONSTRUCTS

KNOWLEDGE CONTENT QUALITY: REFERS TO THE QUALITY OF KNOWLEDGE THAT RESIDES IN REPOSITORIES AND KNOWLEDGE STORES AS ELECTRONIC ARTIFACTS SUCH AS DOCUMENTS, REPORTS, LESSONS LEARNED, AND SO ON. THIS INCLUDES THE NOTION OF REVIEWED, PRUNED, AND MODIFIED KNOWLEDGE CONTENT AND THE LINKAGES AND CONTEXT THAT ADD RICHNESS TO ORGANIZATIONAL KNOWLEDGE. THERE ARE TWO COMPONENTS TO KNOWLEDGE QUALITY: THE PRESENTATION OF KNOWLEDGE IN AN APPROPRIATE FORMAT AND THE USEFULNESS OF THE KNOWLEDGE OR QUALITY OF THE COMMUNICATED KNOWLEDGE FROM THE KMS. MEASURES INCLUDE RELEVANCE, ACCURACY, TIMELINESS, COMPLETENESS AND COVERAGE, CONSISTENCY, CURRENCY, APPLICABILITY, COMPREHENSIBILITY, PRESENTATION FORMATS, STRUCTURE, KNOWLEDGE REPRESENTATION, EXTENT OF INSIGHT, AND THE AVAILABILITY OF EXPERTISE AND ADVICE.

KNOWLEDGE MANAGEMENT SYSTEM QUALITY (KMS QUALITY): THIS IS CHARACTERIZED BY THE SYSTEM'S EASE-OF-USE (FOR BOTH INPUT AND OUTPUT), FUNCTIONALITY, RELIABILITY, FLEXIBILITY, PORTABILITY, INTEGRATION, UP-TIME, RESPONSE TIME, ACCESSIBILITY, SEARCH CAPABILITY AND OUTPUT QUALITY, AND DOCUMENTATION. AN EASY-TO-USE, EASY-TO-ACCESS, RESPONSIVE, AND RELIABLE KM SYSTEM WILL ENHANCE THE PROCESS AND OUTCOMES OF END USERS' KNOWLEDGE CREATION, SHARING, AND UTILIZATION. KMS QUALITY ESSENTIALLY MEASURES RELIABILITY AND PREDICTABILITY OF THE KMS AND IS INDEPENDENT OF THE INFORMATION CONTAINED WITHIN. FOR KMS, IT IS ESSENTIAL THAT THE SUPPORTING TECHNICAL SYSTEM BE FLEXIBLE AND AGILE ENOUGH TO SUPPORT THE CHANGING NEEDS OF THE ORGANIZATION. AS A KMS IS GENERALLY NOT A STATIC SYSTEM BUT RATHER, A SYSTEM MUST BE RESPONSIVE TO NEW ORGANIZATIONAL DEMANDS FOR KNOWLEDGE STORAGE FORMATS, REMOTE ACCESSIBILITY, 24X7 ACCESS, INCREASED USAGE, AND SECURITY.

KNOWLEDGE MANAGEMENT SYSTEM SERVICE QUALITY (KMS SERVICE QUALITY): THE QUALITY OF AN ORGANIZATION'S SUPPORT FOR THE KNOWLEDGE MANAGEMENT SYSTEM. QUITE SIMPLY, KMS SERVICE QUALITY IS NECESSARY TO ENSURE THAT USERS CAN UTILIZE THE KMS EFFECTIVELY: IT IS THE SUPPORT PROVIDED BY THE ORGANIZATION SO THAT THE KMS CAN BE USED BY THE WORKERS. THIS SUCCESS CONSTRUCT INCLUDES THE EFFICIENCY AND EFFECTIVENESS OF IT SUPPORT TECHNICIANS, KNOWLEDGE ENGINEERS, AND OTHER SUPPORT STAFF THAT ASSURE THE AVAILABILITY, RELIABILITY, RESPONSIVENESS, AND ASSURANCE OF THE KNOWLEDGE MANAGEMENT SYSTEM'S HARDWARE AND SOFTWARE AS WELL AS THE EMPATHY, SKILL, EXPERIENCE, AND CAPABILITIES OF THE SUPPORT STAFF. KMS SERVICE QUALITY NOT ONLY ADDRESSES MEASURES OF SUPPORT ACTIVITIES TYPICALLY SEEN IN TRADITIONAL INFORMATION SYSTEMS, BUT ALSO ENCOMPASSES KM ACTIVITIES SUCH AS UPDATING KNOWLEDGE PRESENTATION FORMATS OR REPRESENTATIONS, ENSURING END USERS HAVE THE MOST CURRENT OR APPROPRIATE KNOWLEDGE AVAILABLE, AND PURGING OUTDATED KNOWLEDGE, AMONG OTHERS, AND THUS IS AN IMPORTANT COMPONENT IN THE SUCCESS OF THE KM EFFORT.

USE: THIS IS THE ACTUAL USE OF THE KMS. WITHOUT USE OF THE KMS, THERE IS VERY LITTLE CHANCE THAT A KNOWLEDGE SYSTEM CAN BE SUCCESSFUL OVER A SUSTAINED PERIOD OF TIME. SYSTEM USE MAY BE MEASURED AS FREQUENCY OF USE, TIME OF USE, NUMBER OF ACCESSES, USAGE PATTERN, AND DEPENDENCY. ADDITIONALLY, USE IS MEASURED USING QUALITATIVE METRICS SUCH AS THE NATURE, QUALITY, AND APPROPRIATENESS OF THE USE OF THE KNOWLEDGE MANAGEMENT SYSTEM. THIS DIMENSION NOT ONLY ADDRESSES THE QUANTIFIABLE "TIMES" A SYSTEM IS USED OR HOW LONG A USER ENGAGES WITH THE KMS, BUT ALSO HOW "DEEP" A SYSTEM IS USED (INFORMED AND EFFECTIVE USE) AND THE USE OR NON-USE OF BASIC AND ADVANCED CAPABILITIES. IN OTHER WORDS, DO USERS EXPLORE THE SYSTEM AND FIND NEW USES FOR IT? USE AS A BEHAVIOR IS A NECESSARY BUT NOT SUFFICIENT CONDITION FOR OBTAINING KMS NET BENEFITS.

USER SATISFACTION: THIS STUDY ADOPTS A RATHER NARROW SCOPE IN WHICH TO MEASURE THE OVERALL USERS' APPROVAL OR "LIKEABILITY" OF THE KMS AND ITS OUTPUT. METRICS OF USER SATISFACTION INCLUDE EFFICIENCY, EFFECTIVENESS, ADEQUACY, AND ENJOYMENT GAINED FROM USE OF THE KMS. PERCEIVED EASE-OF-USE IS ALSO A MEASURE OF USER SATISFACTION THAT CAPTURES THE USERS REGARD TOWARD THE EASE OF INTERACTING WITH THE SYSTEM (E.G., THE USER INTERFACE). USERS THAT ARE SATISFIED WITH THEIR ORGANIZATION'S KNOWLEDGE MANAGEMENT EFFORTS WILL BE MORE LIKELY TO VOLUNTARILY PARTICIPATE IN KM ACTIVITIES, WHICH MAY INCLUDE FEEDBACK, RATINGS, AND RANKING USED TO IMPROVE THE QUALITY OF THE S/R SYSTEM. A BI-DIRECTIONAL RELATIONSHIP EXISTS BETWEEN THE USE CONSTRUCT AND THE USER SATISFACTION CONSTRUCT; THAT IS, MORE USE OF A KMS THAT YIELDS POSITIVE RESULTS MAY RESULT IN A HIGHER LEVEL OF USER SATISFACTION WITH THE SYSTEM AND CONVERSELY, A MORE SATISFIED USER OF THE KMS MAY BE MORE OPEN AND ENTHUSIASTIC ABOUT MORE USE OF THIS SAME SYSTEM.

NET BENEFITS: THIS RESEARCH CONSIDERS NET BENEFITS IN RESPECT TO *INDIVIDUAL IMPACT*. MOST KMS STUDIES IDENTIFY PERCEIVED USEFULNESS AS A METRIC FOR NET BENEFITS WHEN THE ANALYSIS IS AT THE INDIVIDUALS' LEVEL. PERCEIVED USEFULNESS IS DEFINED AS THE DEGREE TO WHICH STAKEHOLDERS BELIEVE THAT USING A PARTICULAR SYSTEM HAS ENHANCED THEIR JOB PERFORMANCE. IN THIS PRESENT CONTEXT, HAS THE USE OF THE S/R SYSTEM ENHANCED THE USERS' ABILITY TO TRANSFER KNOWLEDGE? DO THE USERS BELIEVE THEY WERE BETTER ABLE TO TRANSFER KNOWLEDGE USING THE S/R SYSTEM THAN WITHOUT IT? SIMILARLY, USE OF THE S/R SYSTEM IS EXPECTED TO IMPACT A PERSON'S TASK PERFORMANCE. HAS THE USE OF THE S/R SYSTEM HELP USERS BECOME MORE PRODUCTIVE IN TRANSFERRING KNOWLEDGE? OTHER MEASURES OF NET BENEFITS (INDIVIDUAL IMPACT) INCLUDE INCREASED TASK INNOVATION, LEARNING, AND AWARENESS/RECALL.

Evaluation Method

I need your expert perspective to determine the degree of influence of factors/constructs that affect the KMS storage/retrieval system and your judgments should always keep in mind the overall goal of the storage/retrieval system enabling and facilitating knowledge transfer.

It is highly recommended that you keep a paper copy of the factor and construct definitions close at hand for your reference, so as to avoid confusion with the more abbreviated factor and construct names used in the comparison instrument. This will help ensure that you are making fair evaluations in your pairwise comparisons.

COMPARISON SCALE: Use the following key to express the strength of each of the pairwise comparisons

In keeping the overall goal of the KMS storage/retrieval system facilitating and enabling knowledge transfer, please make the following comparisons.
 1:Equally 3:Moderately 5:Strongly 7:Very Strongly 9:Extremely 2,4,6,8:In-between values

If you believe B1 and B3 are equally influential on A1, then simply mark an "X" on the middle cell marked "1".

Which item most influences A1. TOP MANAGEMENT SUPPORT and by how much?

B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
-------------------------------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

If you believe that the item on the left side (here, B1) is more influential than the item on the right side (here, B3) on A1, then use the left side of the scale (highlighted in red below) and choose a value that corresponds to the weight of the influence (e.g., 3=moderately, 5=strongly, etc.).

1:Equally 3:Moderately 5:Strongly 7:Very Strongly 9:Extremely 2,4,6,8:In-between values

Which item most influences A1. TOP MANAGEMENT SUPPORT and by how much?

B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
-------------------------------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

For example, in respect to the overall goal of a storage/retrieval system facilitating and enabling knowledge transfer, if you believe that B1. Knowledge-friendly org. culture is Strongly more important than B3. Effective communicative environment on A1. Top management support, then mark this pairwise comparison as follows:

1:Equally 3:Moderately 5:Strongly 7:Very Strongly 9:Extremely 2,4,6,8:In-between values

Which item most influences A1. TOP MANAGEMENT SUPPORT and by how much?

B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
-------------------------------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

If you believe that the item on the right side (here, B3) is more influential than the item on the left side (here, B1) on A1, then use the right side of the scale (highlighted in red below) and choose a value that corresponds to the weight of the influence (e.g., 3=moderately, 5=strongly, etc.).

1:Equally 3:Moderately 5:Strongly 7:Very Strongly 9:Extremely 2,4,6,8:In-between values

Which item most influences A1. TOP MANAGEMENT SUPPORT and by how much?

B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
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For example, in respect to the overall goal of a storage/retrieval system facilitating and enabling knowledge transfer, if you believe that B3. Effective communicative environment is Very Strongly more important than B1. Knowledge-friendly org. culture on A1. Top management support, then mark this pairwise comparison as follows:

1:Equally 3:Moderately 5:Strongly 7:Very Strongly 9:Extremely 2,4,6,8:In-between values

Which item most influences A1. TOP MANAGEMENT SUPPORT and by how much?

B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
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COMPARISON INSTRUMENT

In keeping the overall goal of the KMS storage/retrieval system facilitating and enabling knowledge transfer, please make the following comparisons.

1:Equally 3:Moderately 5:Strongly 7:Very Strongly 9:Extremely 2,4,6,8:in-between values

Which item most influences **A1. TOP MANAGEMENT SUPPORT** and by how much?

B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
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Which item most influences **A2. MANAGEMENT UNDERSTANDINGS THE VALUE OF KM** and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A3. Continuous KM resource commitment
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment

Which item most influences **A3. THE CONTINUOUS COMMITMENT TO RESOURCES NEEDED FOR KM** and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A2. Mgmt. understands the value of KM
A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A4. KM strategy is linked to org. strategy
A2. Mgmt. understands the value of KM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A4. KM strategy is linked to org. strategy
C3. Willingness to share knowledge	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	G4. Employees absorptive capabilities
D1. IT and firms strategies aligned	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D2. Competence of technology team
E4. Use	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction
E4. Use	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)
E5. User Satisfaction	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)

Which item most influences **A4. THE KM STRATEGY IS LINKED TO THE ORGANIZATIONAL STRATEGY** and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A2. Mgmt. understands the value of KM
D1. IT and firms strategies aligned	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D3. Effective technical infrastructure

Which item most influences **B1. AKNOWLEDGE FRIENDLY ORGANIZATIONAL CULTURE** and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A2. Mgmt. understands the value of KM
B3. Effective communicative environment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
C2. Employee empowerment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C3. Willingness to share knowledge

Which item most influences **B2. AN INCENTIVE AND REWARDS SYSTEM** and by how much?

A2. Mgmt. understands the value of KM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A3. Continuous KM resource commitment
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Which item most influences **B3. AN EFFECTIVE COMMUNICATIVE ENVIRONMENT** and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A2. Mgmt. understands the value of KM
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
C2. Employee empowerment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C3. Willingness to share knowledge

Which item most influences **B4. AMUTUALLY TRUSTING ENVIRONMENT** and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A2. Mgmt. understands the value of KM
A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A3. Continuous KM resource commitment
A2. Mgmt. understands the value of KM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A3. Continuous KM resource commitment

Which item most influences **C1. EMPLOYEE TRAINING** and by how much?

A2. Mgmt. understands the value of KM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A3. Continuous KM resource commitment
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B2. Incentives and reward system
C3. Willingness to share knowledge	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
D2. Competence of technology team	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D3. Effective technical infrastructure

Which item most influences **C2. EMPLOYEE ENPOWERMENT** and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A3. Continuous KM resource commitment
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B2. Incentives and reward system
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
B2. Incentives and reward system	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment

In keeping the overall goal of the KMS storage/retrieval system facilitating and enabling knowledge transfer, please make the following comparisons.

1:Equally 3:Moderately 5:Strongly 7:Very Strongly 9:Extremely 2,4,6,8:In-between values

Which item most influences **C3. EMPLOYEES' WILLINGNESS TO SHARE KNOWLEDGE** and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A2. Mgmt. understands the value of KM
A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A3. Continuous KM resource commitment
A2. Mgmt. understands the value of KM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A3. Continuous KM resource commitment
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B2. Incentives and reward system
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
B2. Incentives and reward system	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
B2. Incentives and reward system	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
B3. Effective communicative environment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C2. Employee empowerment
E3. KMS Service Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction
E3. KMS Service Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)
E5. User Satisfaction	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)

Which item most influences **C5. STATUS OF THE KNOWER (REGARD FOR KNOWLEDGE SOURCE)** and by how much?

D2. Competence of technology team	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D4. Usability - easy to use KM system
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)

Which item most influences **C6. DEDICATED KMS STAFF AND LEADERSHIP** and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A2. Mgmt. understands the value of KM
A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A3. Continuous KM resource commitment
A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A4. KM strategy is linked to org. strategy
A2. Mgmt. understands the value of KM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A3. Continuous KM resource commitment
A2. Mgmt. understands the value of KM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A4. KM strategy is linked to org. strategy
A3. Continuous KM resource commitment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A4. KM strategy is linked to org. strategy
D1. IT and firms strategies aligned	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D3. Effective technical infrastructure

Which item most influences **D1. THE ALIGNMENT OF IT AND THE ORGANIZATIONAL STRATEGY** and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A2. Mgmt. understands the value of KM
A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A4. KM strategy is linked to org. strategy
A2. Mgmt. understands the value of KM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A4. KM strategy is linked to org. strategy

Which item most influences **D2. THE COMPETENCE OF THE TECHNOLOGY TEAM** and by how much?

C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C3. Willingness to share knowledge
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
C3. Willingness to share knowledge	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership

Which item most influences **D3. AN EFFECTIVE TECHNICAL INFRASTRUCTURE** and by how much?

D1. IT and firms strategies aligned	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D2. Competence of technology team
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Which item most influences **D4. USABILITY OR A FRIENDLY SYSTEM TO USE** and by how much?

C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
D2. Competence of technology team	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D3. Effective technical infrastructure

In keeping the overall goal of the KMS storage/retrieval system facilitating and enabling knowledge transfer, please make the following comparisons.

1:Equally 3: Moderately 5: Strongly 7: Very Strongly 9: Extremely 2,4,6,8: In-between values

Which item most influences E1. KNOWLEDGE CONTENT QUALITY and by how much?

B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B2. Incentives and reward system
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
B2. Incentives and reward system	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
B2. Incentives and reward system	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
B3. Effective communicative environment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C2. Employee empowerment
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C3. Willingness to share knowledge
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
C2. Employee empowerment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C3. Willingness to share knowledge
C2. Employee empowerment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
C3. Willingness to share knowledge	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
D2. Competence of technology team	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D3. Effective technical infrastructure
D2. Competence of technology team	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D4. Usability - easy to use KM system
D3. Effective technical infrastructure	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D4. Usability - easy to use KM system
E2. KMS Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E3. KMS Service Quality
E2. KMS Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction
E2. KMS Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)
E3. KMS Service Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction
E3. KMS Service Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)
E5. User Satisfaction	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)

Which item most influences E2. THE SYSTEM QUALITY OF THE STORAGE/RETRIEVAL SYSTEM and by how much?

B2. Incentives and reward system	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C2. Employee empowerment
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C3. Willingness to share knowledge
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
C2. Employee empowerment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C3. Willingness to share knowledge
C2. Employee empowerment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
C3. Willingness to share knowledge	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
D2. Competence of technology team	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D3. Effective technical infrastructure
D2. Competence of technology team	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D4. Usability - easy to use KM system
D3. Effective technical infrastructure	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D4. Usability - easy to use KM system
E3. KMS Service Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction

Which item most influences E3. THE SERVICE QUALITY OF THE STORAGE/RETRIEVAL SYSTEM and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A3. Continuous KM resource commitment
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B2. Incentives and reward system
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
B2. Incentives and reward system	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
B2. Incentives and reward system	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
B3. Effective communicative environment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C2. Employee empowerment
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C3. Willingness to share knowledge
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
C2. Employee empowerment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C3. Willingness to share knowledge
C2. Employee empowerment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
C3. Willingness to share knowledge	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
D1. IT and firms strategies aligned	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D2. Competence of technology team
D1. IT and firms strategies aligned	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D3. Effective technical infrastructure
D1. IT and firms strategies aligned	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D4. Usability - easy to use KM system
D2. Competence of technology team	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D3. Effective technical infrastructure
D2. Competence of technology team	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D4. Usability - easy to use KM system
D3. Effective technical infrastructure	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D4. Usability - easy to use KM system
E4. Use	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction

In keeping the overall goal of the KMS storage/retrieval system facilitating and enabling knowledge transfer, please make the following comparisons.

1:Equally 3:Moderately 5:Strongly 7:Very Strongly 9:Extremely 2,4,6,8:In-between values

Which item most influences E4. STORAGE/RETRIEVAL SYSTEM USE and by how much?

A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A2. Mgmt. understands the value of KM
A1. Top management support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A4. KM strategy is linked to org. strategy
A2. Mgmt. understands the value of KM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	A4. KM strategy is linked to org. strategy
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B2. Incentives and reward system
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
B2. Incentives and reward system	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B3. Effective communicative environment
B2. Incentives and reward system	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
B3. Effective communicative environment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B4. Mutually trusting environment
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C2. Employee empowerment
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C3. Willingness to share knowledge
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C4. Employees absorptive capabilities
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C5. Status of the knower
C2. Employee empowerment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C3. Willingness to share knowledge
C2. Employee empowerment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C4. Employees absorptive capabilities
C2. Employee empowerment	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C5. Status of the knower
C3. Willingness to share knowledge	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C4. Employees absorptive capabilities
C3. Willingness to share knowledge	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C5. Status of the knower
C4. Employees absorptive capabilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C5. Status of the knower
D1. IT and firms strategies aligned	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D4. Usability - easy to use KM system
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E2. KMS Quality
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E3. KMS Service Quality
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)
E2. KMS Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E3. KMS Service Quality
E2. KMS Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction
E2. KMS Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)
E3. KMS Service Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction
E3. KMS Service Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)
E5. User Satisfaction	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)

Which item most influences E5. USERS SATISF ACTION and by how much?

B1. Knowledge-friendly org. culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B2. Incentives and reward system
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C4. Employees absorptive capabilities
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C5. Status of the knower
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
C4. Employees absorptive capabilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C5. Status of the knower
C4. Employees absorptive capabilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
C5. Status of the knower	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C6. Dedicated staff and leadership
D2. Competence of technology team	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D3. Effective technical infrastructure
D2. Competence of technology team	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D4. Usability - easy to use KM system
D3. Effective technical infrastructure	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D4. Usability - easy to use KM system
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E2. KMS Quality
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E3. KMS Service Quality
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E4. Use
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)
E2. KMS Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E3. KMS Service Quality
E2. KMS Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E4. Use
E2. KMS Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)
E3. KMS Service Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E4. Use
E3. KMS Service Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)
E4. Use	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E6. Net Benefits (Individual Impact)

Which item most influences E6. NET BENEFITS (INDIVIDUAL IMPACT) and by how much?

C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C4. Employees absorptive capabilities
C1. Employee training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C5. Status of the knower
C4. Employees absorptive capabilities	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C5. Status of the knower
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E2. KMS Quality
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E4. Use
E1. Knowledge Content Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction
E2. KMS Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E4. Use
E2. KMS Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction
E4. Use	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E5. User Satisfaction

CLUSTER TO CLUSTER COMPARISON NOTES:

For the following cluster to cluster comparisons, still keep the overall goal of the storage/retrieval system facilitating and enabling knowledge transfer, but now think of how much more impactful one cluster is compared with another cluster, with respect to a control cluster. One strange issue comes when you are comparing two clusters with respect to one of the same clusters. Take the example that follows:

In keeping the overall goal of the KMS storage/retrieval system facilitating and enabling knowledge transfer, please make the following comparisons.

1:Equally 3:Moderately 5:Strongly 7:Very Strongly 9:Extremely 2,4,6,8:in-between values

Which cluster most influences the A. STRATEGY AND LEADERSHIP CLUSTER and by how much?

A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B. Culture cluster
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With the above example, think of the comparison like this:

In keeping the overall goal of storage/retrieval systems facilitating and enabling knowledge transfer, what cluster most influences cluster A. Strategy and Leadership: the items in the Strategy and Leadership cluster (e.g. A1. Top Management Support, A2. Management Understands the Value of KM, etc.) or B. Organizational Culture?

In keeping the overall goal of the KMS storage/retrieval system facilitating and enabling knowledge transfer, please make the following comparisons.

1:Equally 3:Moderately 5:Strongly 7:Very Strongly 9:Extremely 2,4,6,8:In-between values

Which cluster most influences the **A. STRATEGY AND LEADERSHIP CLUSTER** and by how much?

A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B. Organizational Culture cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C. People cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C. People cluster
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
C. People cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
C. People cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
D. Technology cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs

Which cluster most influences the **B. ORGANIZATIONAL CULTURE CLUSTER** and by how much?

A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B. Organizational Culture cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C. People cluster
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C. People cluster

Which cluster most influences the **C. PEOPLE CLUSTER** and by how much?

A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B. Organizational Culture cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C. People cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C. People cluster
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
C. People cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
C. People cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
D. Technology cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs

Which cluster most influences the **D. TECHNOLOGY CLUSTER** and by how much?

A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B. Organizational Culture cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C. People cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C. People cluster
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
C. People cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
C. People cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
D. Technology cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs

Which cluster most influences the **E. STORAGE/RETRIEVAL SUCCESS CONSTRUCTS CLUSTER** and by how much?

A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	B. Organizational Culture cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C. People cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
A. Strategy and Leadership	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C. People cluster
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
B. Organizational Culture cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
C. People cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	D. Technology cluster
C. People cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs
D. Technology cluster	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	E. Storage/Retrieval Success Constructs

APPENDIX C

STEP BY STEP ANP PROCESS

The following is provided by Saaty (2013) to outline the steps involved in the ANP:

1. *Make sure that you understand the decision problem in detail, including its objectives, criteria and subcriteria, actors and their objectives and the possible outcomes of that decision. Give details of influences that determine how that decision may come out.*
2. *Determine the control criteria and subcriteria in the four control hierarchies – one each for the benefits, opportunities, costs and risks of that decision and obtain their priorities from paired comparison matrices. You may use the same control criteria and perhaps subcriteria for all of the four merits. If a control criterion or subcriterion has a global priority of 3% or less, you may consider carefully eliminating it from further consideration. The software automatically deals only with those criteria or subcriteria that have subnets under them. For benefits and opportunities, ask what gives the most benefits or presents the greatest opportunity to influence fulfillment of that control criterion. For costs and risks, ask what incurs the most cost or faces the greatest risk. Sometimes (very rarely), the comparisons are made simply in terms of benefits, opportunities, costs, and risks by aggregating all the criteria of each BOCR into their merit.*
3. *Determine a complete set of network clusters (components) and their elements that are relevant to each and every control criterion. To better organize the development of the model as well as you can, number and arrange the clusters and their elements in a convenient way (perhaps in a column). Use the identical label to represent the same cluster and the same elements for all the control criteria.*
4. *For each control criterion or subcriterion, determine the appropriate subset of clusters of the comprehensive set with their elements and connect them according to their outer and inner dependence influences. An arrow is drawn from a cluster to any cluster whose elements influence it.*
5. *Determine the approach you want to follow in the analysis of each cluster or element, influencing (the suggested approach) other clusters and elements with respect to a criterion, or being influenced by other clusters and elements. The sense (being influenced or influencing) must apply to all the criteria for the four control hierarchies for the entire decision.*

6. *For each control criterion, construct the supermatrix by laying out the clusters in the order they are numbered and all the elements in each cluster both vertically on the left and horizontally at the top. Enter in the appropriate position the priorities derived from the paired comparisons as subcolumns of the corresponding column of the supermatrix.*
7. *Perform paired comparisons on the elements within the clusters themselves according to their influence on each element in another cluster they are connected to (outer dependence) or on elements in their own cluster (inner dependence). In making comparisons, you must always have a criterion in mind. Comparisons of elements according to which element influences a third element more and how strongly more than another element it is compared with are made with a control criterion or subcriterion of the control hierarchy in mind.*
8. *Perform paired comparisons on the clusters as they influence each cluster to which they are connected with respect to the given control criterion. The derived weights are used to weight the elements of the corresponding column blocks of the supermatrix. Assign a zero when there is no influence. Thus obtain the weighted column stochastic supermatrix.*
9. *Compute the limit priorities of the stochastic supermatrix according to whether it is irreducible (primitive or imprimitive [cyclic]) or it is reducible with one being a simple or a multiple root and whether the system is cyclic or not. Two kinds of outcomes are possible. In the first, all the columns of the matrix are identical and each gives the relative priorities of the elements from which the priorities of the elements in each cluster are normalized to one. In the second, the limit cycles in blocks and the different limits are summed and averaged and again normalized to one for each cluster. Although the priority vectors are entered in the supermatrix in normalized form, the limit priorities are put in idealized form because the control criteria do not depend on the alternatives.*
10. *Synthesize the limiting priorities by weighting each idealized limit vector by the weight of its control criterion and adding the resulting vectors for each of the four merits: Benefits (B), Opportunities (O), Costs (C) and Risks (R). There are now four vectors, one for each of the four merits. An answer involving ratio values of the merits is obtained by forming the ratio $B_i O_i / C_i R_i$ for alternative i from each of the four vectors. The synthesized ideals for all the control criteria under each merit may result in an ideal whose priority is less than one for that merit. Only an alternative that is ideal for all the control criteria under a merit receives the value one after synthesis for that merit. The alternative with the largest ratio is chosen for some decisions. Companies and individuals with limited resources often prefer this type of synthesis.*
11. *Determine strategic criteria and their priorities to rate the top ranked (ideal) alternative for each of the four merits one at a time. Normalize the four ratings thus obtained and use them to calculate the overall synthesis of the four vectors. For each alternative,*

subtract the sum of the weighted costs and risks from the sum of the weighted benefits and opportunities.

- 12. Perform sensitivity analysis on the final outcome. Sensitivity analysis is concerned with "what if" kinds of questions to see if the final answer is stable to changes in the inputs, whether judgments or priorities. Of special interest is to see if these changes change the order of the alternatives. How significant the change is can be measured with the Compatibility Index of the original outcome and each new outcome.*

APPENDIX D

PROFILE OF EXPERTS

Expert "A" has over 13 years of experience in enterprise-level applications development, design, and implementation for both large government agencies and large multi-national corporations that includes over seven years as project lead for KMS initiatives for a large manufacturing/technology company with a worldwide presence in over forty countries.

Expert "B" is an ACM Senior member with over 20 years of experience in private industry as well as municipal, state, and military software development and consulting. As a software epistemologist for a government contractor and an alternative intelligence researcher for a computational research group, this expert has years of experience in end-to-end processes involved in knowledge- and intelligence-based systems and computational linguistics and philosophy. Expert B has been published and presented articles in intelligence computing, knowledge capturing, and cognitive science.

Expert "C" has over 20 years of experience in knowledge-based research and is an epistemic visualization engineer who develops communication and visualization systems for information and knowledge for a large governmental contractor and research group and is involved in large projects that involve extraction of knowledge from large data repositories and computational linguistics and computational philosophy. Expert "C" has published and presented articles in the field of knowledge capture, intelligence computing, and knowledge visualization.

APPENDIX E

THE INFLUENCE MATRIX

Storage/Retrieval System Success	Strategy and Leadership				Culture				People				Technology				Storage/Retrieval System Success					
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	D1	D2	D3	D4	E1	E2	E3	E4	E5	E6
A1	A1	A1	A1	A1	B1	B1	B1	B1	C1	C1	C1	D1	D1	D1	D1	E1	E1	E1	E1	E1	E1	E1
A2	A2	A2	A2	A2	B2	B2	B2	B2	C2	C2	C2	D2	D2	D2	D2	E2	E2	E2	E2	E2	E2	E2
A3	A3	A3	A3	A3	B3	B3	B3	B3	C3	C3	C3	D3	D3	D3	D3	E3	E3	E3	E3	E3	E3	E3
A4	A4	A4	A4	A4	B4	B4	B4	B4	C4	C4	C4	D4	D4	D4	D4	E4	E4	E4	E4	E4	E4	E4
B1	B1	B1	B1	B1	B1	B1	B1	B1	C1	C1	C1	D1	D1	D1	D1	E1	E1	E1	E1	E1	E1	E1
B2	B2	B2	B2	B2	B2	B2	B2	B2	C2	C2	C2	D2	D2	D2	D2	E2	E2	E2	E2	E2	E2	E2
B3	B3	B3	B3	B3	B3	B3	B3	B3	C3	C3	C3	D3	D3	D3	D3	E3	E3	E3	E3	E3	E3	E3
B4	B4	B4	B4	B4	B4	B4	B4	B4	C4	C4	C4	D4	D4	D4	D4	E4	E4	E4	E4	E4	E4	E4
C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	D1	D1	D1	D1	E1	E1	E1	E1	E1	E1	E1
C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	D2	D2	D2	D2	E2	E2	E2	E2	E2	E2	E2
C3	C3	C3	C3	C3	C3	C3	C3	C3	C3	C3	C3	D3	D3	D3	D3	E3	E3	E3	E3	E3	E3	E3
C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	D4	D4	D4	D4	E4	E4	E4	E4	E4	E4	E4
C5	C5	C5	C5	C5	C5	C5	C5	C5	C5	C5	C5	D5	D5	D5	D5	E5	E5	E5	E5	E5	E5	E5
C6	C6	C6	C6	C6	C6	C6	C6	C6	C6	C6	C6	D6	D6	D6	D6	E6	E6	E6	E6	E6	E6	E6
D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1	E1	E1	E1	E1	E1	E1	E1
D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	D2	E2	E2	E2	E2	E2	E2	E2
D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	D3	E3	E3	E3	E3	E3	E3	E3
D4	D4	D4	D4	D4	D4	D4	D4	D4	D4	D4	D4	D4	D4	D4	D4	E4	E4	E4	E4	E4	E4	E4
E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1	E1
E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2	E2
E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3	E3
E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4
E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5
E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6	E6

APPENDIX F
FROM INDIVIDUAL TO GROUP RESPONSES

The Survey Instrument

A brief presentation was given to each of the three participating experts. At that time, the purpose of the study, the scope of the study, and the basic research questions being investigated were explained to each respondent. Since each expert was already very familiar with KMS, the presentation helped direct the experts' focus and frame the research in terms of the storage/retrieval system in facilitating and enabling knowledge transfer (FEKT). Clarifying questions were asked and answered at that time to ensure the respondents understood the context of the study and that they confined their responses in respect to S/RS success in FEKT.

At that time, each expert was given a hard-copy of the survey instrument (see Appendix B), which again stated the purpose of the research and defined its scope. The survey instrument also lists both the CSFs and S/RS success constructs and their definitions. In addition to the definitions included in the survey packet, this researcher went over each CSF and S/RS success construct with the experts to ensure their understanding of the terminology. Also, the multidimensional idea of S/RS success was again clarified for the respondents. It was recommended that respondents keep a copy of both the CSFs and S/RS success construct definitions next to them for quick reference as they filled out the pairwise comparison forms.

Finally, the actual process of entering the pairwise comparisons onto the survey instrument was explained, mock examples were given to the experts, and the experts were tested to ensure they were marking the form correctly to capture their judgments. Special attention was given to the cluster-to-cluster comparisons to be certain the

respondents understood these more difficult comparisons. The actual survey instrument also contains examples that cover all possible response scenarios and it was recommended that the experts refer to these examples for reference. The experts were encouraged to email or call this researcher at any time for any type of clarification with terms, concepts, or the comparison processes.

Aggregation of Individual Responses to Group Response

The survey instruments were completed independently by the experts and the hard-copy of the instrument was returned to this researcher. Because the Super Decision software does not allow for more than one instance of data input per data model, each expert's survey instrument was entered as a separate instance of the S/RS success ANP model created in Super Decisions for this research. Super Decisions allows for several different data input methods and in this case the Questionnaire input screen of Super Decisions Ver. 2.8 software was used to manually input the data, as it most directly matches the survey form. Also, an advantage of using the Questionnaire input interface is that it allows the researcher to receive immediate feedback on the inconsistency ratio with respect to a specific node or specific cluster. It is generally necessary to keep the inconsistency ratio to 10% or under, and if the inconsistency ratio exceeds this threshold, the researcher should go back to the experts and request that they perhaps reevaluate that set of pairwise comparisons, without disclosing the issue. In this study, there were two nodes – one each from two different experts – that required a reevaluation and after their new responses were reentered in Super Decisions the responses were found to be within the inconsistency tolerance range. Given that all three experts were within inconsistency tolerance, this then ensured that the aggregate model would be within tolerance.

Each respondent's unweighted supermatrix and cluster matrix were separately exported from the Super Decisions software into text files. Each text file was then imported into Microsoft Excel. As each expert responder has roughly the same expertise and experience, there was no need to weight the responses. Therefore, the simple geometric mean was used in this research rather than the weighted geometric mean (i.e., all weights were equal). The geometric mean of the three unweighted supermatrices was calculated in Excel and the results produced the aggregated group response unweighted supermatrix. This unweighted supermatrix contained all the node-to-node local priorities of the group decision. Similarly, the three cluster matrices were used to calculate an aggregated response cluster matrix, again using the geometric mean, which accounted for the cluster-to-cluster comparisons. Shown below are the synthesized model rankings individually derived from each of the experts along with the aggregate ranking for comparison. The rank distance – the sum of the absolute differences between each Aggregate response and individual response – was used to provide some sense as to the difference of individual outcomes versus the mathematically derived outcome.

Comparison of Individual Synthesized Outcomes with Group Aggregated Outcome

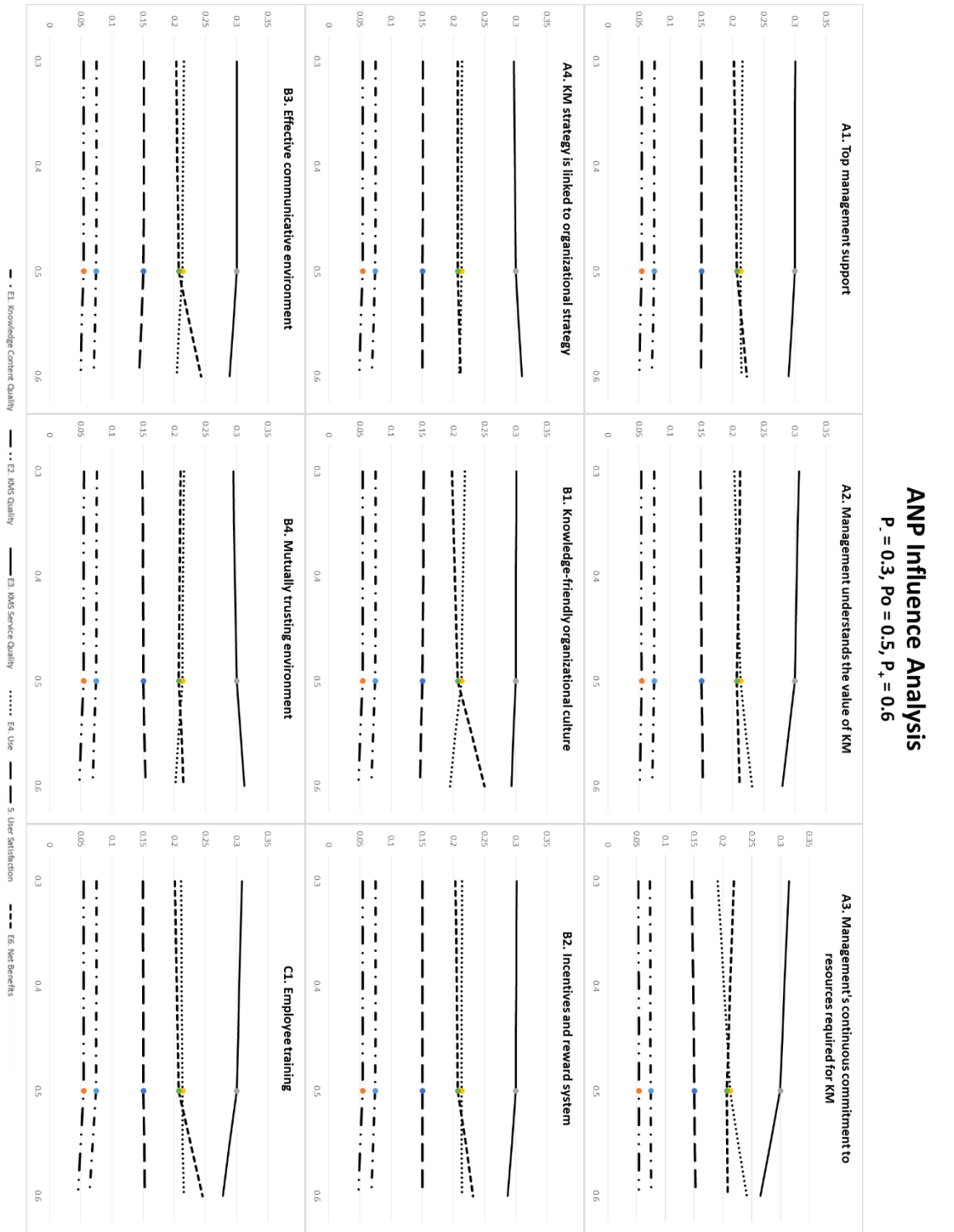
	E1. Knowledge Qual	E2. KMS Quality	E3. KMS Serv Qual	E4. Use	E5. User Satis	E6. Net Benefits	Rank Dist
Aggregate	5	6	1	2	4	3	----
Expert1	5	6	1	4	3	2	4
Expert2	6	5	2	3	4	1	6
Expert3	6	5	2	1	4	3	4

A fourth copy of the S/RS success ANP model was instantiated to contain the final aggregated group responses. Since the geometric mean produced pairwise comparison values that were not whole numbers, the only convenient method to enter the data into Super Decisions was through its Direct Entry method. A disadvantage of using the Direct Entry in Super Decisions was that it did not support the inconsistency calculation feedback. However, this was not an issue because inconsistency was not a problem at the

individual response level for reasons previously discussed. The aggregate response unweighted supermatrix and the cluster matrix values were input directly into the Super Decisions software. This final combined response model was the basis for the analysis for this research.

APPENDIX G

INFLUENCE SENSITIVITY GRAPHICS



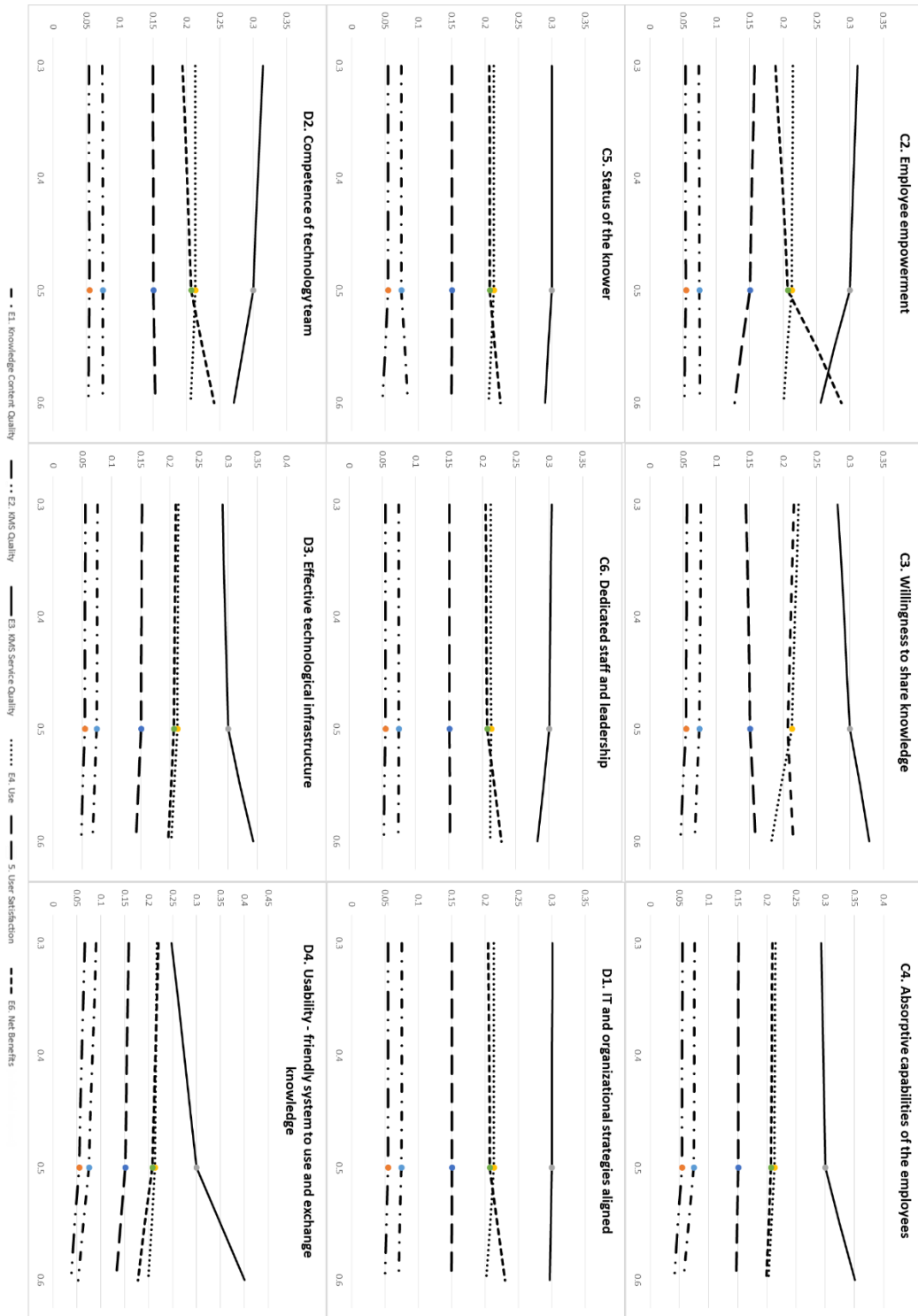
Influence Analysis Nodes A1 through C1. $P_- = 0.3, P_o = 0.5, P_+ = 0.6$

E1. Knowledge Content Quality
 E2. KMS Quality
 E3. KMS Service Quality

E4. Use
 E5. User Satisfaction
 E6. Net Benefits (Individual Impact)

ANP Influence Analysis

$P_- = 0.3, P_0 = 0.5, P_+ = 0.6$

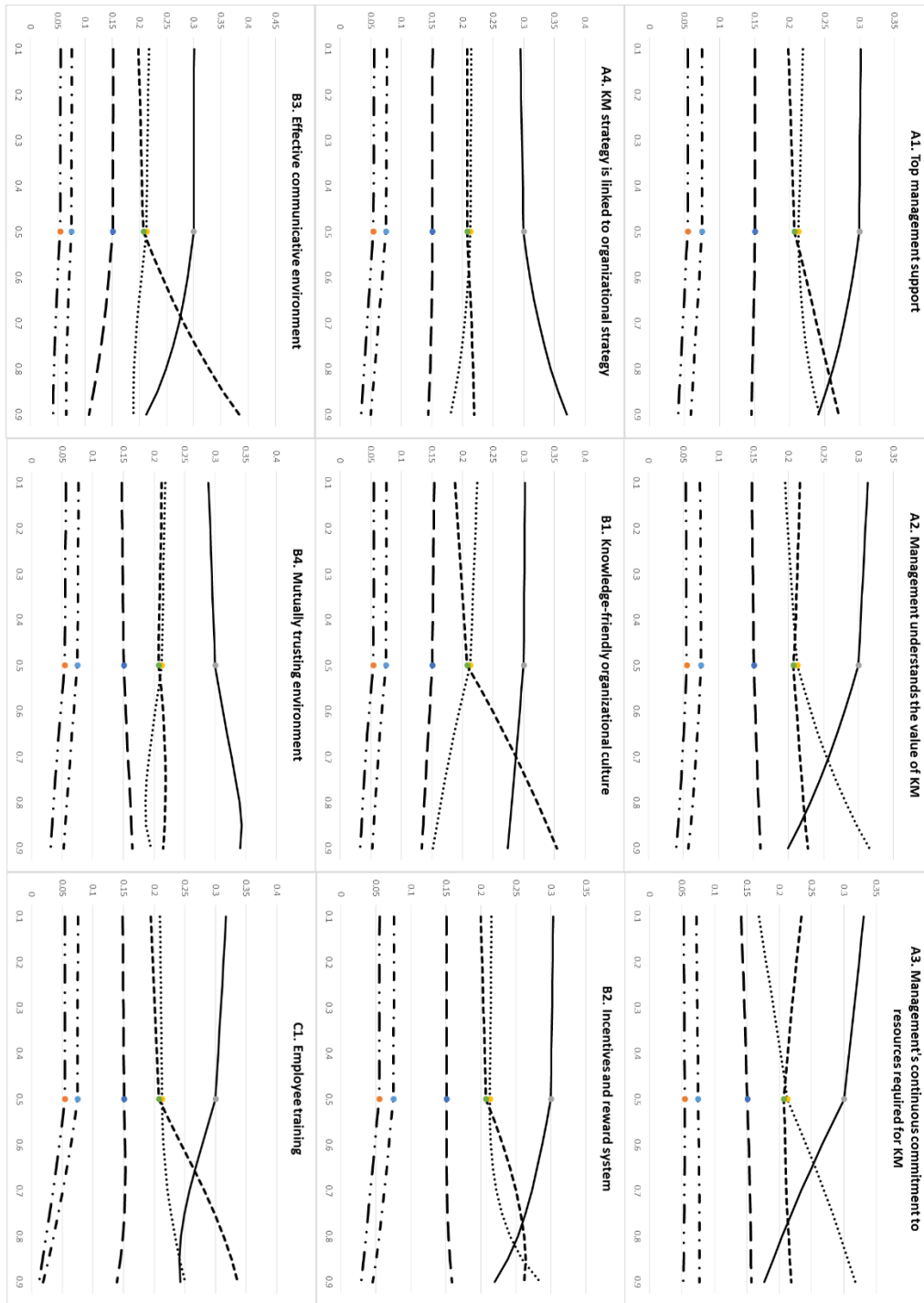


Influence Analysis Nodes C2 through D4. $P_- = 0.3, P_0 = 0.5, P_+ = 0.6$

- E1. Knowledge Content Quality
- E2. KMS Quality
- E3. KMS Service Quality
- E4. Use
- E5. User Satisfaction
- E6. Net Benefits (Individual Impact)

ANP Influence Analysis

$P_- = 0.1, P_0 = 0.5, P_+ = 0.9$

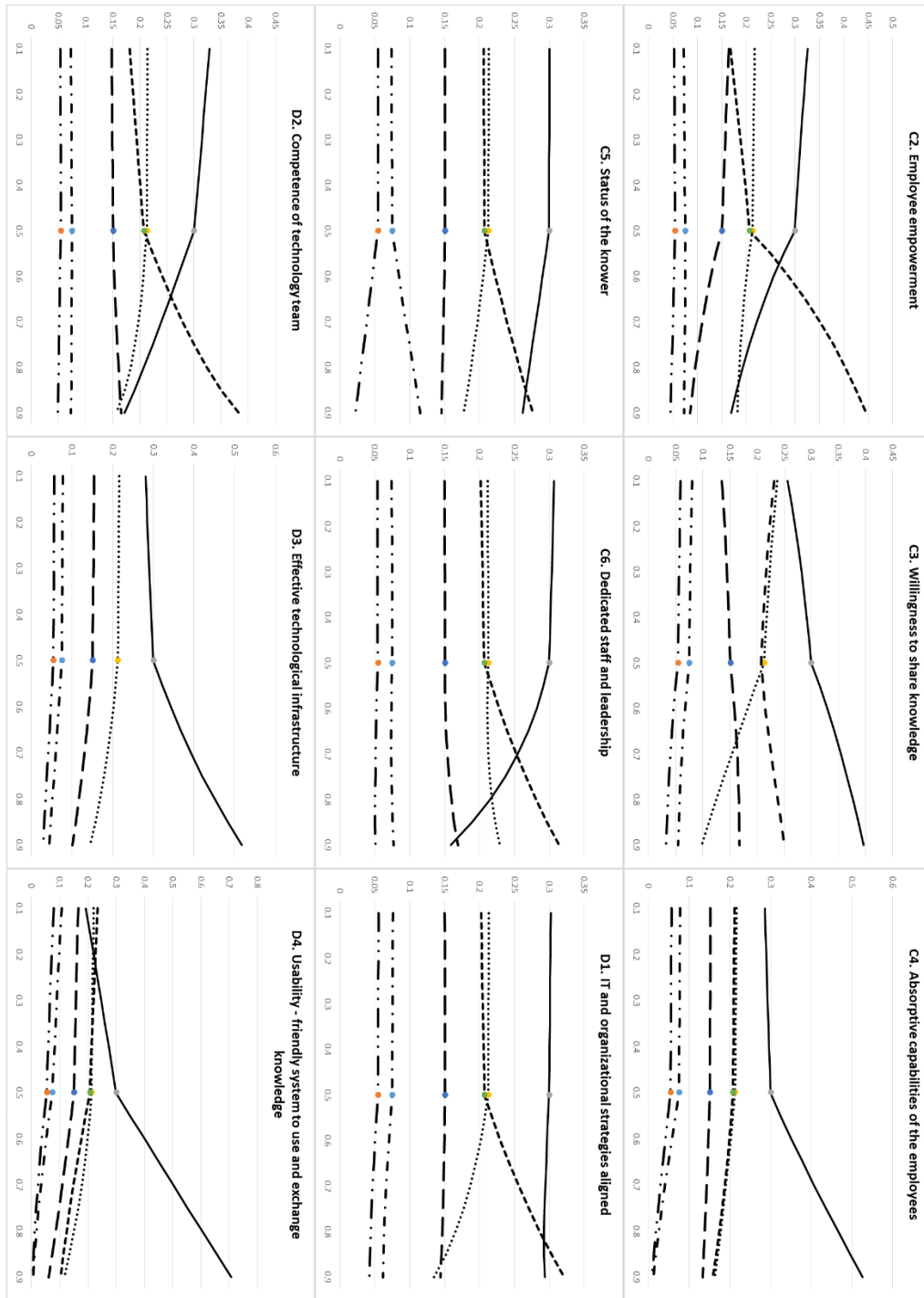


Influence Analysis Nodes A1 through C1. $P_- = 0.1, P_0 = 0.5, P_+ = 0.9$

-** E1. Knowledge Content Quality
- E2. KMS Quality
- E3. KMS Service Quality
-** E4. Use
- E5. User Satisfaction
- E6. Net Benefits (Individual Impact)

ANP Influence Analysis

$P_- = 0.1, P_0 = 0.5, P_+ = 0.9$



Influence Analysis Nodes C2 through D. $P_- = 0.1, P_0 = 0.5, P_+ = 0.9$

- E1. Knowledge Content Quality
- E2. KMS Quality
- E3. KMS Service Quality
- E4. Use
- E5. User Satisfaction
- E6. Net Benefits (Individual Impact)

APPENDIX H
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