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A Case-Based Exploration of Task/Technology Fit in a Knowledge Management Context

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A CASE-BASED EXPLORATION OF TASK/TECHNOLOGY

FIT IN A KNOWLEDGE MANAGEMENT CONTEXT

THESIS

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Abstract

Task/Technology Fit (TTF) posits that as the intersection of the task domain and the capabilities of an information system (IS) increases in magnitude, the performance gains experienced by user through use of the IS will be positively impacted. While rooted in the traditional IS literature, this research proposes that TTF be extended to incorporate additional factors unique to the context of Knowledge Management (KM). Based upon the findings of this research, it is reasonable to conclude that when employing the TTF model to determine KMS fitness, additional factors other than the task requirements and KMS capabilities should be considered. This research also shows that the social ecology present within the organization has significant impacts on KMS fit. Finally, this research lends credibility to the idea that KMS are indeed a unique subset of IS and that traditional IS models (such as TTF) should reflect the unique social nature of KM.

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Michael W. Moseley

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A CASE-BASED EXPLORATION OF TASK/TECHNOLOGY FIT IN A KNOWLEDGE MANAGEMENT CONTEXT

I. Introduction

Background

At the height of the Industrial Revolution, an organization's primary goal was to acquire as much of the traditional factors of production (land, labor, and capital) as possible. The great capitalists of that era, such as Henry Ford and John D. Rockefeller, understood that gaining the upper hand on competitors required having access to more land, labor, and capital. Companies that had more of these resources simply had more business options to choose from and could explore new markets and products. In the industrial era, such companies possessed the advantage.

While gathering the traditional factors of production was successful in the industrial era, Drucker (1994) contends that the industrial era is over and that the rise of the knowledge worker has signaled the arrival of the *knowledge era*. According to Drucker, the most important resource in this new era is not land, labor, or capital: it is knowledge. Furthermore, Drucker states that the "economic challenge of the post-capitalist society will therefore be the productivity of knowledge work and the knowledge worker" (p. 8). In the knowledge era, the effective management and application of knowledge will drive the success of organizations.

Most researchers agree that knowledge is a justified, personal belief that increases one's ability to take decisive action (Alavi & Leidner, 1999; Nonaka, 1994). According to Davenport and Prusak (2000), knowledge "…is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information" (p. 5). Say for a moment that an individual is heading outdoors for a nice walk in the park. Wanting to know what the weather might be like for the outing, they listen to the local weather forecast and learn that the temperature outside is 65˚F. When considered by itself, the fact that the temperature is 65˚F outside is unremarkable. It is when this information is placed within the *framework* of the individual's experience that it becomes valuable; it becomes knowledge. The individual may think: "It is rather cold outside, so I will wear a coat today." In this case, what was information (it is 65˚F outside) has become knowledge (experience indicates that 65˚F is cold) which ultimately led to action (a coat will be worn).

This example with the weather illustrates a point made by Alavi and Leidner (1999): "knowledge is not a radically different concept than information, but rather that information becomes knowledge once it is processed in the mind of an individual" (p. 6). Although this example using the weather is trivial, consider knowledge's place in a business setting. Knowledge gained via the analysis of competitors, market conditions, and financial information can be used to either support or refute potential courses of action within the business context.

As discussed, the era of knowledge has already dawned. Organizations recognize knowledge as a key resource much like money and material (Huber, 2001). Organizations have come to realize that their survival can depend upon their ability to acquire, develop, and exploit knowledge more effectively than their competitors (Huber). Seeking to unleash the power of knowledge resources, attention has turned to a relatively new field of research: knowledge management. Knowledge Management (KM) can be defined as the identification and mobilization of knowledge resources in an effort to turn these resources into value-creating activities (von Krogh, 1998). Researchers generally agree that KM is comprised of four basic processes: creation, storage/retrieval, transfer, and application (Alavi & Leidner, 2001).

Knowledge creation is the process by which new knowledge content is created by an entity (individual, group, organization) in response to a changing environment (Alavi & Leidner, 2001). As changes arise in the environment, information regarding these changes is placed within context of the entity's experience and expertise. New knowledge is created as this information is assimilated into the entities framework of understanding.

Knowledge storage/retrieval is the process by which knowledge enters a state of rest. As new knowledge is developed, its immediate usefulness may not be significant. When stored properly, coupled with an ability to quickly and accurately retrieve it, knowledge can be brought to bear on current situations.

Knowledge transfer, as the name implies, is the transfer of knowledge to the places in which it is needed (Alavi & Leidner, 2001). Finally, knowledge application is simply that: the application of knowledge to a problem to reach a decision and take action. As has been discussed, the power of knowledge lies in its ability to lead to action.

Organizations are beginning to realize the importance of these knowledge processes in their own efforts to manage knowledge effectively.

A vast amount of research has been conducted in an effort to explore exactly what benefits are afforded organizations that manage knowledge effectively. Most researchers agree that when managed effectively, knowledge can provide organizations with several benefits. According to Argote and Ingram (2000), the field of strategic management has recently begun to emphasize knowledge as the source of competitive advantage in organizations. Osterloh and Frey (2000) agree by saying that knowledge is an "essential source" of an organization's competitive advantage (p. 538). Davenport and Prusak (2000) also agree that knowledge is important, contending that the knowledge-based activities, such as developing products and processes, are the activities that have the greatest ability to provide competitive advantage. Research indicates that better knowledge can lead to measurable increases in efficiency and production (Davenport & Prusak). Furthermore, organizations that spend time getting in touch with what they *know* can make wiser decisions regarding strategy, competitors, customers, distribution channels, and product and service life cycles (Davenport & Prusak). In summary, researchers have noted that the effective management of knowledge can give organizations the upper hand in a fiercely competitive, global economy.

In May 2001, International Data Corporation and *Knowledge Management* magazine conducted a survey to investigate the status of KM practices in American companies. The results of the survey indicated three main goals that motivated companies to begin a KM initiative: retain the expertise of personnel, increase customer satisfaction, and improve profits or increase revenues (Dyer, 2001). To achieve these goals, companies applied KM practices to four main business needs: the capture and sharing of best practices, the development and distribution of training or corporate learning, the management of customer relationships, and the delivery of competitive intelligence (Dyer). All of these practices focus on one particular aim: to keep new and existing knowledge flowing within the organization. Knowledge that doesn't flow eventually becomes stale and irrelevant, and will be unable to contribute to the formulation of new knowledge (Borghoff & Pareschi, 1997).

In an effort to increase the efficiency of KM within organizations, attention has been given to the application of information technology (IT) resources in this area. The potential of utilizing modern information technologies to facilitate KM is new and exciting (Alavi & Leidner, 1999). Such technologies that are designed to facilitate KM are known as Knowledge Management Systems (KMS). KMS can be defined as "IT-based systems developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer, and application" (Alavi & Leidner, 2001, p. 114). Given the growing importance of knowledge within the organization, the acquisition and application of computer-aided KMS is one of the major thrusts for managing knowledge (Huber, 2001).

Research Focus

Excited about the potential positive impact of KM efforts, many organizations have scrambled to implement initiatives designed to facilitate KM. One such initiative is the acquisition and implementation of a KMS. Organizations employing a KMS hope that once these systems are online, knowledge will start flowing naturally and profit margins will begin to increase. Sadly, this is seldom the case. According to Davis, Bagozzi, and Warshaw (1989): "Organizational investments in computer-based tools to support planning, decision-making, and communication processes are inherently risky" (p. 982). Organizations that rush to procure a KMS, or implement any KM-related initiative for that matter, often do so under the false assumption that knowledge moves without friction or motivating forces (Davenport & Prusak, 2000). They view their employees as vessels of knowledge waiting to spill their experiences and insight on others "with no concern for what they may gain or lose by doing so" (Davenport & Prusak, p. 26).

Before rushing to procure a KMS, organizations must understand the nature of the task that is to be supported by the KMS. For instance, the tasks and knowledge processes within an engineering firm are probably very different from those in a financial management firm or a manufacturing firm. The knowledge workers within each organization have different contexts within which they apply their knowledge. They also have different ways of conducting the KM processes of knowledge creation, storage/retrieval, transfer, and application. When designing an information system such as a KMS, it is very important to keep the nature of the task in mind so that the capabilities designed into the KMS naturally complement the task.

The research stream of Task/Technology Fit (TTF) is concerned with the matching of the capabilities of an IS such as a KMS with the task for which it was designed. The central theme of TTF holds that information technologies will be used only if the capabilities that they bring to the table support (or fit) the activities and needs of the user (Dishaw & Strong, 1999). According to Dishaw and Strong (1999): "Rational, experienced users will choose those tools and methods that enable them to complete the task with the greatest net benefit" (p. 11). Consider for a moment trying to paint a masterpiece with a hammer. Although it could be done, provided that the artist has plenty of skill and patience, the hammer is not the best tool for the job. Experienced artists know the individual qualities and attributes that each type of brush can bring to the painting. In the same way that a brush must fit the painting task, a KMS must fit the knowledge needs of the users.

Research Question

There is still plenty of debate as to what comprises effective KM. According to Wiig (1997), no general approach to managing knowledge has been established by the research literature. Wiig argues that several isolated, and sometimes diverging, notions are being advanced. These different approaches to KM have caused the development of different kinds of KMS often designed with some sort of target audience in mind. One example is British Petroleum's (BP) Virtual Teamwork Program, an in-house initiative whose goal is to build a network of people using desktop videoconferencing, multimedia e-mail, application sharing, shared chalkboards, document scanners, and groupware, among other technologies (Davenport & Prusak, 2000). Although BP initially didn't label this project a KMS, that is essentially what it was and it achieved a certain level of success in it own right (Davenport & Prusak).

A KMS that is considered "successful" in one company can be utilized in a different company with little to no effect. BP's Virtual Teamwork Program was designed to operate effectively in BP's business and operational environment. It may or may not achieve the same level of success in a different organization such as Intel or the Department of Defense. This implies that the success of the KMS is not only dependent upon its own design, but also upon the nature of the knowledge environment into which it is installed. The way that the KMS supports the knowledge processes of creation, storage/retrieval, transfer, and application must *fit* the way that knowledge is represented and communicated within the knowledge environment of the firm.

As discussed earlier, TTF is concerned with the degree to which technologies fit the tasks for which they are designed. TTF, like KM, is a relatively new area of research that is still evolving (Dishaw & Strong, 1999). This researcher has been unable to find a significant amount of research that looks at the nature of TTF in a KM context. This exploratory research effort attempts to provide some insight into this research gap. In particular, this research will attempt to answer this question:

Does task/technology fit differ in the context of knowledge management systems versus more traditional information systems?

This research will attempt to explore how TTF changes when the context is shifted from traditional information systems such as e-mail clients and word processors to KMS.

Implications

This research effort seeks to increase the understanding of the nature of TTF in a KMS context. By understanding the changes to TTF, researchers and designers can better understand the task environment that a KMS will have to operate in. This understanding would allow KMS developers to be conscious of the fit between tool characteristics and task characteristics as they relate to the user's choice to use the tool (Dishaw & Strong, 1999). As a result, the KMS can be designed to more effectively fit the task at hand. By understanding TTF as applied to KMS, researchers can develop accurate models that attempt to better explain why users choose to use (or not use) a KMS to complete a task (Dishaw & Strong).

II. Literature Review

Introduction

In order for organizations to be successful, they must be able to compete in an extremely turbulent market place where speed and agility are prized. Argote et al. (2000) maintain that organizational knowledge forms the basis of competitive advantage. Alavi and Leidner (2001) further qualify this assertion by claiming that it is the actual application of knowledge that is the source of competitive advantage. Regardless of how knowledge is operationalized however, recent research has consistently shown that an organization's knowledge, if managed and applied properly, can provide an advantage over competitors (Gupta & Govindarajan, 2000).

It is one thing to tell an organization to apply their knowledge, but actually doing it can be a completely different issue. To that end, researchers and practitioners have drawn upon a discipline and field of study we have come to know as Knowledge Management (KM). In general, KM is concerned with the application of knowledge to business processes and procedures in order to fuel innovation. As a discipline, KM is rooted in action and requires that knowledge be used and applied before it is to have any impact within an organization (Jennex, 2008). Organizations that are aware of the inherent power of knowledge often decide to implement specific systems designed to facilitate KM. These systems – known as Knowledge Management Systems (KMS) – are often comprised of various information technologies designed to get new knowledge into the hands of those who need it.

The Information Systems (IS) literature proposes that in order for an IS, such as a KMS, to increase the performance levels of users, the capabilities of the IS must "fit" the task for which it is designed to serve or augment. This concept is referred to as Task/Technology Fit (TTF) and it highlights the importance of the task to performance (Dishaw & Strong, 1999). It is the goal of this research effort to explore how the concept of TTF changes, if it even does so, in the context of one of the most popular KM initiatives – the KMS. Before tackling this notion of TTF as it applies to KMS, let us step back for a moment and explore exactly what is meant by the term *knowledge*. To inform our discussion, knowledge will be explored from two perspectives: the cognitive perspective and the constructionist perspective.

Perspectives on Knowledge

Cognitive Perspective

Originating during the "cognitive revolution" of the early 1950s, the cognitive perspective is the most firmly rooted and well-known perspective regarding the nature of knowledge (von Krogh, 1998, p. 134). As von Krogh notes, this perspective arose from tremendous advances in the areas of computer science, systems theory, psychology, and neuroscience. A greater understanding in these fields gave scientists more insight into how the mind works. Within this perspective, knowledge is considered a representation of the world and the key task of any cognitive system (such as the brain) is to model such representations as accurately as possible. Knowledge in this perspective is universal in that "two cognitive systems should achieve the same representation of the same object or event" (von Krogh, p. 134). In other words, two individuals who observe and study a phenomenon should arrive at the same mental model that represents their understanding of said phenomenon.

The cognitive perspective also implies that all knowledge is explicit and easily encoded into forms that can be transferred between different individuals or groups (von Krogh, 1998). According to von Krogh, explicit knowledge is capable of being encoded and stored, and easily transmitted to others. Explicit, sometimes referred to as codified, knowledge is transmittable in a formal, systematic language (Nonaka, 1994). Alavi and Leidner (2001) define explicit knowledge as knowledge that is articulated, codified, and communicated in symbolic form and/or natural language. Regardless of the definition that is adopted, one thing remains constant throughout the literature: explicit knowledge can be expressed using a mutually understood notation. That notation can be in the form of words, pictures, mathematical formulas, etc. Thus, knowledge in this form has a certain degree of tangibility that allows for manifestation outside of the mind of its possessor. In the context of an organization, this type of knowledge is embodied in such things as memoranda, e-mail correspondence, briefings, regulations, policies, and organizational charts.

To illustrate the role of explicit knowledge in the cognitive perspective, consider this extension of the bicycle analogy offered by Polanyi (1962). Suppose that someone knows how to ride a bicycle extremely well. In the expert's mind is a model of what is required to ride the bicycle correctly. Because the cognitive perspective holds that all knowledge can be codified, this expert should be able to write an instruction manual describing the process of riding a bicycle. The instruction manual could contain a method, complete with illustrations that, when followed, would result in the successful operation of a bicycle. Suppose also that someone who has never ridden a bicycle chooses to read the manual. Assuming that the manual is written in a comprehensive manner and is free of errors, the novice should be able to reach the same mental model as that of the expert. The novice bicyclist could then jump on a bicycle and merrily ride away.

As anyone who has mastered the bicycle knows, reading a manual does not necessarily equate to a successful bicycling experience. In a similar vein, one cannot read a book on painting and suddenly recreate the masterpieces of Michelangelo. There seems to be an element missing from the cognitive perspective of knowledge that concerns the less tangible aspects of *knowing* something. If the cognitive perspective were applicable to riding a bicycle, the classic image of the father running down the sidewalk while guiding a peddling child on a bicycle would no longer exist. Children, instead of learning to ride a bicycle through practice and personal experience, would simply read the instruction manual and go about their merry way.

Researchers who subscribe to the cognitive perspective view knowledge as an object independent of an entity such as an individual or organization (Baloh, 2007). Coupled with the belief that all knowledge can be codified, proponents of this perspective argue that KMS should assume a machine-oriented design which "…focuses on codification and storage facilities, where knowledge is stored in the form of information in databases, documents in document management systems, and so forth, where it can be accessed by employees" (Baloh, p. 28). Because all knowledge is capable of being codified and thus represented in some sort of computer system, the focus is placed on ensuring that there is plenty of storage space and search capability for the person who needs it.

Constructionist Perspective

In 1962, Polanyi offered a challenge to the cognitivist perspective by saying: "There are things that we know but cannot tell" (p. 601). The constructionist perspective of knowledge arose from new insights in the areas of neurobiology, cognitive science, and philosophy (von Krogh, 1998). According to von Krogh, the constructionist perspective views knowledge as an act of construction or creation based upon inputs from the environment that are placed in some sort of context. This assertion stands in stark contrast to the cognitive perspective which views knowledge as a representation of the environment. Knowledge is not universal and the constructionist is not concerned with comparing various representations of the world (von Krogh). The constructionist perspective allows for two individuals to have disparate mental models explaining the same environmental phenomenon.

The constructionist perspective also acknowledges the existence of explicit knowledge, that which is easily codified, and tacit knowledge, that which is highly personal and not easily expressed (von Krogh, 1998). On the subject of tacit knowledge, Polanyi's bicycle analogy (1962) again seems to ring true:

> "I can say that I know how to ride a bicycle or how to swim, but this does not mean that I can tell how I manage to keep my balance on a bicycle or keep afloat when swimming. I may not have the slightest idea of how I do

> this, or even an entirely wrong or grossly imperfect idea of it, and yet go on cycling or swimming merrily" (p. 601).

Thus, it is one thing to *know* how to ride a bicycle, and yet *telling* another how to ride it can prove challenging. That is why a child, after the removal of the training wheels, must still develop his or her tacit understanding of riding a bicycle through sheer repetition and practice.

According to von Krogh (1998), the recognition that knowledge can exist in a tacit form is what is exciting about the constructionist perspective (p. 134). Tacit knowledge is highly personal, not easily expressed, and not easily shared with others. In addition, von Krogh states: "Tacit knowledge involves physical skills, such as putting the movements together in a high-precision luxury watch, as well as perception skills, such as interpreting a complex seismic readout of an oil reservoir" (p. 134). Nonaka (1994) echoes a similar sentiment by saying that tacit knowledge is "…deeply rooted in action, commitment, and involvement in a specific context" (p. 16). According to Nonaka: "Knowledge that can be expressed in words and numbers only represents the tip of the iceberg of the entire body of possible knowledge" (p. 16). Grover and Davenport (2001) continue along similar reasoning suggesting that tacit knowledge "is embedded in the human brain" (p. 7). All of these definitions point to the fact that everyone possesses knowledge that they would probably have a difficult time articulating to others.

Researchers who subscribe to the constructionist perspective view knowledge as an inherently social process. Therefore, the goal of a KM initiative shaped by the constructionist perspective would be to ensure the people with the questions meet and work with the experts who have the answers. It is by the connection of these two groups that tacit and explicit knowledge are transferred (Baloh, 2007). Thus, for the constructionists like Baloh, a KMS should have strong collaboration tools and built-in expert-seeking functionalities such as a corporate "yellow pages".

The Question of Perspective

The question invariably arises as to which of these perspectives, the cognitive or constructionist perspective, is correct. Baloh (2007) argues that the answer is dependent upon the business context. Baloh states that the resulting KM strategy should arise out of an analysis of the business processes. Consider this example given by Baloh:

> "For example, the accounting department will be concerned with knowledge that is fairly declarative in nature (e.g., standards and procedures from the accounting boards), whereas the customer service department will employ procedural or rule-based knowledge (e.g., how to fix a product bug). The differences in the knowledge needs will call for different types of KMS" (p. 32).

Baloh's example highlights the fact that different knowledge tasks have different knowledge needs. Some knowledge tasks are cognitive in nature such as assembling products on an assembly line – each employee should have roughly the same mental representation on how to assemble the product. Other knowledge tasks are more constructionist in nature such as developing graphics for a web site – multiple designers may each have unique representations regarding the project at hand. Baloh argues that it is not important which perspective is correct, but which perspective is most at play in the knowledge task of interest.

It is here that the notion of "fit" is introduced. The foundational premise of TTF is that greater levels of fit between the design of an IS such as a KMS and the knowledge-based task characteristics, the better the performance of the user (Baloh, 2007). Although TTF states that the capabilities offered by a KMS should fit the knowledge task for which it was designed, TTF does not specify how or even what knowledge to gather for the KMS. It is here that KM becomes important in that it defines what knowledge is valuable to the organization, and where knowledge should be distributed in an effort to improve decision-making. Before advancing the concept of TTF further, let's take a moment to more fully explore the notion of KM and the KMS that support it.

Knowledge Management

As was noted previously, researchers generally agree that knowledge allows individuals or organizations to make decisions and take action in response to their environments (Jennex, Smolnik, & Croasdell, 2007). The existence of tacit knowledge also means that employees may possess special knowledge that cannot be easily expressed, but could be of the utmost value to the company. Considering these two points, organizations are often faced with a series of questions and challenges concerning the production and application of knowledge. First, they must determine where within the company knowledge assets reside. It is not enough to simply say that it is everywhere. Focus must be directed towards those business processes with the highest potential to produce or benefit from knowledge. Next, organizations have to figure out how to represent, extract, and codify the knowledge in such as way as not to lose its meaning. Finally, organizations must identify who is to receive and utilize that knowledge. Studies in the area of Knowledge Management (KM) address many such issues associated with these organizational dilemmas.

Jennex (2008) defines KM as "…the practice of selectively applying knowledge from previous experiences of decision-making to current and future decision making activities with the express purpose of improving the organization's effectiveness" (pp. 50-51). He goes on to say that KM "…is an action discipline" and that "…knowledge needs to be used and applied for KM to have an impact" (p. 51). According to Wiig (1997), the objectives of KM are: "to make the enterprise act as intelligently as possible to secure its viability and overall success," and "to otherwise realize the best value of its knowledge assets" (p. 1).

When compared to other research streams, KM is relatively new. In early 1993, Prusak and his colleagues organized one of the first academic and practitioner conferences devoted to KM (Prusak, 2001). To their surprise, the conference attracted more than 150 paid participants and became "…a good milestone to mark the beginning of the knowledge management timeline" (Prusak, p. 1003). The participants seemed to have one thing in common: a notion that knowledge was the key residual that could "…explain internal productivity after everything thing else had been accounted for" (Prusak, p. 1003).

Skeptics may claim that KM is simply a new buzz word for the waning re-engineering movement (Prusak, 2001). However, Prusak compares KM to any other system of thought that has value: "…[KM's] combination of new ideas with ideas that 'everyone has known all along' should reassure practitioners rather than unnerve them" (p. 1002). Prusak goes on to say that KM is a "…practitioner-based, substantive response to real social and economic trends" (p. 1002).

Prusak (2001) offers three trends that have fertilized the growth of KM. First of these trends is that the increasingly interconnected nature of the world, termed globalization, is driving organizations to innovate at even faster rates than before. No longer does an American company only have to worry about its domestic competitors, but foreign competitors as well. Indeed, the number of global competitors, products, and different distribution channels is astounding (Prusak, 2001). According to Wiig (1997), KM becomes more important considering the new economic reality of globalization and it sometimes serves as the differentiating factor for individuals, corporations, and nations. Clearly, rapid globalization has fueled the KM movement.

The next trend that inspired the growth of KM is the ubiquitous nature of computing resources. Prusak (2001) contends that the cost of computing resources has become cheap enough as to be no longer considered a barrier to entry (Prusak, 2001). Not too long ago, organizations that had access to computing resources were rare; these organizations had the advantage. Now, everyone has access to powerful computing technologies at a fraction of the cost just years ago. Advantage is therefore no longer gained by merely having computing resources, but by utilizing computing resources effectively.

Finally, an emerging knowledge-centric view of the firm has led to the rise of KM. In this view of the firm, knowledge forms the basis for competition between organizations (Wiig, 1997). Instead of pursuing the most efficient utilization of scarce resources (land, labor, capital), organizations have instead focused their attention on pursuing strategies to manage the knowledge inherent in their employees and processes (Wiig). The central tenant of this view is "…how well knowledge and other intellectual assets are brought to bear to make the enterprise's customers successful" (Wiig, p. 5). These three trends have brought attention to the importance of knowledge to the organization.

Knowledge Management Systems

There are very few studies today concluding that focusing on knowledge is a waste of time and resources. As such, organizations have scrambled to implement knowledge-related initiatives without much thought as to what factors may influence their success or demise. According to Baloh (2007): "The introduction of any organizational intervention – including a new IT tool – into an existing environment has the potential to serve as a catalyst for change" (p. 25). Note that this does not necessarily imply positive change. The change could in fact be for the worse. Due to the potential value residing in knowledge assets within the organization, it is only prudent to approach the management of these resources cautiously and with study and reflection.

Among the many initiatives that organizations use to promote KM is the use of information technologies to aid in the knowledge processes. Alavi and Leidner (2001) define KMS as "IT-based systems developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer, and application" (p. 114). Jennex and Olfman (2004a) define KMS in simple terms by saying that KMS "are systems designed to manage organizational knowledge" (p. 1). Regardless of how you define it, a KMS facilitates at least one of the many critical knowledge processes at work in an organization.

Organizations have always been involved in the knowledge processes of creation, storage/retrieval, transfer, and application. According to Holsapple (2005): "Computer-based technology has transformed the way in which individuals and organizations accomplish knowledge work by amplifying, complementing, leveraging, and (in some cases) improving on innate human knowledge handling capabilities" (p. 47). These computer-based technologies (KMS) allow the knowledge processes to be executed faster and more accurately than they could be accomplished by humans alone. Due to the low cost of storage media and the increasing power of search algorithms, a KMS can be adapted to store and search through an incredible amount of information. Considering the prominence of e-mail, instant messaging, and the World Wide Web, IT is well suited to link people together and therefore aid in knowledge transfer. Finally, a KMS can enhance the application of knowledge by bringing the right knowledge to bear in a critical decision-making process. Organizations have always performed knowledge work. If implemented properly, KMS allows that knowledge work to advance to the next level.

Knowledge Management System Success

After implementing a KMS, the natural follow-on question deals with whether or not it is working. How does a company know if their KMS is doing what it should? A significant amount of research has been conducted to answer such questions. In order to define what knowledge management system success means, we must first frame the issue in respect to knowledge management success. Jennex et al. (2007) proposed the following composite definition of KM success by integrating the responses of several KM researchers and practitioners:

> "KM and KMS success are a multidimensional concept. Each includes capturing the right knowledge, getting the right knowledge to the right user, and using this knowledge to improve organizational and/or individual performance. KM success is measured using the dimensions of impact on business processes, strategy, leadership, efficiency and effectiveness of KM processes, efficiency and effectiveness of the KM system, organizational culture, and knowledge content" (p. 5).

As this definition implies, KM success and KMS success are closely related. KMS success is the degree to which the KMS contributes to the overall success of the KM program within an organization. It is quite possible to have a failed KMS but at the same time an overall successful KM program. Specifically, knowledge may get to the right person at the right place at the right time; it may have just not been because of the KMS.

There have been many proposed models for measuring KMS success. Among these is the popular DeLone and McLean (1992) IS Success Model and its close derivative, the Jennex and Olfman (2004b) KMS Success Model. Both of these models suggest that instead of one generic success construct, KMS success should be thought of as multidimensional. The notion of KMS success as multidimensional is congruent with the consensus definition of KMS success proposed by Jennex (2007). By understanding what factors influence KMS success, attempts to design and build these systems can be better informed. In the next sections, we will more fully explore the DeLone and McLean IS Success Model as well as the Jennex and Olfman KMS Success Model. The differences between the two models may ultimately be informative to the discussion of how TTF might be conceptualized within the context of KMS.

DeLone & McLean Information System Success Model

In 1992, DeLone and McLean published the original version of the IS Success Model as shown in Figure 2.1. At the time of DeLone and McLean's work, researchers were using a wide variety of constructs in an effort to measure IS success. For example, one researcher might use the response time of the IS as an indication of success while another researcher might use the accuracy of the report generated by the IS as an indication of success. According to DeLone and McLean (1992): "It does little good to measure various independent or input variables, such as the extent of user participation or the level of IS investment, if the dependent or output variable—IS success or MIS effectiveness—cannot be measured with a similar degree of accuracy" (p. 61). Thus, the authors' main focus was to consolidate a large body of research at the time in an attempt to specify a model that could be used to explain the constructs that influence IS success.

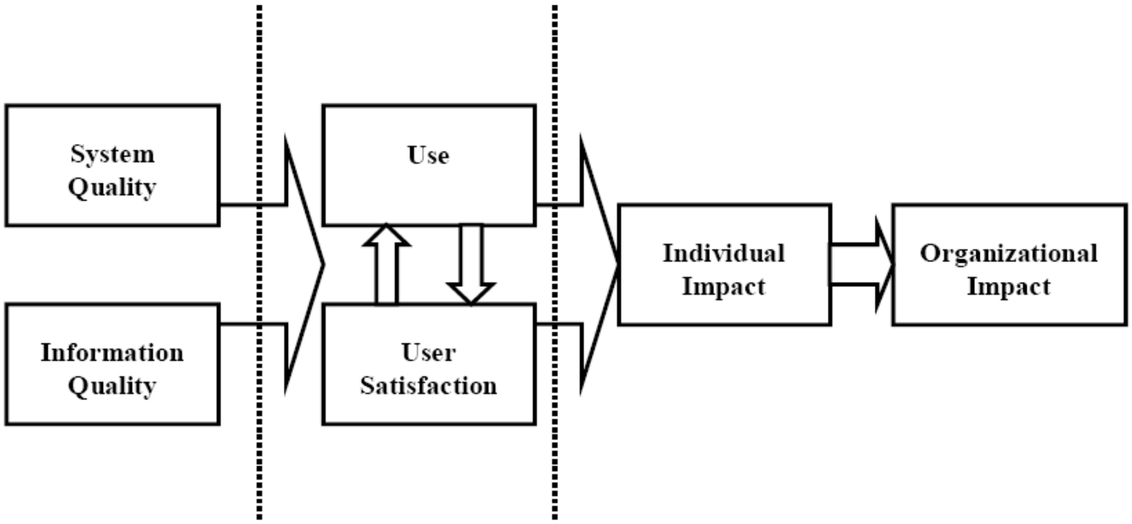

Figure 2.1 – DeLone & McLean IS Success Model (1992, p. 87)

DeLone and McLean (1992) analyzed 180 empirical studies dating from 1981 to 1987 to develop a comprehensive list of the constructs that their contemporaries where using to define success. The model depicted in Figure 2.1 was a result of their extensive review of the literature at that time regarding information systems success. As the model shows, constructs developed to measure information system success generally fell into six major categories: System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact.

The dimension of System Quality is concerned with the IS itself and measures the quality of the system's performance. Constructs that fall within this dimension are resource utilization, response time, and ease of use. The Information Quality dimension takes into account the information that is processed by the IS. Constructs in this dimension are: information accuracy, completeness, and relevance. The Use dimension attempts to capture the actual use of the system by its users. In some cases, hardware monitors where connected to IS to measure the number of network connections or keystrokes made by users. Other research efforts attempted to measure use by volume, such as the volume of client accounts processed by the IS of interest. The dimension of User Satisfaction, as its name implies, measures the degree of user satisfaction with the IS. However, DeLone and McLean (1992) warn that one should be careful to define exactly whose satisfaction is of interest. User satisfaction could be measured with respect to many different people within an organization. DeLone and McLean mentioned one study in particular that used the satisfaction of chief executive officers in a study on the success of an overall MIS effort. The dimension of Individual Impact seeks to measure the overall effect of an IS on the behavior of the user. The impact that an IS has on an individual is extremely hard to define; performance was often used as a proxy for impact because researchers maintain that performance and impact are closely related. Finally, the Organizational Impact dimension seeks to measure the effect of an IS on the performance of an organization.

When originally published in 1992, the IS Success Model quickly gained popularity as a useful framework from which success models could be built. During the period of 1993 to the middle of 1999, 159 published research efforts had referenced the IS Success Model (DeLone & McLean, 2002). In 2002, DeLone and McLean revisited the IS Success Model in an effort to address some of the feedback received from the research community. Several changes were made and the modifications to the IS Success Model are shown in Figure 2.2 below.

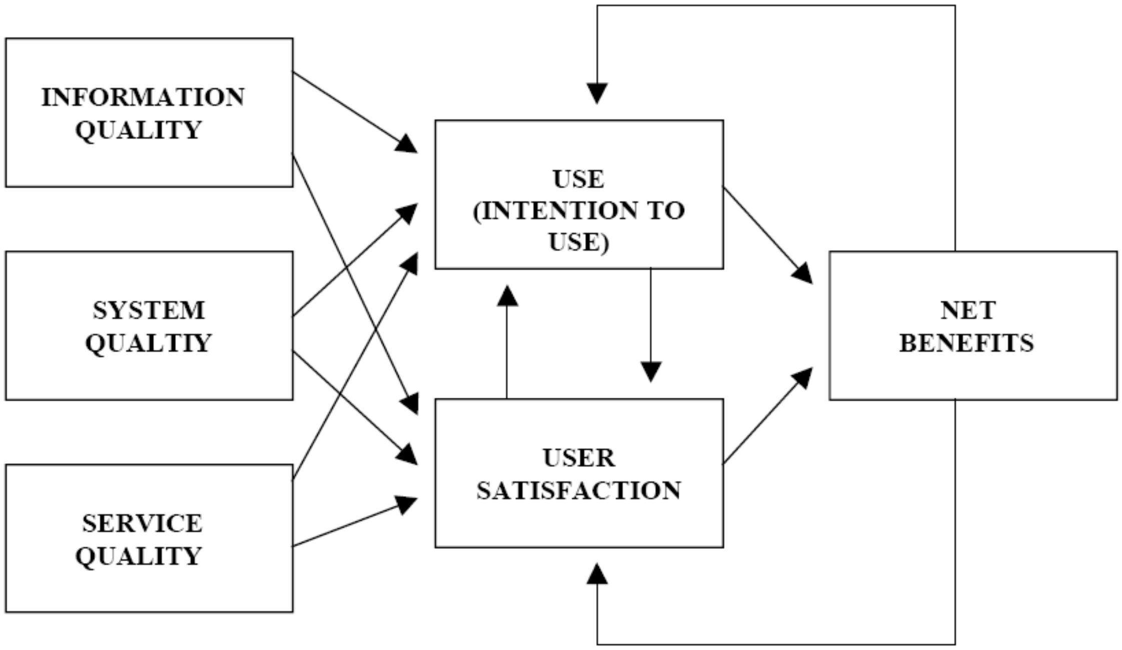

Figure 2.2 – Revisited Delone & McLean IS Success Model (2002, p. 9)

According to DeLone and McLean (2002), the modifications made to the IS Success Model are simply changes in degree and not in kind. First, they extended the model by adding the dimension of Service Quality. This dimension is focused on measuring the quality of the support functions that are put in place to support the users of the IS. For instance, if the department in charge of administering an IS provides consistently poor service to users, then it can be said that the quality of the service is low. Another modification made by DeLone and McLean is the combination of the Individual Impacts and Organizational Impacts into one dimension: Net Benefits. This consolidation made the overall model more parsimonious and emphasized that it is the responsibility of researchers using the IS Success Model to define what impacts are to be measured (DeLone & McLean, 2002).

Finally, DeLone and McLean concede that the dimension of Use may not be applicable to all research contexts and therefore proposed that Intent to Use can be substituted when the research context warrants. Specifically, they cited the inherent difficulties in interpreting the multidimensional aspects of Use in their original model. Seddon and Kiew (1996) argue that the non-use of a system "does not necessarily mean a system is not useful, it may simply mean that the potential user has other more pressing things to be done" (p. 92). Seddon and Kiew go on to propose that other constructs could be substituted for Use given certain situational characteristics. Of all of these modifications, the ability to substitute Intent to Use for Use is most significant for the current research effort. This particular issue will be explored further in later sections of this analysis.

Jennex & Olfman KMS Success Model

Any time an organization invests resources into a knowledge management project, it is important to have a way to measure its effectiveness. Measuring KMS success or effectiveness is valuable to the organization because such information can be used to justify knowledge management investments (Liu, 2005). Also, having a method by which knowledge management systems can be measured for effectiveness gives greater insight and understanding as to how these systems should be built and implemented (Jennex & Olfman, 2004b).

The Jennex and Olfman KMS Success Model (Figure 2.3) is one tool that can be used to measure the effectiveness of KMS. This success model is based upon the widely accepted DeLone & McLean Information System Success Model (Jennex & Olfman, 2004b). The DeLone & McLean model was chosen as the foundation for the KMS Success Model because a KMS is a specialized type of information system (2004b).

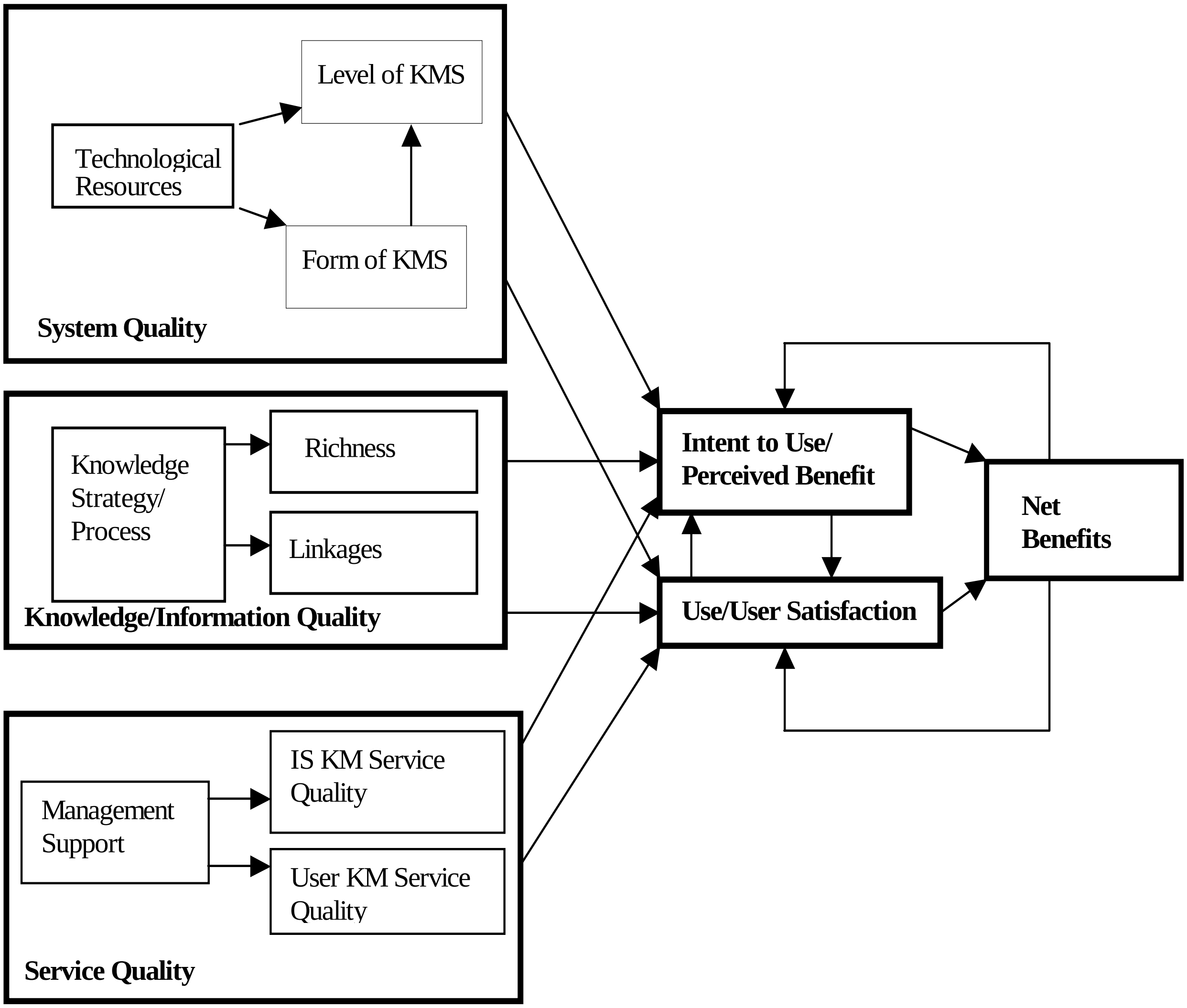

Figure 2.3 - Jennex & Olfman KMS Success Model (2004b, p.6)

System Quality

As its name implies, the dimension of System Quality is concerned with the quality of the KMS itself. It is defined by how well the KMS performs the functions of knowledge creation, storage/retrieval, transfer, and application (Jennex & Olfman, 2004b). The focus here is on such things as the amount of resources dedicated to the system, the amount of knowledge that can be stored in the system, and the strength of the utilities used to retrieve the knowledge that is stored. These focus areas are operationalized using three separate constructs: Technological Resources, Form of the KMS, and Level of the KMS (Jennex & Olfman).

In order for a KMS to be effective, an organization must be willing to devote the proper technological resources to the project. The Technological Resources construct "captures ideas about the networks, databases, and other hardware involved in the KMS, as well as the experience and expertise behind the KMS initiative and the usage competence of typical KMS users" (Liu, 2005, p. 70). This means that the KMS should be allocated the proper hardware and software so that it can meet its intended purpose. Attempting to run the KMS on under-powered hardware or over saturated network links will reduce the overall quality of the system.

The Form of KMS construct measures the degree to which the knowledge management processes (creation, storage/retrieval, transfer, and application) are computerized and integrated (Jennex & Olfman, 2004b). The construct reflects the amount of knowledge that a user can access via the KMS interface (Liu, 2005). If the KMS only contains a small amount of knowledge from the context of interest, there will be very little that users can access. In this case, the construct of Form of KMS would be measured low.

Finally, the construct of Level of KMS attempts to measure the KMS's ability to extract the needed knowledge from the system in an efficient and productive way. This construct focuses on the KMS's search and retrieval functions because these functions are what allow users to specify search terms to the system (Liu, 2005, p. 71). Weak search and retrieval functions will cause either wrong or insufficient results to be displayed. A KMS that covers a vast amount of knowledge from a context of interest is essentially useless if the search and retrieval algorithms that service the KMS are weak.

The Jennex and Olfman KMS Success Model suggests that as the availability of technological resources increases, there will be a positive effect on both the form and the level of the KMS. Better software and hardware allow for greater automation of the processes of KM (the form of the KMS). Also, the form of the KMS influences the level of the KMS. As more and more knowledge makes its way into the system (form), the search and retrieval functions (level) will have a greater repository from which to pull query results. With each search, more knowledge is presented to the user which in turn improves the Service Quality dimension of the KMS.

Knowledge/Information Quality

The dimension of Knowledge/Information Quality is concerned with the delivery of the right knowledge to precisely the right users at precisely the right time (Jennex & Olfman, 2004b). The simple act of capturing knowledge doesn't necessarily guarantee that the quality of the knowledge will be high. Thus, this dimension is also characterized by three foundational constructs: Knowledge Strategy/Process, Richness, and Linkages (Jennex & Olfman).

The Knowledge Strategy/Process construct is concerned with the organizational processes used to identify which knowledge should be captured (Jennex & Olfman, 2004b). In order for a knowledge management initiative to be successful, organizations should define what knowledge is of interest and also in what form it should be captured. It does little good to spend resources in procuring a KMS if the organization has not thought about the knowledge that should be captured. Without having these discussions, users of the system will not know how to approach the system. They may wonder as to exactly what knowledge should be put into the KMS. Consequently, the users may not use the system, or it might be populated with knowledge of questionable worth. The Knowledge Strategy/Process construct takes into account the formality of these processes as well as the format and context of the knowledge to be stored. The construct of Richness is meant to capture the accuracy and timeliness of the knowledge and that the context is useful. The Linkages construct reflects the importance of being able to link a piece of knowledge back to its originator. It is not enough to simply have access to knowledge, but users also want to know the source of the knowledge so they know who to contact if they need additional knowledge.

The particular strategy and process that an organization uses to collect knowledge impacts the quality of both the knowledge stored in the system (richness) and the knowledge known about individual employees (linkages). It is important for organizations to develop policies geared toward enhancing and encouraging knowledge shared among employees through the KMS. An effective policy is one that gives knowledge workers the flexibility to contribute and sets guidelines as to what exactly should be collected. If the policy is too strict, the desire to share will be diminished.

Service Quality

The dimension of Service Quality seeks to capture the quality of the support that users of the KMS can expect. This dimension ensures "that the KMS has adequate support for users to utilize the KMS effectively" (Jennex & Olfman, 2004b, p. 8). Like the other dimensions, it is operationalized into three constructs: Management Support, User KMS Service Quality, and Information System KMS Service Quality.

Without management support, the KMS effort will be severely hampered. In an environment that is not conducive to KM, use of the KMS could be viewed as a waste of time; time that could be used generating profits for the company. According to Jennex and Olfman (2004b), there are three important things that management must provide: 1) establishing support in order to ensure that adequate resources are allocated to the KMS, 2) encouraging employees to facilitate an environment conducive to knowledge sharing, and 3) developing sufficient control structures to aid in monitoring knowledge and KMS use (p. 8).

The construct of User KM Service Quality refers to the support given to the actual users of the KMS. This support encompasses a host of activities including providing the user with training and the degree or nature of the training that is available. For example, is there an initial training session offered or do users have access to subsequent assistance after the initial training period? By including this construct in their model, Jennex and Olfman (2004b) highlight the importance of continuing user support. Users who attempt the use the KMS and find that their questions are extremely difficult to answer are more likely to just give up or utilize only those functions that they feel comfortable with.

Finally, the construct of IS KM Service Quality refers to the support provided for the KMS by the information technology function of the organization (Jennex & Olfman, 2004b). If a user contacts the help center regarding an issue with the KMS, is their issue taken seriously and responded to in a timely fashion? If they find their account is locked, is due attention paid to their request for help? If it not, it could sour the user's perceptions of the KMS and discourage future use. It is important to note the difference between this construct and the construct of User KM Service Quality. IS KM Service Quality is focused more on the support function assigned to perform the day-to-day maintenance of the KMS (such as the Help Desk). User KM Service Quality is more concerned with the materials and training available to the user to assist in their use of the KMS.

Use/User Satisfaction

The Use/User Satisfaction construct measures the degree to which users actually use and are satisfied with the KMS (Jennex & Olfman, 2004b). In instances where the use of the KMS is mandatory, the construct of Use may be more applicable because it refers to the use and application of outputs from the system. In situations where use is not mandatory, the construct of User Satisfaction may be used. A user may be perfectly happy with a KMS but may only need to use it occasionally. If the construct of Use were applied in this case, actual use would be low because the user only uses the KMS occasionally. When applying the KMS Success Model, Jennex and Olfman state that it is very important for the researcher to adjust the model to fit the context of interest.

Intent to Use/Perceived Benefit

The Intent to Use/Perceived Benefit construct seeks to measure the "perceptions of the benefits of the KMS by users" (Jennex & Olfman, 2004b, p. 9). If this construct is measured and found to be high, users perceive the KMS to be valuable and are more likely to turn to the KMS for their knowledge needs. If it is measured to be low, the inverse is true; users would not perceive the KMS to be valuable and therefore would not be likely to use it.

The inclusion of the Intent to Use construct in the KMS Success Model has important implications for the current research effort. In the revisited IS Success Model, DeLone and McLean (2002) stated that the construct of Intent to Use could be substituted for Use in certain research contexts. Jennex (2005) proposes that KMS success is not based upon the amount of system use, but upon the user's *intent* to use the KMS. In his research, Jennex (2005) noted, "End users stated that it was knowledge used infrequently that was knowledge with the greatest value and impact. This implies that the KMS with the greatest impact is the KMS that may not be used all that frequently" (p. 7). In another more recent research effort, Jennex (2008) interviewed KMS users and observed that, "Several interviewees echoed the sentiment that it was not how often they used the KMS but rather it was the one time that they absolutely had to find knowledge or found unexpected knowledge that proved the worth of the KMS" (p. 58). Therefore, it seems clear that KM is indeed a unique research context in which the notion of Intent to Use is arguably more meaningful than Use alone to the study of KMS success.

Net Impact

Any time a customer uses the KMS, an impact will be made on the customer's performance in the workplace (Jennex & Olfman, 2004b). Jennex and Olfman state than an impact could be an indication "…that an information system has given the user a better understanding of the decision context, has improved his or her decision-making productivity, has produced a change in user activity, or has changed the decision maker's perception of the importance or usefulness of the information system" (p. 9) Jennex and Olfman also note that the impact is not necessarily positive. Utilization of a KMS could lead to negative impacts if it is not suited for the knowledge task, contains inaccurate knowledge, or is simply difficult or extremely expensive to use.

The Unique Nature of KM

Many research efforts (Jennex, 2005, 2008; Seddon & Kiew, 1996) support the assertion that KMS are a unique form of IS and that the constructs used to measure KMS success should be selected with care. Just as Jennex and Olfman (2004b) adapted the IS Success Model to the KMS context, it is reasonable to expect that the same may hold true for TTF – a model that also has its roots in the traditional IS literature. As such, we are left to ask how TTF should be tailored to the unique context of KMS.

The issue of use with respect to KMS is applicable to the current research effort for the following two reasons. First, one of the major tenets of TTF is that a greater degree of fit between the task domain and the capabilities of the IS encourages higher levels of use. As we have seen, a more accurate construct for measuring fit in the context of KMS may be Intent to Use versus Use. Second, it provides additional support for the notion that KMS are specialized forms of IS and therefore require models tailored to their context for effective measurement. Baloh (2007), although focused on design principles for KMS, supports the application of TTF models to KMS. Baloh asserts, with the appropriate adjustments, these models could shed light on designing KMS for success. Just as Jennex and Olfman derived their KMS Success Model from the DeLone and McLean IS Success Model, this research assumes the same can and perhaps should be done with TTF in the context of KMS.

Task/Technology Fit In KMS

The heart of TTF lies in the assumption that the value of an IS to its users is dependent upon how well the IS helps the users complete some task or collection of tasks (Goodhue, 1998). Task/technology fit is explicitly defined as the degree to which the characteristics of a technology fit the task that it was designed to support (Goodhue & Thompson, 1995). Figure 2.4 below depicts a generic TTF model showing how the interaction between task requirements and tool functionality ultimately impact the performance of the individual using the IS. Goodhue and Thompson suggest that the performance of tasks by users can be increased by the use of an IS with a high degree of fit between the requirements of the task and the functionality of the tool.

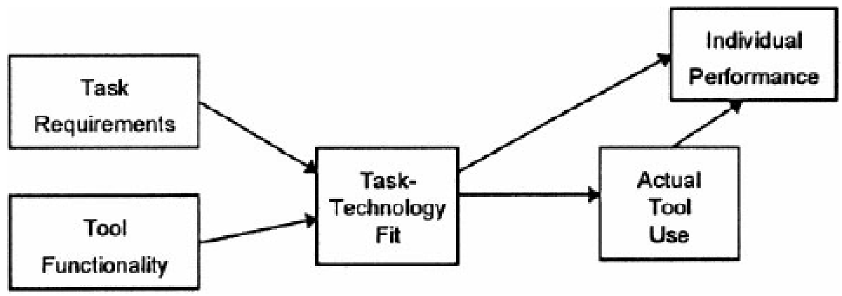

Figure 2.4 – Generic TTF Model (Dishaw & Strong, 1999, p. 11)

Task Requirements

According to Goodhue and Thompson (1995), the Task Requirements construct seeks to measure "…the actions carried out by individuals in turning inputs into outputs" (p. 216). Within the context of KM, Baloh (2007) suggests that Task Requirements as a construct seeks to capture the nature of the work and the kind of knowledge involved in the task. Baloh proposes the existence of two task domains: focused and broad. Focused tasks rely upon functional knowledge pertaining to a specific area (Baloh). Broad tasks rely upon general knowledge from a variety of processes within the organization (Baloh).

Tool Functionality

The construct of Tool Functionality measures the capabilities and design features of a tool used by individuals to perform one or more tasks. Tool Functionality includes the hardware, software, and data characteristics of the systems as well as the services designed to support them (Goodhue & Thompson, 1995). To determine how well a tool aids in the completion of a task, one must be familiar with the tool's capabilities and characteristics. Baloh (2007) proposes that most KMS fall among two types of design: machine-oriented design, and human-oriented design. Machine-oriented design

"…focuses on codification and storage facilities, where knowledge is stored in the form of information in databases, documents in document management systems, and so forth, where it can be accessed by employees" (Baloh, p. 28). Human-oriented design seeks to connect individuals and "… channels individual expertise, facilitates conversation, and helps in locating knowledge holders (Baloh, pp. 28-29).

Task/Technology Fit

According to Mathieson and Keil (1998), TTF refers "…to the congruence between a technology and a task, that is, the extent to which a particular task can be performed effectively and efficiently with a particular technology" (p. 222). Goodhue and Thompson (1995) define TTF as "…the degree to which a technology assists an individual in performing his or her portfolio of tasks" (p. 216). Based upon its definition, one can see that TTF is an interaction between the requirements of the task and the functionality of the tool (Mathieson & Keil, 1998).

Tool Use

Goodhue and Thompson (1995) define Tool Use as "…the behavior of employing the technology in completing tasks" (p. 218). Users must use a system in order to receive any benefits from it. Use can be measured in a variety of ways. Hardware or software monitors can gather usage metrics, users can report their usage, or researchers can observe usage behaviors. Regardless of the method of measurement, the interest is on the user using the system.

Individual Performance

Goodhue and Thompson (1995) define Performance as "…the accomplishment of a portfolio of tasks by an individual" (p. 218). Like Use, Performance can be measured many different ways. For example, the time it takes to complete a task, the time it takes to arrive at a decision and the quality of the decision can all be used to measure performance (DeLone & McLean, 1992). The most appropriate measure of Performance depends upon the business context.

KMS Critical Success Factors

It has already been suggested that KMS are unique forms of IS. As such, it seems appropriate that traditional IS models should adapt to the context of KM. The KMS Critical Success Factors as proposed by Jennex and Olfman (2004a) can aid in answering this question. In 2004, Jennex and Olfman conducted a review of the literature to determine what factors are critical to a successful KMS. The results of 14 different studies were condensed into a set of 12 success factors (2004a, p. 4). These 14 studies evaluated 78 knowledge management initiatives and organizations using a variety of methods: case studies, surveys, Delphi studies, and experiments (2004a, p. 2). Table 1 contains the success factors in order by the number of citations that each factor received in the literature. Jennex and Olfman characterized the first four factors as "key success factors" due to their being cited in at least half of the 14 reviewed studies (2004a, p. 4).

Table 2.1 – KMS Critical Success Factors (Jennex & Olfman, 2004a)

Success Factor	**Citations**
Integrated technical infrastructure including networks, databases/repositories, computers, software, KMS experts	8
A knowledge strategy that identifies users, sources, processes, storage strategy, knowledge and links to knowledge for the KMS	7
A common enterprise wide knowledge structure that is clearly articulated and easily understood	7
Motivation and commitment of users including incentives and training	7
An organizational culture that supports learning and the sharing and use of knowledge	5
Senior management support including allocation of resources, leadership, and providing training	4
Measures are established to assess the impacts of the KMS and the use of knowledge as well as verifying that the right knowledge is being captured	4
There is a clear goal and purpose for the KMS	4
The search, retrieval, and visualization functions of the KMS support easy knowledge use	3
Work processes are designed that incorporate knowledge capture and use	3
Learning organization	3
Security/protection of knowledge	2

One recurring theme within the CSFs is the importance of the social aspects of KM. For example, one of the CSFs states that it is important to have an organizational culture that supports learning and the sharing of knowledge. Most obviously this CSF supports the inclusion of organizational culture into our research framework. It also supports a concept of knowledge being transferred within a market-like structure.

Contextual KMS Success Factors

Jennex and Olfman's (2004a) Critical Success Factors provide evidence that KM is by its very nature a social discipline. As stated by von Krogh (1998): "Success with 'managing knowledge' will therefore ultimately depend on a manager's sensitivity to people issues" (p. 134). Baloh (2007) argues that the ability of an organization to create and utilize its knowledge is extremely dependent upon social factors within the organization. According to Gupta and Govindarajan (2000), "Building an effective social ecology – that is, the social environment within which people operate – is a crucial requirement for effective knowledge management" (p. 71). Because of the importance of the social ecology, this research proposes that the social ecology also impacts the fitness of a KMS towards accomplishing the knowledge tasks for which it was designed.

Gupta and Govindarajan (2000) use the term social ecology to refer to the social system (culture, structure, information systems, reward systems, processes, people, and leadership) in which people operate to get their jobs done. The social ecology encompasses any element related to or having an impact on the behaviors of individuals. By using the word ecology, they suggest that the social system is not merely a set of random, disparate elements, but an interactive, comprehensive whole where the social dimensions continuously affect each other. Because all of these dimensions interact with each other, a successful KMS initiative must integrate into the established social ecology.

This research will focus upon four specific elements of social ecology to determine their place within TTF: knowledge markets, cognitive barriers, knowledge networks, and organizational culture. As we explore each of these four elements, it is important to keep in mind that each element influences and manipulates other elements within the social ecology. For instance, organizational culture has an impact upon the prevalence and effectiveness of the knowledge networks within an organization. At the same time, the presence and strength of knowledge networks has an influence on an organization's culture. At times, these elements can seem highly correlated, but each is unique enough to warrant individual exploration.

Knowledge Markets

As previously noted, knowledge is the resource that enables good decision-making. For knowledge to be useful, it must be transferred from the point of origin to the point of decision. According to Davenport and Prusak (2000), organizations must first understand the forces that *cause* knowledge to move before implementing initiatives that attempt to *make* knowledge move. Davenport and Prusak (2000) argue that market-like forces power the movement of knowledge within an organization. Specifically, employees make choices everyday with regards to how to spend their limited time and energy and these choices are based upon perceived self-interest. Davenport and Prusak (2000) compare the knowledge market to any other such market in that, "Like markets for goods and services, the knowledge market has buyers and sellers who negotiate to reach a mutually satisfactory price for the goods [knowledge] exchanged" (p. 25). In other words, the knowledge market is the arena in which knowledge workers exchange a scarce unit of knowledge-based currency for present or future value (Davenport & Prusak).

The key to effective knowledge management is the realization that knowledge markets exist and that they operate upon similar principles as more traditional markets (Davenport & Prusak, 2000). Failure to completely understand these market forces can lead to a potentially frustrating experience with KM. As Davenport and Prusak (2000) note, "Many knowledge initiatives have been based on the utopian assumption that knowledge moves without friction or motivating force, that people will share knowledge with no concern for what they may gain or lose by doing so" (p. 26). Organizations that simply install a KMS have no guarantee that employees will actually share their knowledge. Market forces could be such that employees perceive it too risky to share their knowledge. To raise the stakes even further, Davenport and Prusak (2000) maintain that knowledge initiatives that do not acknowledge the presence of market forces "are doomed to fail" (p. 26).

Within any market, a certain element of trust must exist or the market grinds to a halt (Davenport & Prusak, 2000). The knowledge market is no exception. If you purchase goods or services, you place a certain degree of trust that your purchase will ultimately be delivered. If the goods are not delivered or the services are substandard, you may have legal means with which to remedy the situation. Davenport and Prusak (2000) assert that the luxury of enforceable contracts does not exist in the knowledge market; therefore, "…the knowledge market – with no written contracts and no court of appeals – is very much based on credit, not cash" (p. 35). This "credit" is built upon a foundation of trust between partners in a knowledge-based exchange, and this trust is an essential ingredient in a knowledge market (Davenport & Prusak, 2000). "Untrustworthy behavior, constant competition, imbalances in giving an receiving information, and a 'that's not my job' attitude endanger effective sharing of tacit knowledge" (von Krogh, 1998, p. 136). Thus, trust is simply essential; without it, the knowledge market grinds to a halt.

Assuming that trust is present and healthy within an organization, Davenport and Prusak (2000) argue that there are three forms of currency that serve to motivate knowledge flow within the market (presented here from most significant to least significant): reciprocity, repute, and altruism. When an employee weighs the decision to share their knowledge, they compare the value of their knowledge with the perceived value of one or more of these forms of currency. These forms of currency serve as the mediums of exchange when knowledge transactions take place.

Reciprocity, the most important of the knowledge currencies, can be defined as an expectation of an exchange of knowledge. "A knowledge seller will spend the time and effort needed to share knowledge effectively if he expects the buyers to be willing sellers when he is in the market for their knowledge" (Davenport & Prusak, 2000, p. 32). Thus, before entering into a knowledge transaction, employees, either knowingly or unknowingly, calculate the potential return for their effort. For example, if you ask for knowledge and I perceive that you do not have anything of value for me either in the present or future, I will be less likely to share my knowledge with you. As a general and market-proven rule, employees will not want to spend scarce resources such as time and energy if the potential return is small.

Another currency that can be exchanged in the knowledge market is reputation. Davenport and Prusak (2000) define repute in terms of perception, "A knowledge seller usually wants others to know him as a knowledgeable person with valuable expertise that he is willing to share with others in the company" (p. 32). For instance, an employee may value the perceived boost to their reputation should they be able to share some sort of scarce knowledge resource. On the other hand, employees seeking a certain expertise will try to single out the most reputable seller in an effort to increase the "quality" of the purchased knowledge. Davenport and Prusak (2000) also state the repute is tightly coupled with reciprocity. Employees may share their knowledge not only to boost their reputation as a source of knowledge, but also to encourage their colleagues to share with them when they are seeking knowledge.

The final currency is altruism. Altruism can be thought of in terms of intrinsic motivation: knowledge is shared for the sake of internal satisfaction without the need of external rewards. "Many knowledge sharers are motivated in part by a love of their subject and to some degree by altruism, whether 'for the good of the firm' or based upon a natural impulse to help others" (Davenport & Prusak, 2000, p. 33). Consider an employee who has been on the job for 30 years. They have vast storehouses of knowledge because they have "pretty much seen it all." In the twilight of their career, they may choose to share their knowledge simply because it is helpful or they delight in their field of expertise.

As Davenport and Prusak (2000) maintain that it is important to consider the dynamics of knowledge markets and market forces when attempting to develop and implement a KM initiative such as KMS. Ultimately, knowledge market forces will influence an employee's desire to participate in any sort of KM initiative. In the context of KMS, knowledge market forces will influence an employee's intention to use a system. Consider the forms of currency that exist in the knowledge market. Knowledge sellers will decide to sell their knowledge based upon three factors: the expectation of getting something in return, the reputation of the entity seeking the transaction, and the degree to which the seller desires to help the knowledge buyer.

It follows from these studies that such knowledge market forces influence one's intent to use a KMS. If knowledge sellers do not perceive any benefit from releasing their knowledge, they will not be likely to use a KMS to do so even if the KMS is well-suited to the knowledge task. Also, if knowledge sellers do not perceive any benefits to their reputation, they may be less inclined to use the KMS regardless of how well it may fit the task. Finally, if the company does not in some manner formally track and reward knowledge sharing, the sellers of knowledge in the organization may perceive a small potential return compared to the value of the knowledge they have to offer.

Cognitive Barriers

While knowledge market-forces provide the currency for use in transactions between knowledge sellers and buyers, problems can arise when a transaction is agreed upon causing knowledge to be relinquished by the seller and given to the buyer (in exchange for currency). Meaning can be lost in the transaction as the seller attempts to express knowledge to the buyer and the buyer attempts to gain an understanding of the knowledge. Cognitive barriers are those things with prevent a knowledge seller and knowledge buyer from arriving at a shared understanding. Cognitive barriers serve an important purpose within the social ecology as they affect how and to what extent individuals share knowledge with others.

From the perspective of the knowledge seller, communicating tacit knowledge in such a way as to allow someone else to understand it can prove challenging (Huber, 2001). This is because sharing tacit knowledge normally requires that the seller employ unconventional language techniques such as analogies and metaphors in order to convey meaning to the buyer (von Krogh, 1998). The burden is then placed upon the buyer whose task is to take the unconventional language, place it within the realm of his or her own understanding, and construct meaning. As a result, much of the meaning may be lost in translation between the knowledge seller and knowledge buyer. Likewise, the knowledge buyer could present cognitive barriers to the exchange. Assuming that the knowledge seller effectively communicated their knowledge, the knowledge buyer may not have a solid understanding of the context of the knowledge. Again, some of the meaning of the knowledge may be lost in translation.

According to von Krogh (1998), a source of barrier deals with the innate human need for a legitimate and shared language. Language provides the method by which individuals within the social ecology communicate. In order for meaning (much less knowledge) to be expressed, individuals must share some sort of shared language set. A legitimate language is essentially a stock of words that are informally (or sometimes formally) adopted and recognized to have a shared meaning among members of a group or organization (von Krogh). The field of medicine, because it deals with the complex workings of the human body, needs to have a standardized bank of words. The same is true of the legal system which requires lawyers not only to understand the law, but to apply and defend it in court.

Cognitive problems are most often encountered when dealing with tacit knowledge (Huber, 2001). If this tacit knowledge is especially sticky (or highly entwined with cognitive processes), the cognitive problems are only exacerbated (Huber, 2001). Consider a master blacksmith trying to explain how to fashion metal into some form. How will they be able to explain the exact amount of force that will be required to shape the metal? When they perform such activities themselves, they may simply be "feeling" for the right amount of force to be applied to the metal and adjusting their actions accordingly. The stickiness of this tacit knowledge, when coupled with the ignorance of the listener in the ways of working with metal, will serve as a cognitive barrier.

It is reasonable to conclude that the presence of cognitive problems has the ability to affect the performance of employees. Vast stores of knowledge could be available, but if employees are unable to use it, then the knowledge has little ability to affect the current level of performance. Cognitive barriers may also come into play during the definition and identification of the knowledge task requirements. For example, if the knowledge task is especially complex and resides mostly in the minds of the employees (they know how it works but can't really explain it), then articulating the requirements will be burdensome. Ultimately, if the knowledge task requirements are not well understood or well articulated, it would be hard to design a KMS to match – or fit – those requirements very well. Hence, cognitive problems clearly have the potential to impact KMS success.

Knowledge Networks

Knowledge is an inherently social commodity as it resides in the minds of people. Research indicates that the presence and strength of knowledge networks has an impact upon the success of a KM initiative (Davenport & Prusak, 2000). A knowledge network is defined as a community comprised of individuals who are brought together by a common interest (Davenport & Prusak, 2000). Moreover, "When networks of this kind share enough knowledge in common to be able to communicate and collaborate effectively, their ongoing conversation often generates new knowledge within firms" (Davenport & Prusak, 2000, p. 66). When knowledge workers use these conversations to trade "highly informative war stories" with their colleagues, they are in fact managing knowledge (p. 45). One colleague may share an experience with another colleague. Armed with this new knowledge, the gaining colleague then applies that knowledge towards the solution of a problem in their domain. In a strong knowledge network, this process occurs many times over and allows for knowledge to be applied over a broad set of tasks.

In the late 1980s and early 1990s, Julian Orr conducted a detailed ethnographic study of Xerox service technicians (as reported in Brown & Duguid, 1991). One particular anecdote provides an excellent example of such knowledge networks in action:

> "Orr began his account of the reps' day not where the process view begins – at nine o'clock, when the first call comes in – but at breakfast beforehand, where the reps share and even generate new insights into these difficult machines. Orr found that a quick breakfast can be worth

> hours of training. While eating, playing cribbage, and gossiping, the reps talked work, and talked it continually. They posed questions, raised problems, offered solutions, constructed answers, laughed at mistakes, and discussed changes in their work, the machines, and customer relations. Both directly and indirectly, they kept one another up to date about what they knew, what they'd learned, and what they were doing" (Brown & Duguid, 2000, p. 76).

These observations highlight a few key aspects of a knowledge network. First, a knowledge network is not merely a group of people with a shared interest; it is a group of people who *communicate* with one another about a shared interest. These Xerox service technicians discussed with one another difficult situations that were encountered and what they did about it. Second, a knowledge network consists of people who are passionate about their area of expertise. If the Xerox service technicians were not passionate about their jobs, they might not have gone to breakfast in the first place. Even if they did go to breakfast, the conversation might have turned towards trivial subjects such as the weather or the score of last night's football game. Knowledge networks, because they are comprised of individuals sharing knowledge with one another, comprise a very importance place within the social ecology.

Organizational Culture

Organizational culture can be defined as "the set of values, beliefs, norms, and expectations that are widely held in an organization" (Huber, 2001, p. 76). These elements comprising organizational culture color the way organizations view challenges and influence the way decisions are made. For instance, "At Mobil Oil, where disapproval of 'bragging' is embedded in the culture, the efficiency of the knowledge market was reduced because knowledge owners are reluctant to 'advertise' their knowledge and were distrusted by their colleagues if they did" (Davenport & Prusak, 2000, p. 27).

One way organizational culture manifests itself is through stories and habits (von Krogh, 1998). Stories can highlight failed attempts to implement a technology, pursue a new market opportunity, or develop a new product. These types of stories engender a fear of failure with regards to innovation. Employees not wanting to look foolish may choose to keep silent rather than suggest the next big idea. Like stories, habits can hold an organization back from reaching maximum potential. Habits are routines within the company that are difficult or even impossible to turn (von Krogh). Employees may feel that if the process isn't broken, it shouldn't be fixed even though there may be a thousand more efficient ways to do it.

The formal procedures adopted by an organization also define its culture (von Krogh, 1998). According to von Krogh, formal procedures can be a "double-edged sword" (p. 135). He goes on to say that formal procedures represent the embedded experiences and the successful solutions to complex tasks. In order words, procedures or techniques that work well within the organization are written down and adopted as policy for employees to follow. The problem arises when the policy becomes a habit above question or challenge, even when the need to change such a policy arises.

A KM initiative that is too restrictive runs the risk of interfering with the flow of information. For example, consider a policy that requires written documentation of all contacts outside of the organization due to concerns of corporate espionage. With such a policy in place, employees might reluctant to contact individuals outside of the organization for knowledge. They may instead seek an inferior solution internally. Another example would be the adoption of a KMS that had strict processes for knowledge creation built in. An employee may have acquired a unique piece of knowledge, but may be stifled when trying to enter it into the repository. Too much managerial oversight or regulation can reduce the effectiveness of knowledge networks (Davenport & Prusak, 2000).

Finally, and most fundamentally, an organization's paradigm, or lens through which it views its surroundings, goes a long way towards determining its culture (von Krogh, 1998). As von Krogh maintains, "A company's strategic intent, vision or mission statement, strategies, and core values constitute its paradigm" (p. 136). An organization's paradigm does not simply develop overnight, but slowly manifests itself over several years shaped by the experiences of the organization. Like habits, an organization's paradigm can be extremely hard to change without a degree of pain involved. Knowledge processes can be stifled by the ruling paradigm if the paradigm gives rise to a political and cultural environment that is not conducive to participation in knowledge-based exchanges and transactions.

Proposed KMS Fitness Model

Figure 2.5 below illustrates a proposed model for the current investigation that incorporates the many concepts and their interrelationships as introduced during the previous discussions of TTF and social ecology. The research framework is derived from the basic TTF model (see Figure 2.4) as presented by Dishaw and Strong (1999) with two notable exceptions. First, the construct of Use was replaced with Intent to Use in light of the discussion that Intention to Use may be a more appropriate use measure in the context of KMS. Second, the direct relationship between TTF and Performance was removed. In this proposed model, TTF still influences Performance indirectly through the construct of Intention to Use. The constructs comprising TTF are outlined in a dashed box in the figure.

Looking at the proposed model, one might wonder where within the model does the user actually use the system. This model is advanced from the notion that a system must indeed be used if it is to have an impact on a user's performance. However, the construct of Use per se was replaced by the construct of Intention to Use. The issue of Use within the model therefore lies in the definition of Performance. Specifically, Performance is defined as "the degree to which an individual is able to accomplish a task or number of tasks." This definition implies that use of a KMS, relative to the desired performance objectives, has already occurred or is in the process of occurring.

Additional lines of influence between elements of TTF and the social ecology are commensurate with the research and findings reported in the previous sections of this review. However, this model will ultimately be used only as a starting point for the current investigation, and as a point of analytical consideration and comparison for the results obtained during the course of conducting the present study. Just as the notions of IS success and IS usage are treated in qualitatively different fashions within the context of KMS, so too might the concepts and mechanisms associated with TTF be different when viewed against the backdrop of a KMS. The specific methodology by which such issues were explored will be presented in the following chapter.

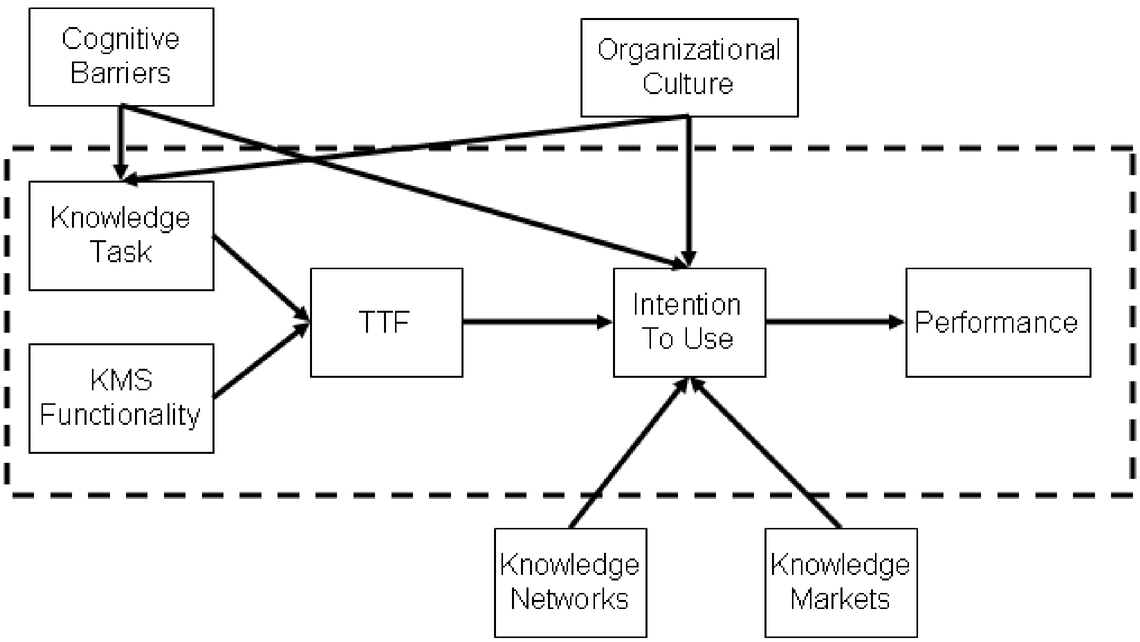

Figure 2.5 – Proposed TTF Model in the Context of KM

III. Methodology

Research Strategy

When deciding the proper methodology, consideration must be paid to the apparent complexity of the research question. The question posed by this research derives a great deal of its complexity from two primary areas. First, although research suggests that TTF may in fact change in the context of KM (the major premise of the current study), it could very well be that TTF is extremely intuitive and straight-forward and is therefore not subject to change across varying contexts. The methodology used in this study must be flexible enough to allow for either possibility. Second, assuming that TTF does indeed change in the context of KMS, there is uncertainty as to what that change looks like. Any number of different constructs could be at play beyond the traditional TTF constructs, which have been selected as the starting point of the proposed model (see Figure 2.5 above). Research findings support the idea that the social ecology within an organization impacts the fitness of a KMS, but the elements that comprise the social ecology are extremely diverse and their potential impacts are not clearly or fully defined relative to the constructs associated with the KMS.

Given this complexity, a methodology was needed that allowed the flexibility to explore the issues at hand. In particular, coming to appreciate an accurate picture of TTF in a KMS context, and the potential consequences of the social ecological factors identified in the previous chapter, requires immersion, deep understanding, and the ability to get at and analyze the various nuances present and at work in the social contexts surrounding KMS fitness.

Yin (2003) suggests there are three specific factors that can help researchers distinguish between the major research strategies that are available. First, there is the type of research question posed. The research question posed by this study is focused on the "what". This research is concerned with exploring what role, if any, do the social aspects of KM play in the fitness of KMS to the knowledge tasks for which they are designed. Yin (2003) proposes that research questions focused on answering the "what" are best answered using survey techniques (such as interviews and questionnaires) or archival record analysis.

The second factor that should be considered when selecting a research method is the extent to which the researcher has control over actual behavioral events (Yin, 2003). In this study, the researcher has no control over behavioral events which therefore ruled out any experimental methods. The final factor that should be considering when selecting a methodology is the degree of focus placed on contemporary versus historical events (Yin, 2003). In this research, the focus is upon contemporary events and phenomena. Of interest specifically is the employee's experience with the social ecology present within the DAC, the tasks that make up their job, and the computer-based systems designed to make their job easier. Based upon these various rationale and guidelines a case study approach was therefore selected and designed to accommodate a series of inter-related, in-depth, and semi-structured interviews.

Research Context

Research Site

To explore how the social factors surrounding KMS implementation influence or change the nature of TTF, an organization currently developing and fielding a new KMS for supporting knowledge-intensive work was selected as the research location. The DAC is a tenant agency located at the McAlester Army Ammunition Plant in McAlester, Oklahoma (DAC, 2007). The mission of the DAC is to "provide the military services timely ammunition training, [demilitarization] technology, explosives safety, engineering, career management, and technical assistance through logistics support" (DAC, 2007). To accomplish this mission, the DAC performs the following functions. First, it provides civilian ammunition training through its Ammunition School under the Associate Director for Training. Second, the DAC provides support for explosives safety to the Department of the Army (DA) through its Technical Center for Explosives Safety under the Associate Director for Explosives Safety. Third, logistics engineering support is provided under the Associate Director for Engineering.

The DAC also provides assistance to all DA installations in areas of supply, maintenance, transportation through the Technical Review and Assistance Division under the Associate Director for Operations. In addition, the DAC is responsible for the management of two DA career programs for ammunition expertise Quality Assurance Specialists (Ammunition Surveillance) (QASAS) through its Ammunition Civilian Career Management Office and Ammunition Managers through its Ammunition Management Career Program Office also under the Associate Director for Operations. In support of these two career programs, the DAC provides approximately 58 training courses to ammunition personnel across a wide variety of disciplines. The courses cover everything from basic ammunition storage, transportation, and testing to more granular topics such as the radiation safety requirements for the storage, use, and transportations of the M1-A Abrams main battle tank (DAC, 2007). Finally, the DAC manages demilitarization research and development initiatives for the Army's conventional ammunition and Joint Service large rocket motors through the Demilitarization Technology Directorate (DAC, 2007).

Such a diverse set of functions makes the DAC a good candidate for this study. Not only does the DAC create new knowledge through its engineering directorates, it is also responsible for transferring this knowledge to the training directorates to be included as new course material for students. In addition to executing these knowledge processes internally, the DAC must also utilize these same processes to service external customers as well.

For example, the DAC is in charge of a program called Ammo Help. Ammo Help is a web-based application that provides a point of contact for personnel all over the global who may have ammunition-related questions. Ammo Help can be reached via phone or through the Web. When the DAC receives a question through Ammo Help, staff members review the question and forward it to the appropriate expert. Most questions can be handled within a 24-hour period with the goal being to answer each question in a timely fashion. Once a question has been answered, that question (with its subsequent answer) is posted on a Frequently Asked Questions (FAQ) page so that others can access the solution as well. With a little over 200 employees involved in research, development, training, and operations, the knowledge needs of the DAC are extensive (DAC, 2007). As such, the DAC serves as a rich knowledge environment in which to test the concept of KMS fitness.

Expertise Transfer System

The DAC is facing a problem not uncommon to many organizations (both civilian and military): an aging workforce with employees reaching retirement. When an employee retires from an organization, their 20 to 30 years of work experience, training, and know-how walk out the door with them. To replace those who have retired, new employees must be hired and trained. To help address this problem, the DAC partnered with Oklahoma State University to develop the Expertise Transfer System (ETS) to capture the knowledge from employees and make that knowledge available to the community as a whole.

To capture knowledge, the ETS performs the following steps. First, personnel are interviewed and the interviews are recorded either via video or voice. The topic of the interview depends upon the background of the employee. For instance, if the employee is returning from a deployment, knowledge gained specifically from that deployment experience is sought. If the employee is about to retire, questions focus on general lessons learned from working at the DAC. The interviews are semi-structured in nature and allow the subject room to discuss a wide variety of topics they deem useful.

Once the interviews are conducted, the recordings are processed through speech recognition software to form a text transcript of the session. This text transcript is then mined using a set of algorithms to look for causal statements. One such set of causal statements below concerns the safe transportation of ammunition:

> "…whether or not the item was safe to keep. Not only to keep, but to transport, because it's not like the roads are like here in the United States. And you certainly had other considerations, as far as transportation, than what you would have here in the States. So, considering that, I would have to feel comfortable enough that I could transport it to the ASP, where they were saving all of this. Plus the user could use it safely, and not get injured or injure any one."

There are several causal statements within this transcript. For instance, the transcript suggests that road conditions have an impact on whether or not ammunition can be safely transported. The transcript alludes to the roads in the United States being good for transporting ammunition from one place to another. This may not be the case overseas. Road conditions overseas would play a large part in the consideration to transport ammunition or not. The employee in this interview is saying that when he or she comes across this certain situation, it causes them to perform this certain set of actions.

The causal statements gathered from the interviews are then converted into a causal map. Figure 3.1 is an example of a causal map based upon the previous transcript regarding the safe transport of ammunition. This particular causal map captures the factors that influence the successful transportation of ammunition (reference interview excerpt above). The blue ovals represent factors that are not under one's control. The grey rectangle indicates a condition that can be controlled in the field. In this instance, the person responsible for transporting ammunition can make the decision whether or not to move unstable ammunition.

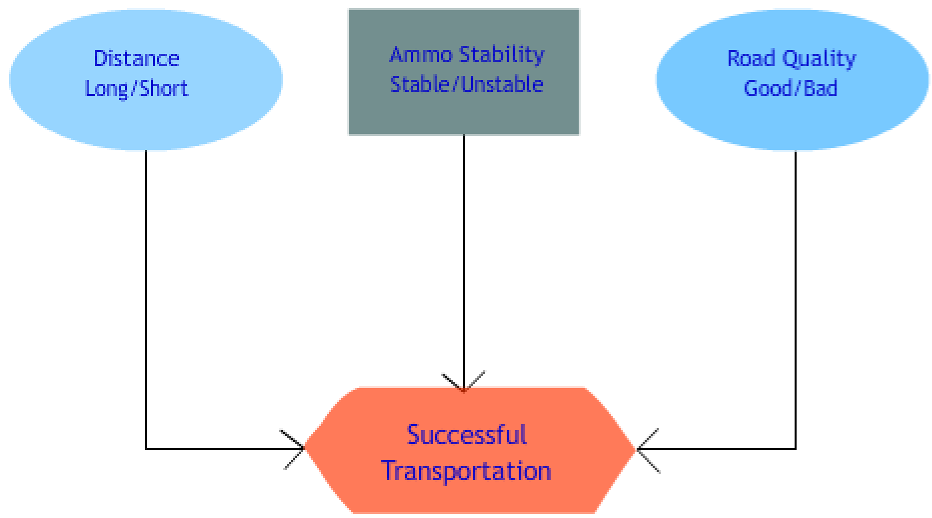

Figure 3.1 – Example ETS Knowledge Nugget

After mining the interview transcripts for the knowledge nuggets, the nuggets are incorporated into the ETS and are made available to the wider community. Although the ETS is currently in the development phase, the DAC would eventually allow Department of Defense (DoD) employees in ammunition-related fields to have access to the ETS. In addition to a standard "pull mechanism," where users go to the repository and pull the knowledge they need, the ETS is designed to have a push capability as well. This capability primarily supports the training of new employees in the areas of ammunition training.

As more and more knowledge is added to the ETS, instructors are notified via e-mail as to the presence of nuggets that they might be interested in, or to nuggets that align with the courses that they are teaching. When the instructors are notified of a knowledge nugget of interest, they can then log into the ETS and read the transcript of the interview, watch the interview itself, or look at other knowledge nuggets that are closely related. The goal is for the instructors to incorporate these pieces of knowledge into their training courses so that new employees at the DAC can get a better feel for what to expect out in the field.

Participants

Participants for this study were taken from a group of employees who were attending an instructor training course offered by Oklahoma State University in early 2008. On the first day of the training class, the principle researcher gave a short presentation on the purpose of the research study. The class was told that their participation was voluntary and would help in the development of the ETS. After the presentation, a sign-up sheet was circulated so that volunteers wishing to participate could select a time convenient with their schedule.

Out of a total of eleven students in the training course, seven volunteered to be interviewed resulting in a response rate of 63 percent. Four of the respondents were male and three of the respondents were female. The average age of the participants was 45.8 years (standard deviation 9.9 years). The average work experience at the DAC was 2.78 years (standard deviation 1.55 years).

Procedures and Data Collection

Using the TTF and social ecology constructs as a guide, a semi-structured interview protocol was developed that contained questions eliciting each respondent's experience and thoughts relative to the constructs of interest in this study. In addition to thoughts on each individual construct, questions were included to investigate how experiences or perceptions of each construct impacted, or was impacted by, each of the other constructs of interest.

To refine the quality of the interview questions for field usage, the interview protocol was first evaluated by a colleague who was knowledgeable as to the foundational concepts of KM and could therefore offer practical advice as to potential areas of improvement for the interview protocol. One of the changes made as a result of the evaluation was the rearrangement of questions to facilitate a natural flow in the interview conversation. Also, a few questions were reworded to correct grammatical mistakes or difficult syntax.

The interview protocol consisted of two parts. In the first part, respondents were asked questions in an effort to explore their experience and understanding of the constructs of interest. For instance, the nature of the instructor's various knowledge tasks was explored using questions derived from the four knowledge processes identified in chapter 2. Respondents were also asked how they felt, perceived, or experienced the way knowledge was created, stored, transferred, and applied at the DAC. In addition to the constructs comprising TTF, respondents were asked questions aimed at exploring the social dimensions of interest in this study. Respondents were asked questions to gain an insight into the culture of the DAC as well as the prevalence of cognitive barriers, knowledge markets, and knowledge networks. Appendix A provides the complete protocol used in this study.

In the second phase of the interview, respondents provided a description of how each of the constructs related to one another. The relationships between constructs of the research model, as shown in the relationship table in Appendix A, were each explored as part of the interview protocol. For example, respondents were asked if cognitive barriers impacted the functionality of a KMS or if the functionality of a KMS impacted cognitive barriers. If respondents perceived a bidirectional relationship, they were asked to state in which direction the relationship was most prevalent. Respondents also had the option to assert that there was no relationship between the two constructs. This line of questioning was repeated until all planned comparisons between the research constructs had been examined. At the end of data collection, a total of 607 minutes of interviews had been captured. On average, each interview lasted approximately 87 minutes.

After the interviews were completed, the relationship tables from each respondent were aggregated and analyzed in accordance with Northcutt and McCoy's (2004) Interactive Qualitative Analysis (IQA). According to Turner (2006), IQA "…seeks to capture the lived reality of individuals and their experiences, actively involving study participants in the mapping and depiction of their stories to fully explore a given phenomena" (p. 47). The IQA procedure used by this research differs from traditional IQA as proposed by Northcutt and McCoy (2004) in two important ways.

First, in a full IQA study, respondents are asked to develop the various constructs involved in their understanding of how some sort of system or process behaves. This research did not require respondents to generate their own list of constructs regarding KMS fitness because the constructs were provided for them as part of the research model.

Second, inter-relationships internal to the constructs of the TTF were not tested for all possible combinations of influence or effect. For instance, in the generic TTF model, a direct relationship does not exist between the task and an individual's performance. Therefore, respondents were not asked if they felt that the knowledge task impacted performance or vice versa. As a result, only the relationships established by the foundational TTF were tested. However, the impacts of the social ecological elements upon each TTF construct were tested in an effort to shed light upon how the social ecology impacts the constructs comprising TTF.

A tally was collected indicating the number of times respondents indicated that one construct influenced another. For instance, a tally would be generated for the number of times a respondent indicated that cognitive barriers impact the functionality of a KMS, that the functionality of a KMS impacts cognitive barriers, or that there is no relationship between the two constructs. The individual tallies were then incorporated into a structural model involving all constructs and relationships in accordance with the IQA methodology. The goal of the IQA analysis in this study was to develop a perceptual and experienced-based model, founded upon the generic TTF model constructs and then examine the way in which various social factors may impact each of those constructs, and how well the underlying model itself described the context of this particular KMS implementation. The next chapter will focus upon the results obtained from the interviews as well as the results from the IQA.

IV. Analysis and Results

Chapter Overview

The analysis presented in this chapter follows a similar format to the interviews themselves. Results will focus first on the constructs of interest as drawn from the research model and then the interrelationships between those constructs will be explored. Finally, a representational model derived from the participants' data will be presented and discussed in order to provide insight into the nature of TTF in the context of the DAC's particular KMS implementation and context of use.

Construct Analysis

To aid in the analysis of each construct, findings from the interviews will be presented in a table format. Each table contains three columns. The first column titled "Major Theme" is exactly that: the major theme that was extracted from the interviews. The second column titled "Component" allows for the presentation of the unique threads that comprise the major theme. The third and final column titled "Prevalence" contains the number of respondents who gave an answer that fell within the corresponding component. The reader should note that the prevalence does not always add up to seven each time and that the prevalence should not be interpreted as a ratio of total respondents. The semi-structured interviews were allowed to take different twists and turns; therefore, one respondent could discuss an issue that was simply not thought of by other respondents. The number in the "Prevalence" column simply gives the reader an indication of how many respondents mentioned a certain theme.

Knowledge

Table 4.1 – Recurring Themes Concerning Knowledge

Major Theme	Component	Prevalence
Definition of knowledge	Set of facts or collection of information related to a topic	2
	Information that would lead to or cause an event	1
	Ability to comprehend a process or procedure	2
	Information that has been learned	2

The very first question in the interview was designed to elicit the respondent's thoughts on the definition of knowledge. Each individual definition of knowledge colors not only what respondents think about knowledge itself, but also how knowledge relates to the other constructs in this study. As Table 4.1 indicates, there were a diverse set of responses regarding the definition of knowledge. This is not too surprising considering comments made by Davenport and Prusak (2000), "Most people have an intuitive sense that knowledge is broader, deeper, and richer than data or information" (p. 5). The responses captured in Table 4.1 do suggest three characteristics regarding knowledge. First, knowledge must be internalized either through the mechanism of education or experience. Second, knowledge is specific to a certain context or topic. This is not to say that knowledge from one field cannot be applied to another, but it must be applied towards a context in order to garnish meaning. Finally, knowledge allows decisions to be made. Knowledge is what allows organizations to react to an environment in a constant state of change.

Knowledge Task

Table 4.2 – Recurring Themes Concerning Knowledge Task

Major Theme	Component	Prevalence
Knowledge creation	Knowledge is created through experience in the field	4
	Knowledge is created by the engineering directorates	1
	Knowledge is created through research and training	1
Knowledge shared instead of created	Felt that the primary role of an instructor was to share knowledge instead of create it	3
Knowledge storage	Knowledge is stored via computer or online in some form	4
	Instructors discourage bulk memorization of facts – teach students where to go for information	2
	The DAC has the John Byrd library – repository for printed information on ammunition	2
Knowledge transfer	Hands on training	3
	Classroom or web-based training	5
	Meetings	1
	Mentoring programs	1
Knowledge application	Knowledge is applied by people doing their jobs	1
	Solving problems	1
	Teaching	2

The knowledge task at the DAC is rather extensive as shown in Table 4.2. Not only is the DAC concerned with training new QASAS personnel, but they act as a clearinghouse for ammunition-related information and knowledge through Ammo Help and related programs. To explore the complexities of the knowledge task at the DAC, the knowledge task was defined in terms of the four knowledge processes: creation, storage/retrieval, transfer, and application. Table 4.2 contains a summary of the major themes given by respondents.

A majority of respondents felt that knowledge was primarily created through experience in the field. That knowledge is created by experience suggests that knowledge is generated by applying what was learned through training and other such vehicles to real-world situations and observing the results. In addition to experience in the field, one respondent indicated that employees in some of the engineering and technology-oriented directorates create knowledge. These types of directorates perform research and development to find new ways of properly storing, transporting, and maintaining ammunition. What is discovered by these directorates could comprise “new” knowledge.

Another interesting theme arose during the discussion of knowledge creation. Many respondents preferred to view their role as more of a “knowledge sharer” than necessarily a “knowledge creator.” The majority of respondents, being instructors at the DAC, felt that their most important job was to take knowledge gained by experience and make it available to the students. This distinction between knowledge sharing and knowledge creation is manifested with the design of the ETS. The ETS is designed to take the experiences of QASAS personnel and make them available to instructors as a teaching aid.

Most respondents perceived knowledge storage in terms of technology: knowledge being stored in the form of documents, regulations, and course material on some sort of digital medium. However, a few respondents viewed knowledge storage in terms of knowledge being stored in the minds of students (through memorization). These respondents stated that they did not emphasize bulk memorization; instead, instructors were more interested in teaching students how to think critically and how to find answers to problems they might encounter.

This lack of emphasis on bulk knowledge storage arises from two primary factors. First, the amount of information that a QASAS personnel is responsible for is simply staggering. It would be too much to ask one person to memorize such a large body of information. Second, the knowledge pertaining to QASAS is extremely volatile in nature and subject to constant change. One respondent stated that the "…knowledge that we have today may be obsolete tomorrow so we have to know how to continually refresh that." It is here that a tool such as the ETS will be beneficial.

Another interesting point brought up in the discussion of knowledge storage was the John Byrd library. The John Byrd library serves as a repository of printed information at the DAC. One of the products maintained at the library is a database of explosive malfunction investigations. These explosive malfunction investigations provide a rich source of knowledge as well as a testimony to the dangerous nature of ammunition. As will be discussed in more detail, the presence of the DAC library is a positive indicator of the knowledge-oriented culture at the DAC. According to Davenport and Prusak (2000), "If you've got a good library, a textual database system, or even effective education programs, your company is probably already doing something that might be called knowledge management" (p. 163).

Knowledge transfer was most often defined in terms of knowledge being passed from instructor to student. Interns at the DAC complete 12 months of classroom instruction and then 12 months of on-the-job training (OJT). Some of these courses are computer based and others are instructor-led in a classroom setting. In addition to knowledge being transferred in a classroom setting, the DAC also provides hands-on training opportunities that allow students not only to learn by "seeing" but learn by "doing" as well.

From the perspective of an instructor at the DAC, knowledge is primarily applied by students through the use of exams covering the course material and the preparation of briefings to be given to classmates. Exercises such as these allow students to demonstrate their acquisition of knowledge by applying it to solve various problems. Respondents also stated that knowledge is applied by people doing their jobs and solving problems. The main sense was that knowledge allows people to do things. Again, when knowledge is applied, it invariably leads to some sort of action.

KMS Functionality

Table 4.3 – Recurring Themes Concerning KMS Functionality

Major Themes	Component	Prevalence
Important KMS capabilities	Knowledge should be up-to-date and correct	3
	Search capability – strong search algorithms that allow users to find what they need	2
	Intuitive – easy for user to navigate and find what they are looking for	2
	Should be able to contact the “owner” of the knowledge for clarification if questions are encountered	1
	Fast – users should not have to wait an unreasonable amount of time for queries to complete	1
	Must have a visual representation of knowledge	1
Examples of a bad KMS	KMS contains erroneous knowledge or procedures – could get someone injured or killed	1
	KMS requires user to filter through a lot of invalid information	1
	Causes people to become too dependent upon the Internet	1
	Password management – having to keep track of many different login IDs and passwords	1

To shed light upon the capabilities that are important to KMS users, respondents were asked which capabilities they felt were most important. Table 4.3 contains the major themes extracted from these responses. Besides the seemingly default answers of speed and a user-friendly interface (which will not be discussed at length here), respondents mentioned three things of interest. First, the most mentioned capability was the requirement that the KMS contain validated knowledge. One respondent cited a situation where someone could be injured or killed if they were misled by invalid knowledge within the KMS. This requirement is derived from the dangerous nature of ammunition.

The second capability that is important is the use of strong search algorithms. In the case of the ETS, the ability to search through the transcripts is appealing because users "…wouldn't have to listen to a 45 minute interview to get the one applicable sentence that [they] are looking for." Another respondent echoed a similar sentiment in that, "having to sit there and listen to somebody like me drone on and on just to find a little tidbit of information is a waste of time."

Also of interest is one respondent's request that each piece of knowledge (or knowledge nugget in the terminology of the ETS) come with contact information for the owner of said piece of knowledge. This capability would be helpful in the event that a KMS user stumbles across a piece of knowledge that is deemed critical, but they have a hard time understanding the context from which the knowledge was derived. In this event, the user simply would have to contact the knowledge owner and then ask any clarifying questions. A capability such as this is currently under development in the ETS; each knowledge nugget published in the repository will be linked with an owner who can answer questions and provide additional insight if needed.

Task/Technology Fit

Table 4.4 – Recurring Themes Concerning TTF

Major Theme	Component	Prevalence
TTF definition	The definition of TTF is intuitive and makes sense	7
Driver of TTF	Written by people with experience in the task	1
	System is user friendly	1
	System had a wide variety of functions to fit any conceivable task situation	1
	Must have a large body of information to pull from	1
Characteristics of systems with poor fitness	System could not interface with other systems – not interoperable	1
	Had to have inside knowledge how to use the system	1
	Time to post a transaction was extremely slow	1
	Lack of human interaction when a question is encountered	1
	No user's manual	1

Respondents were asked to read the definition of TTF and give their thoughts concerning the definition. The majority of students stated that the definition does make sense. TTF, as a concept, is rather intuitive. A tool must fit the task for which it was designed. If it fails to match (fitness is low), then TTF posits that a user's intention to use will be negatively impacted.

Respondents were then asked what sort of characteristics influence the fitness of a KMS to a given knowledge task. Here, the answers were very diverse. One respondent stated that the KMS should be developed by people who had experience with the task. These people with experience in the knowledge task would then know what works and what doesn't work. There is less of a chance for "functionality creep," where extra functionality is incorporated into the tool without considering if it is really needed or even relevant to the task. Another driver of TTF was the availability of a large body of information from which to query. In the case of KMS, this makes sense.

After discussing factors that improve fitness, respondents were asked to give examples of systems that poorly fit the task for which they were designed. Again, there were a very diverse set of answers as shown in Table 4.4 above. Of interest to the current discussion is a comment made by one respondent which highlighted the importance of human interaction when dealing with KMS. This respondent indicated that it was very important to be able to talk to a person when questions were encountered. This capability is currently included within the ETS; each knowledge nugget has an "owner" assigned to it and the owner information includes name and phone number so that someone seeking clarification on a knowledge nugget would know who to call.

Intention to Use

Table 4.5 – Recurring Themes Concerning Intention to Use

Major Theme	Component	Prevalence
Factors that influence an individual's intention to use a computer system	It should be user-friendly	2
	General lack of experience with computer technology – did not grow up around computers	1
	It should be fast – should not have to wait for search queries	1
Example where a user's intention to use a system did not translate into actual use	Limited knowledge / lack of training	1
	Use of a new system was mandatory but the system had many problems	1
	Access / insufficient permissions	2

As Jennex (2005) suggests, the construct of Intention to Use may be more appropriate within the context of KMS. To test this theory, respondents were first asked to give examples where their intention to use a system did not translate into actual use. The major themes extracted from this portion of the interview are shown in Table 4.5 above. One respondent used Microsoft Access as an example. The respondent stated that they have seen the capabilities of Access demonstrated and were extremely impressed with what can be done with it. The impressive capabilities of Access caused the respondent's intention to use the program to increase. However, the respondent stated that learning Access is challenging and therefore prevented their actual use of the product. In this case, the respondent expressed an intention to use Access but that intention did not necessarily translate into actual use due to training issues.

Respondents were then asked what factors influence their intention to use a system. Respondents indicated that the system must the user-friendly and fast. These are important qualities for any system to have. One respondent indicated that they did not grow up in the age of computers and therefore their general lack of experience with computers negatively impacted their intention to use them. Such factors seem endemic to IS in general and should arguably be the goal or concern of any IS design team, not just those responsible for a KMS.

Performance

Table 4.6 – Recurring Themes Concerning Performance

Major Theme	Component	Prevalence
Computers essential to performance	Could not imagine doing job as a whole without a computer	2
Ways computers hurt performance	Information contained in the system is not current	1
	Wading through access / permission issues	1
	Managing information in the repository tedious and time-consuming	1
Ways ETS could improve performance	Use as a teaching aid	1
	See if anyone has prior experience with a certain situation	3
	Allow a relatively new person to get caught up	1

Computers have indeed changed the way Americans work. Respondents were asked questions that sought to understand how a system like the ETS would affect the performance of employees. Table 4.6 above contains the major themes extracted from these conversations. Respondents in general could not imagine doing their jobs without the aid of a computer.

To get an idea how computers actually impact performance, respondents were asked to give examples of situations were they felt computers were a hindrance rather than a help. One respondent stated that the time it would take to manage the information in the repository could hurt job performance. As the amount of knowledge in the repository increases, the demands will likewise increase on knowledge owners. Not only do knowledge owners have to manage the content in the repository, but they must also field calls and messages from colleagues seeking clarification. Assuming that the knowledge owner is responsible for more than simply keeping the repository up to date, this engagement may lead to performance degradation. Another way a KMS such as the ETS can hurt performance is if it contains invalid knowledge. In this case, users of the system would have to double-check the knowledge extracted from the system. After a few times "being burned" by faulty information, trust in the system would be reduced and users would cease to use it.

Finally, respondents were asked what performance benefits could be derived from a system such as the ETS. Most respondents indicated that the ETS would allow someone to query the repository to find knowledge regarding a problem or situation that they are facing. An employee facing some sort of problem could query the ETS to find a similar circumstance, see what decisions were made in that circumstance, and also see if those decisions were effective or ineffective. If the decisions were effective, applying the same knowledge to the current situation may lead to a favorable outcome. Another respondent stated that the ETS would be useful as a teaching aid—an instructor could pull a situation from an interview and then allow the class to discussion what they would have done if they were faced with a similar circumstance.

Cognitive Barriers

Table 4.7 – Recurring Themes Concerning Cognitive Barriers

Major Theme	Component	Prevalence
Shared language	Employees at the DAC share similar language and background – do not feel the need to "translate" knowledge to colleagues	3
Things that reduce the effect of cognitive barriers	Information placed in an online repository so that multiple people have access	1
	More experience	1
	Approachable colleagues that are willing to answer questions	1
Things that magnify the effect of cognition barriers	Highly technical knowledge that is difficult to translate into simpler terms	1
	Assumption that someone else will pass the knowledge along	1
	No one gets together to share information	1
	Lack of experience	1
Source of job complexity	The ammunition information is constantly changing – can be difficult to stay ahead of the changes	2
	The dangerous nature of ammunition	1

Table 4.7 above contains the major themes regarding the prevalence and nature of cognitive barriers at the DAC. As the research literature suggests, cognitive barriers can come into play whenever a group of individuals attempt to transfer knowledge that is especially complex or context-specific (Huber, 2001). To measure how respondents perceived the complexity of their jobs, respondents were asked to rate the complexity of their jobs (from 1 to 10 with 10 being extremely complex). The average response was 7.46 with a standard deviation of 1.21. Respondents in general felt that their jobs were in fact complex and many spent a significant amount of time on a recurring basis ensuring that they had the most current information available.

To a large degree, this complexity arises out of the dynamic nature of the job. One respondent stated, “[The job] is constantly evolving, there is no steady state. We joke that the only constant is change.” Another source of complexity is the inherently dangerous nature of ammunition; one wrong move could end with catastrophic results. As such, having the absolute latest knowledge regarding these dangerous items is essential.

To get an idea of the mechanisms that counter cognitive barriers at the DAC, respondents were asked what sorts of factors make it easy to share knowledge. Of particular interest was one respondent’s remark that having colleagues who are approachable and willing to share knowledge can alleviate the presence of barriers, “…all I have to do is just ask somebody. Everybody’s been really helpful to me.” Another respondent echoed a similar sentiment when asked what factors make it difficult to share knowledge. This respondent stated that employees who do not have a willingness to share knowledge with each other can magnify cognitive barriers. Both of these statements underscore an important theme in this research: the willingness and ability of employees to share knowledge can have an impact upon the presence and strength of cognitive barriers within the organization.

These statements give a glimpse into how the sub-components within the social ecology interact with each other. Even if there are extensive cognitive barriers in place due to the sheer complexity of the knowledge, it will be demonstrated that knowledge market forces and knowledge networks could overcome them. On the other hand, adversarial knowledge markets that have high costs of entry only served to magnify cognitive barriers within the organization.

Knowledge Networks

Table 4.8 – Recurring Themes Concerning Knowledge Networks

Major Theme	**Component**	**Prevalence**
Characteristics of an expert	Knowledgeable	2
	Ability to convey knowledge to others	1
Identifying experts	Points-of-contact identified in the DAC phone directory	2
	Locate an expert who has information on who knows what within the network	1
	Be proactive – find out on your own where knowledge is	2
Things that facilitate knowledge network growth	Employees move from job to job – helps the network grow through contact with new people	2
	Staying in-touch with friends and colleagues	1
	Employees who are willing to share	1
	QASAS is a small community – roughly 500 total personnel worldwide	2

Respondents were asked what sorts of thing help in the quest for an expert. A few respondents indicated that the organizational phone book has points-of-contact for some of the various systems within the DAC. This delineation of experts can be extremely beneficial from the standpoint of a newcomer; a new employee simply has to open the phone book and find the contact for the particular system for which they have a question. Another way to locate an expert is to find someone who already has an extensive knowledge network developed. This individual would serve as a guidepost of sorts directing those who need expertise to those who have expertise. Finally, respondents indicated that to find an expert, one has to simply be proactive. If an individual doesn't know something, keep searching until the answer is found. This mindset of persistence is also indicative of the QASAS culture. QASAS personnel take pride in their ability to solve ammunition-related problems as well as developing their own repository of experience.

One issue raised by respondents what that their strict schedules impeded their ability to simply talk to their coworkers. One respondent stated, "Schedules are one thing because sometimes there are people that I would like to sit down and talk with but due to my schedule or their schedule it is physically impossible." Location was another issue cited as a stress upon the formation of knowledge networks because employees "…could be anywhere worldwide." Indeed, the DAC has satellite organizations located worldwide and also personnel are often TDY which further challenges the establishment of knowledge networks.

Organizational Culture

Table 4.9 – Recurring Themes Concerning Organizational Culture

Major Theme	Component	Prevalence
Communication	Lack of information flowing between technology-oriented directorates and training-oriented directorates	1
	A recurring bulletin and notes from staff meetings are published – these list news from different directorates and projects that are being worked on	2
	Lack of information from the chain-of-command; employees learn about new things from colleagues	4
Education	Education is valued and employees are encouraged to seek education	4
Schedules	Demanding schedule can impede opportunities for sharing knowledge	1
Policies / Procedures	Policies and procedures in place do not hinder knowledge sharing	3
Innovation	Innovation is neither encouraged nor discouraged	3
Senior Leadership	Senior leadership supports knowledge sharing but expectations / attitudes toward knowledge sharing not openly communicated to employees	2
Competition	Competition between directorates causes friction for knowledge sharing	1
Mentoring	There is an active mentoring program in place	2
Incentives	Lack of any sort of incentive program that could be linked to knowledge sharing	4
	Personal evaluation by supervisor provides enough incentive to share knowledge	2

Table 4.9 above contains the major themes related to the culture within the DAC. Because organizational culture was clearly perceived as a very broad concept covering many different issues and aspects, the following discussion breaks the various themes down into individual sections for further discussion.

Communication

Most respondents indicated that they did not receive as much information from their chain-of-command as they would like. One respondent stated that "…just like most of the military finds out what's going on over in Iraq through CNN, we don't learn [about new things] through our channels." A majority of respondents perceived that there were communication barriers between management and the worker-level. These communication barriers inhibit the flow of such things was senior leadership values and expectations, stories of success as well as failure, and policy and procedural changes. For instance, respondents were asked if they had ever been given a list of expectations regarding knowledge sharing; most respondents said that they had not.

Another communication barrier exists between the employees in Building 2 and the employees across the street in Building 35. Building 35 houses some of the more technical functions of the DAC. This building is where new ammunition technologies are developed. One respondent felt that the instructors "…are the last to know" about new technologies and developments arising out of Building 35. They went on to say that it would be beneficial to familiarize the interns with the new technologies that they will more than likely see out in the field. Communication barriers prevent this information flow between directorates.

It can be argued that all organizations of significant size struggle with communication and must make a conscious effort to communicate well. As such, the communication challenges expressed by the respondents should not be viewed as egregious. One respondent stated that they had work experience in the private sector and the communication challenges that exist at the DAC are comparable to other organizations.

To help combat against communication barriers, the DAC circulates two publications on a recurring basis. The first publication exists in the form of a bulletin that lists people's accomplishments. Such a bulletin serves as a useful tool for documenting which employees have expertise in the various programs around the DAC. In addition to the bulletin, the DAC also publishes notes taken during staff meetings. These notes allow the employees to stay aware of the issues being discussed and considered by senior management.

Education

Another positive aspect of the DAC culture is an appreciation of education. This was evidenced by senior leaders encouraging employees to seek education opportunities. One respondent stated, "I'm pretty sure if I ask [education] would be afforded to me." One respondent, who wished to increase their effectiveness as an instructor, was given the opportunity to earn a masters degree. This same respondent indicated that there were other DAC employees who were working on their doctorates.

Policies and Procedures

Respondents were also asked their opinions on the policies and procedures at the DAC and whether or not these governing regulations promote or hinder the sharing of knowledge. The overwhelming majority stated that the do not hinder their attempts to share knowledge. One respondent stated, "I think [that the policies within the DAC] actually assist. I don't think that there is any conscious effort to hold knowledge in one place."

Innovation

One respondent stated that "...innovation is not discouraged but it's not highly encouraged either." Yet another expressed a similar sentiment regarding a general lack of innovation in that, "It's probably just the comfort level of the staff that we have. It has worked this well for this long, why rock the boat now." One reason for such sentiments could be the result of the DAC pursuing accreditation. Seeking accreditation causes organizations to become subject to a vast array of external requirements and regulations. These requirements can often be too strict and therefore hinder new knowledge or innovation from occurring.

Incentives

The vast majority of respondents could not name any sort of incentive program that rewards people for sharing ideas or knowledge. Respondents were asked if there was any sort of "employee of the month" program that recognizes employees for outstanding achievements. Many respondents stated that there are parking spots for employees who win such awards but there is not an active program currently underway. In the absence of formal incentive programs, some respondents felt that their annual performance evaluations served as a sort of incentive. Specifically, their supervisors could recognize knowledge sharing by including such language in the performance evaluation when it is written up.

Competition

One respondent stated "To some degree, yes [the directorates within the DAC] understand one another. They don't always work and play well together. It is very competitive." This sense of competition arises between the directorates due to funding. Directorates that can "sell" their programs effectively are more likely to receive a larger budget share at the beginning of the fiscal year. Respondents indicated that these budget considerations can trip up the flow of knowledge between directorates. A directorate with a perceived knowledge advantage might choose to restrict knowledge sharing until budgetary decisions have been made in an effort to gain more funding. When asked how often such knowledge restrictions occur, the respondent stated, "I think that's an exception, but it is becoming more frequent."

Knowledge Markets

Table 4.10 – Recurring Themes Concerning Knowledge Markets

Major Theme	Component	Prevalence
Currency	Altruism identified as main currency at play in the market	3
	Reputation of the knowledge sender important to identify credibility of the knowledge	2
	Competition for promotion	1
Willingness to share knowledge	Employees are willing to share knowledge	3

Respondents were given the definition of the Knowledge Market construct and were then asked their thoughts on the definition. Respondents were asked if they agreed with the definition or if they perceived the construct in some other way. In addition, respondents were asked if there were any additional forms of currency at play other than the three given in the definition. Most respondents replied that the definition of the Knowledge Markets construct does indeed make sense. Respondents indicated that the three currencies provided (reciprocity, repute, and altruism) covered their understanding and perceptions of how such a market might function.

Questions were then asked of respondents to explore the currencies that might be in play at the DAC. A majority of respondents indicated that based upon their experience at the DAC, their colleagues were more than willing to share knowledge when asked. One respondent estimated that 90% of the employees that they come in contact with are altruistic and therefore share knowledge "because it is the right thing to do." This result is not surprising given the analysis of the organizational culture at the DAC.

KMS TTF Model Analysis

After asking respondents their thoughts on the individual constructs, the respondents were then asked, based upon their perceptions and experiences, how the constructs were related to each other. These responses were aggregated together and the results are presented in Table 4.11 below. Four rows appear highlighted in the table. These rows represent conflicts where a majority of respondents felt that some sort of relationship existed between the constructs but those respondents were split as to the direction of the influence. For instance, in the relationship between cognitive barriers and knowledge markets, four out of seven indicated that there was some sort of relationship at play between those constructs; however, two respondents stated that cognitive barriers impacted knowledge markets while the other two respondents indicated exactly the opposite. These conflicts will be accounted for later as the IQA model-building technique continues.

In addition to these highlighted rows indicating conflicts, four additional rows contain numbers denoted with an asterisk. In these cases, the numbers had to be adjusted based upon interpretation errors reported by respondents. During this exercise, respondents were given a sheet of paper which contained the definitions of each of the constructs of interest. Although respondents were free to reference the definitions at any time, many respondents articulated the relationship in question in terms of a different construct or using different meaning. For instance, when articulating the relationship between the knowledge task and other constructs, many respondents discussed the knowledge task in terms of *performing* the knowledge task rather than just the knowledge task itself. In such situations where respondents referenced performance instead of the task, the number was adjusted. This is a limitation of the current study and will be discussed in more detail in the next chapter.

Table 4.11 – Aggregated Relationship Totals

Construct "A"	Construct "B"	"<---"	"-->"	"0"
CB	F	2	4	1
CB	IU	0	5	2
CB	KM	2	2	3
CB	KN	4	3	0
CB	KT	1	2*	2
CB	OC	5	2	0
CB	P	1	6	0
CB	TTF	3	2	2
F	TTF	0	7	0
IU	P	3	2	2
IU	TTF	5	0	2
KM	F	1	4	2
KM	IU	1	5	1
KM	KN	4	3	0
KM	KT	2	1*	1
KM	OC	2	2	3
KM	P	1	6	0
KM	TTF	2	3	2
KN	F	2	3	2
KN	IU	1	4	2
KN	KT	2	2*	1
KN	OC	4	2	1
KN	P	2	5	0
KN	TTF	2	2	3
KT	TTF	1*	3	1
OC	F	2	4	1
OC	IU	0	4	3
OC	KT	0*	4	2
OC	P	1	6	0
OC	TTF	2	2	3

After aggregating the responses as shown in Table 4.11, the next step was to develop the construct relationship matrix. This matrix highlights the direction of influence as articulated by the respondents for the constructs in this study. For instance, when asked to articulate the relationship between cognitive barriers and KMS functionality, a majority of respondents (four in this case) felt that cognitive barriers impact functionality. As such, this relationship was denoted in the matrix below (Table 4.12). This process was repeated until all rows in the table were addressed.

Table 4.12 – Construct Relationship Matrix

Tabular IRD												
	CB	F	IU	KM	KN	KT	OC	TTF	P	OUT	IN	Δ
CB		↑	↑	↑	←	↑	←	←	↑	5	3	2
F	←			←	←		←	↑		1	4	-3
IU	←			←	←		←	←	←	0	6	-6
KM	←	↑	↑		←	←	←	↑	↑	4	4	0
KN	↑	↑	↑	↑		↑	←	↑	↑	7	1	6
KT	←			↑	←		←	↑		2	3	-1
OC	↑	↑	↑	↑	↑	↑		↑	↑	8	0	8
TTF	↑	←	↑	←	←	←	←			2	5	-3
P	←		↑	←	←		←			1	4	-3

After the construct relationship matrix was completed, the rows were then sorted in descending order by Δ. When sorted, the most influential constructs in the system appear at the top of the matrix. As Table 4.13 indicates, constructs related to the social ecology serve as the "drivers" in the system. Organizational culture (OC) is referred to as the "primary driver" in the system because it influences all of the other constructs and it is not influenced by any other construct. It is here that one begins to get a sense for the importance of the social ecology to TTF as a model. In the far left column of the model there is a striking segregation between the social ecological factors and the constructs comprising TTF. The first four constructs (reading top to bottom) all comprise the social ecology as described in Chapter 2. The remaining five constructs all comprise the traditional TTF model.

Table 4.13 – Construct Relationship Matrix (Sorted)

Tabular IRD (Sorted)												
	CB	F	IU	KM	KN	KT	OC	TTF	P	OUT	IN	Δ
OC	↑	↑	↑	↑	↑	↑		↑	↑	8	0	8
KN	↑	↑	↑	↑		↑	←	↑	↑	7	1	6
CB		↑	↑	↑	←	↑	←	←	↑	5	3	2
KM	←	↑	↑		←	←	←	↑	↑	4	4	0
KT	←			↑	←		←	↑		2	3	-1
F	←			←	←		←	↑		1	4	-3
TTF	↑	←	↑	←	←	←	←			2	5	-3
P	←		↑	←	←		←			1	4	-3
IU	←			←	←		←	←	←	0	6	-6

Figure 4.1 illustrates the results from the first iteration of the IQA model-building technique. The model depicted in Figure 4.1 is built by drawing an arrow (a relationship) between two constructs in the direction indicated in the construct relationship matrix given in Table 4.13 above. For instance, Table 4.13 indicates that organizational culture impacts cognitive barriers (as denoted by the arrow pointing to cognitive barriers). As such, a relationship is drawn from organizational culture to cognitive barriers. Again, each arrow in Figure 4.1 represents the perceived or experienced relationship between the constructs as articulated by the respondents. To continue, the arrow from Organizational Culture to Cognitive Barriers means that a majority of respondents felt that their perceptions or experiences of the culture within the DAC have an impact upon the presence and strength of cognitive barriers within their task domain.

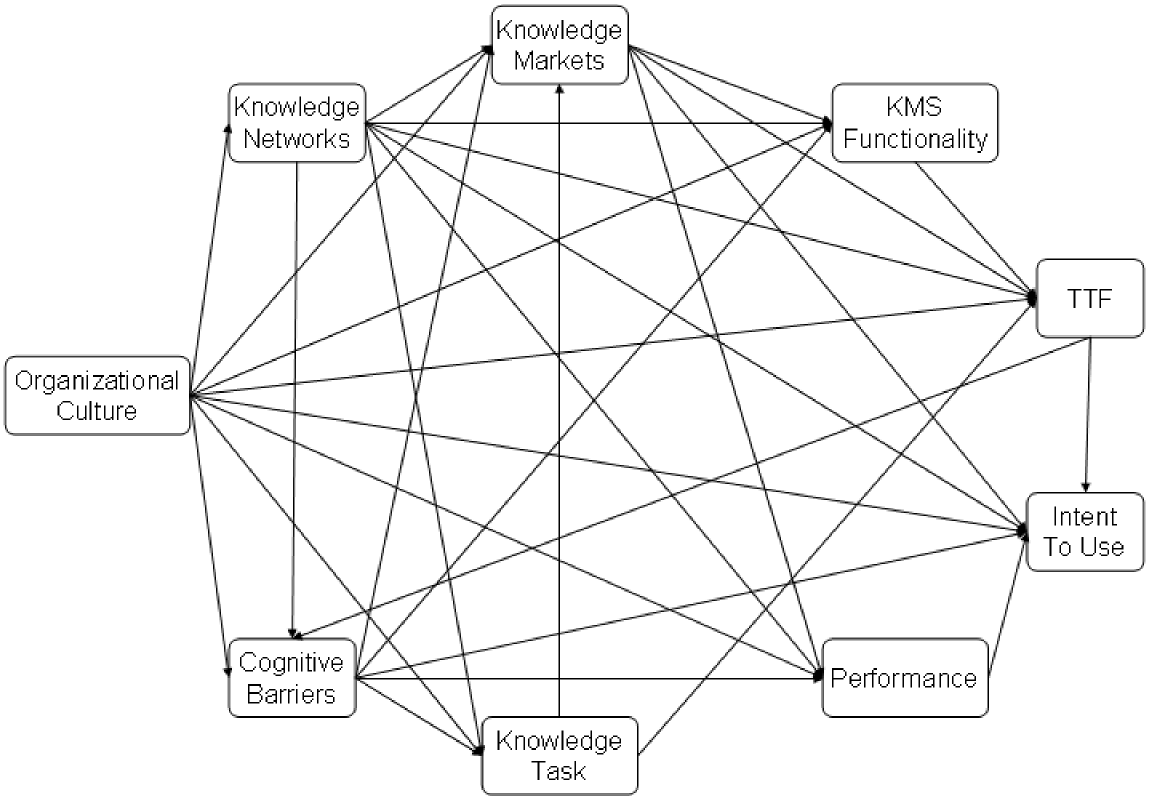

Figure 4.1 – IQA Analysis Model (First Iteration)

The next step in the IQA model-building technique was to remove the redundant links in the model. This step is designed to make the model more parsimonious while still retaining the underlying information about the "flow" of precedence and influence within the perceptual system. For instance, in Figure 4.1 above, Organizational Culture impacts KMS Functionality; however, Organizational Culture also impacts Knowledge Markets, which in turn impacts KMS Functionality. Thus, Organizational Culture impacts KMS Functionality through multiple paths (both directly and indirectly through Knowledge Markets). Therefore, the arrow between Organizational Culture and KMS Functionality was removed because the "absolute" connection between culture and functionality is still implied by retaining the indirect connection between the intervening construct. This process was repeated until no such redundant links remained in the model. The results of this process is depicted in Figure 4.2 below.

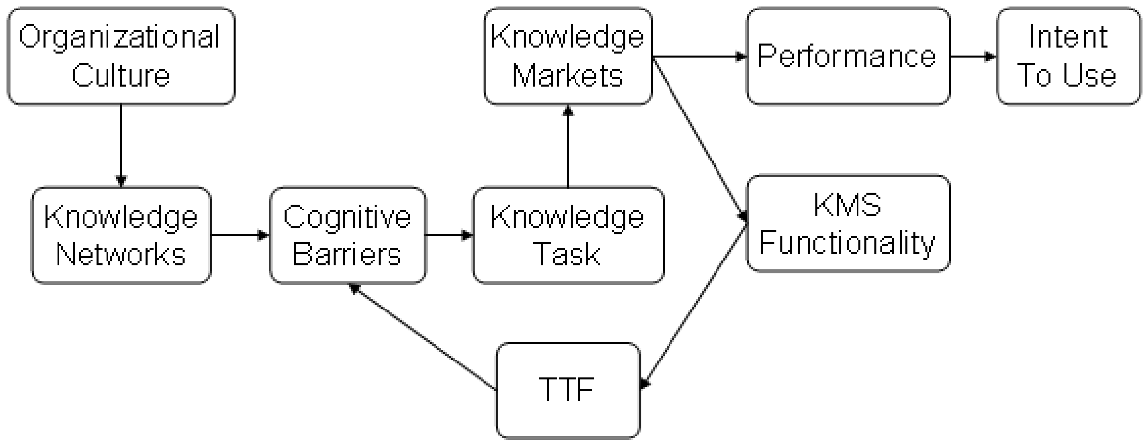

Figure 4.2 – IQA Model (Redundant Links Removed)

The final step in the IQA process was to account for the conflicts mentioned earlier in Table 4.11. For each conflict (there were four), the resultant model had to ensure that there was not only a path from "A" to "B", but also the conflicting path from "B" to "A." Again, more respondents than not articulated a relationship between the constructs, but respondents were split as far as the direction of that relationship. Adding conflicts back into the model accounts for this "split" direction. Figure 4.3 depicts the relationship (highlighted) that had to be added to the model to account for the conflicts. In this case, only one relationship had to be added to the model in order to account for all four conflicts.

Figure 4.3 serves as a representation of how the TTF model unfolds in the minds of the DAC respondents. This model provides a unique perspective on the prevalence of the social ecology to the fitness of a KMS for a specific knowledge task.

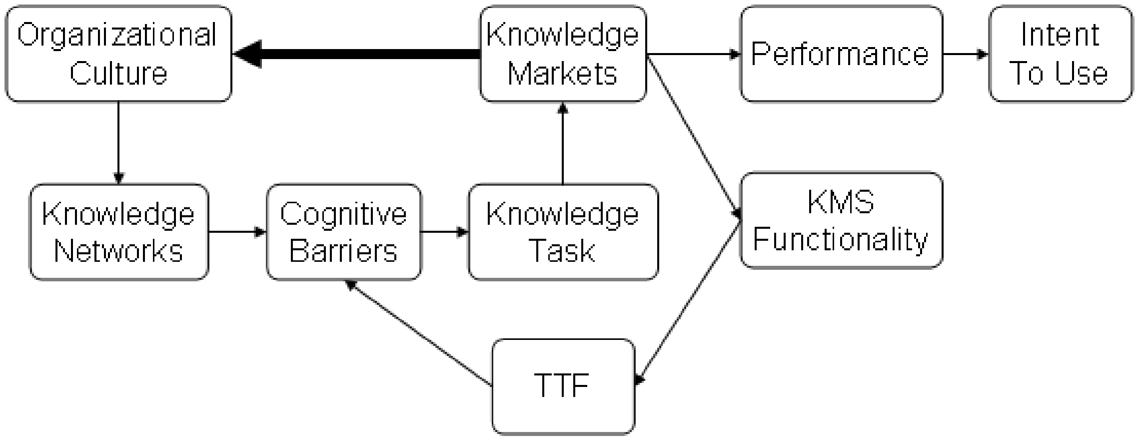

Figure 4.3 – IQA Model (Conflicts Added)

In the concluding chapter, additional commentary will be provided on this model as well as some additional recommendations for securing a successful KMS or improving the chances of KMS fit.

V. Conclusions and Recommendations

Research Question Revisited

At the end of the first chapter, a research question was posed to establish the research goal and to focus the research effort. That research question was articulated as follows:

Does task/technology fit differ in the context of knowledge management systems versus more traditional information systems?

To answer this question, two commentaries will be advanced. First, the TTF model proposed at the end of the second chapter will be revisited to determine if any of the relationships posited by the model were in fact supported by this research. Second, the prevalence of the social ecological factors selected by this research will be examined.

Proposed TTF Model

At the end of the second chapter, a model for TTF in the context of KM was proposed (see Figure 2.5) as the starting point for the exploration of what changes TTF might undergo in a context such as KM. Figure 5.1 revisits the proposed model and shows the relationships that were and were not supported by the data collected in this research. The relationships denoted by a dotted arrow were supported while the relationship denoted with a solid arrow were not supported and are therefore drawn contrary to their original direction. As shown in Figure 5.1, the majority of relationships initially proposed in Figure 2.5 were supported by the data collected in this research.

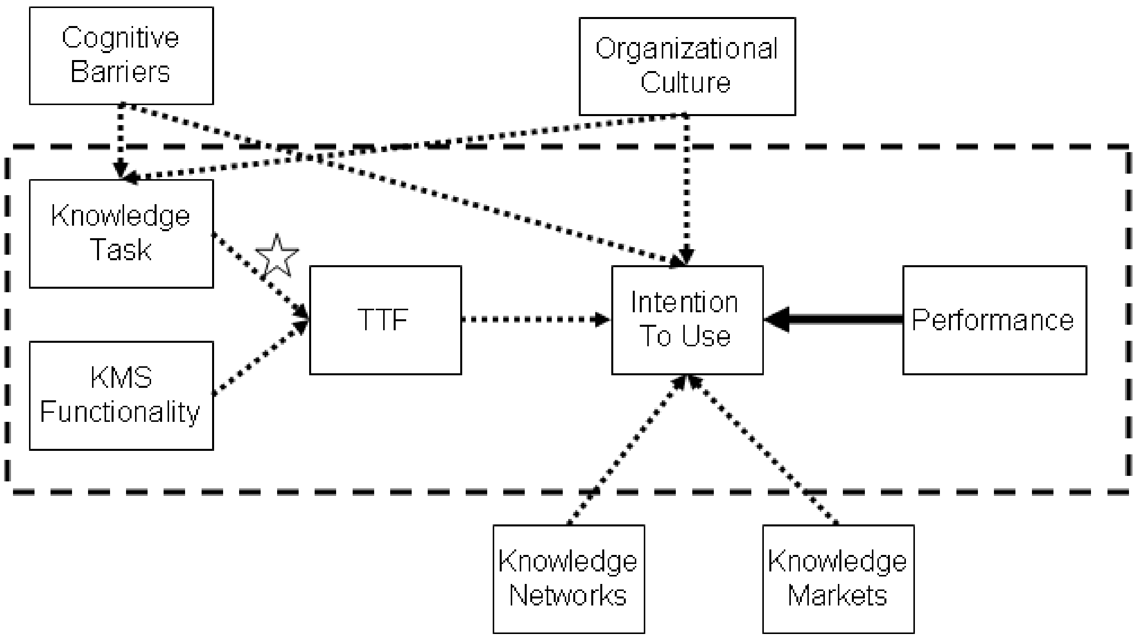

Figure 5.1 – Relationships as Proposed in TTF Model

Within Figure 5.1, there are two relationships that deserve additional commentary. First, the relationship between the constructs of Performance and Intention to Use (denoted by a solid arrow in Figure 5.1) is drawn in the opposite direction than the proposed TTF model. It was originally proposed that an individual's intention to use a system would impact their resulting performance on a particular knowledge task. Results obtained by this research seem to suggest the opposite; users who experience a positive increase in their knowledge task-related performance will also experience a positive impact upon their intention to use the KMS in the future.

This relationship implies that in order to positively impact a user's intention to use a KMS, the user must experience performance gains early in their interaction with the KMS. Achieving early successes could be brought about through training that is performance-oriented. For instance, instead of merely training users how to use the KMS (click this button or select from that drop-down menu), one should train the users how to *increase their job performance* by using the KMS. It can be argued that by providing users performance-oriented training users are already being trained in the use of the KMS. By utilizing training developed from the perspective of performance, this research suggests that users are more likely to experience early performance gains and therefore are more likely to use the KMS to help solve future problems.

Before successfully training users from a performance perspective, one must be intimately familiar with the knowledge task, which brings us to the second relationship in Figure 5.1 requiring further discussion – the relationship between the Knowledge Task and TTF (denoted with a star in Figure 5.1). Although not necessarily an unsupported relationship in this case, the relationship between TTF and the knowledge task works a bit differently than originally proposed in the TTF model. Figure 5.2 helps illustrate this difference. Figure 5.2 represents the essential elements of Figure 4.3 (the final perceptual model obtained in this study) with emphasis added to the feedback loop containing the social ecological factors.

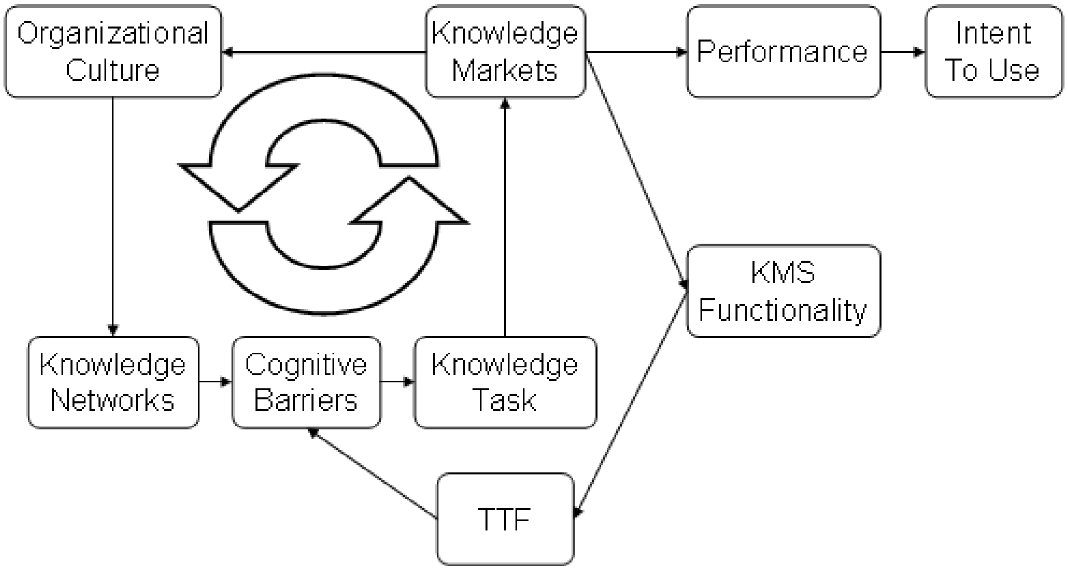

Figure 5.2 – IQA Model With Social Feedback Loop Highlighted

In particular, the location of the Knowledge Task construct within the social feedback loop seems to indicate that employees define their knowledge tasks not only in terms of the task itself, but also in terms of the social ecology within the organization and the cognitive barriers at play. For instance, consider two identical companies. Both companies serve as consulting firms that handle extremely complex situations for their clients. At Company A, the social ecology is adverse to knowledge processes. Workers hoard knowledge seeking promotion (the only real incentive) above their peers. At Company B, on the other hand, the social ecology is extremely conducive to knowledge processes. Employees are rewarded in teams and therefore openly share knowledge with one another.

If two employees filling the same role at each company were interviewed, the feedback loop in Figure 5.2 suggests that each would define their knowledge task differently. The employee at Company A might articulate a higher level of knowledge task complexity because knowledge-based resources in their company are scarce. The employee at Company B might view their task in completely different terms based upon their access to rich channels of knowledge exchange and interchange. In an organization where culture and environment do not facilitate the flow of knowledge, the knowledge task grows more complex as employees have to work harder to find the knowledge needed to complete their task. In this case, employees would define the knowledge task differently than they would in an organization whose culture and environment facilitate knowledge sharing.

Social Ecology and TTF

Overall, findings in this research effort support the TTF model proposed at the end of the second chapter. Although a majority of relationships shown in Figure 5.1 were supported, results also indicate a much more complex interplay between the factors associated with TTF and those outside the traditional TTF system of constructs. In particular, Figure 5.3 below highlights the importance of the organizational social ecology to the fitness of a KMS for a knowledge task. As Figure 5.3 demonstrates, the constructs comprising the social ecology (organizational culture, cognitive barriers, knowledge networks, and knowledge markets) impact *every* construct internal to TTF. This complexity and prominence of social ecological factors lends credence to the notion that TTF does in fact change within the context of KM. In particular, the inherently social characteristics of KM appear to play an important role in determining KMS fit.

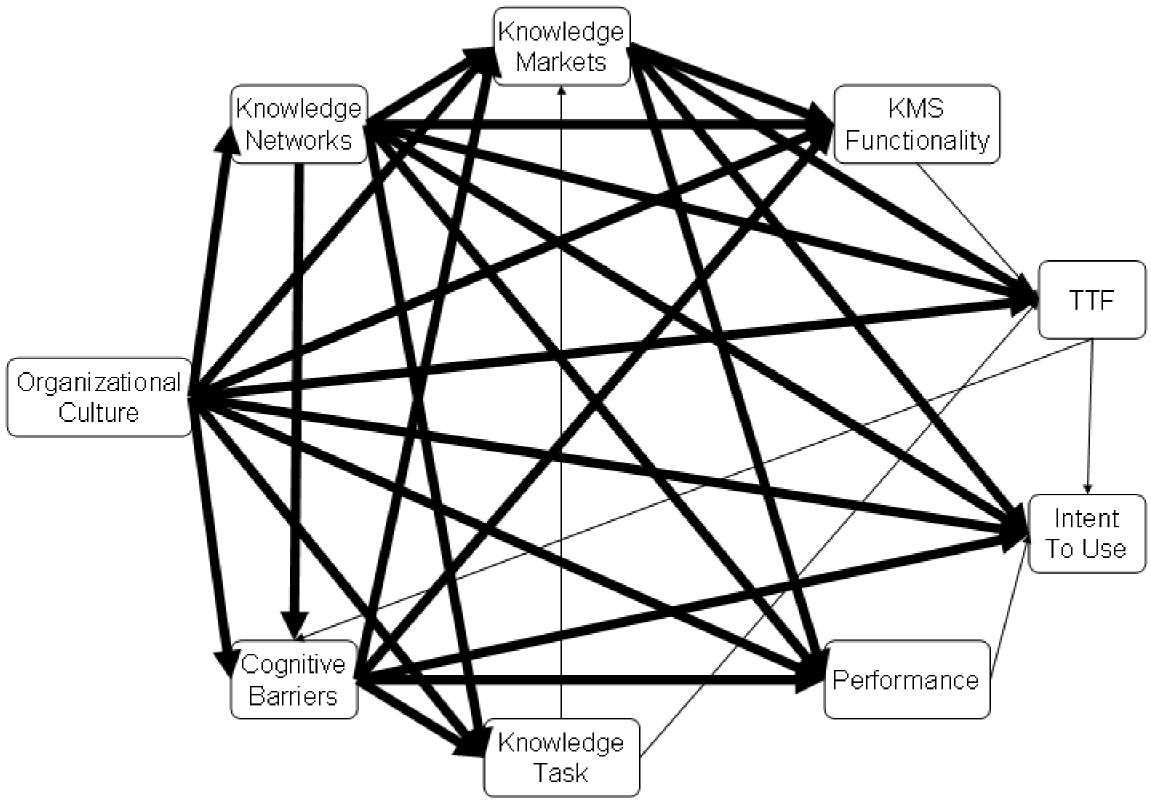

Figure 5.3 – Influence of Social Ecology in TTF

When Figure 5.3 is considered along side Figure 4.3, the prominence of the social ecology to TTF becomes even more apparent. In Figure 4.3, all of the social factors (organizational culture, cognitive barriers, knowledge networks, and knowledge markets) are all located within a single feedback loop. This social feedback loop has a significant influence within the model because it serves as a mediator of sorts between KMS fit and the user's performance and intention to use the system. The presence of the social feedback loop in Figure 4.3 also suggests that the respondents viewed each individual social factor as tightly coupled. It could very well be that organizational culture, cognitive barriers, knowledge networks, and knowledge market forces are simply subconstructs in a larger "organizational social ecology" construct. This abstraction is depicted in Figure 5.4 below. Through the tightly coupled nature of the relevant constructs, the social feedback loop supports Gupta and Govindarajan's (2000) assertion than an effective social ecology "…is a crucial requirement for effective knowledge management" (p. 71).

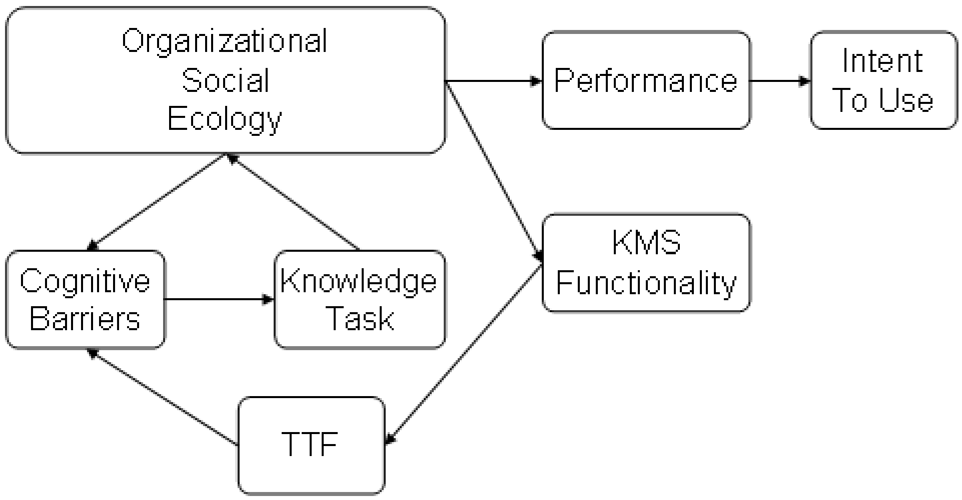

Figure 5.4 – TTF Model with Social Factors Merged

The prominent position of the social feedback loop also suggests that the social aspects of KM cannot be ignored when attempting to measure the fitness of a KMS for a knowledge task. As the model in Figure 5.4 suggests, the organization's social ecology influences not only the resulting performance of an employee, but also an employee's perception of the functionality of a KMS. For instance, in an organization where the flow of knowledge is impeded by social constraints, employees may place less value upon the capabilities of a KMS.

Recommendations for Action

As the results of this research suggests, the DAC is well on their way to achieving success with the ETS. The small glimpses into the culture of the DAC given by the respondents in this study show that as a whole, the culture is conducive to knowledge sharing. The employees are open to the ideas of KM in general with many of them suggesting that KM is a good idea. Considering that this research found the culture within the organization to be an extremely significant driver of not only TTF but also employee performance and intention to use, it seems as if the DAC is on its way to a successful KMS implementation. Despite these facts, it is not quite time for celebration just yet. The ETS is still in its infancy. The goal of the knowledge-based initiatives underway at the DAC should be to make the knowledge processes of creation, storage/retrieval, transfer, and application so ingrained into the culture of the organization that they essentially become transparent. Employees work with knowledge not because they are required by some policy to do so, but they work with knowledge because "that is the way we do it here." To reach the goal of fully integrated knowledge processes, continued effort on multiple fronts should be pursued.

To help achieve this goal, Davenport and Prusak (2000) suggest that a little common sense goes a long way. As the DAC continues to implement their KM initiatives, they should keep these principles in mind. First, the initial focus should be placed upon high-value knowledge (Davenport & Prusak, 2000). High-value knowledge is often the knowledge most closely associated with core business functions and influences core business decisions. Initial skeptics of KM may be brought on board only if they see early, concrete successes. Bringing quality, high-value knowledge to bear on core business processes has best potential to provide these early successes.

Second, Davenport and Prusak (2000) suggest that a small pilot project should be undertaken instead of a large, overarching organizational knowledge management plan. In the opinion of the researcher, the ETS fits within this criterion. Again, the mantra here is demonstrable success. Organizations excited about KM can sometimes bite off more than they can chew leaving some (particularly senior management) with a bitter taste in their mouths. Not only does this discolor current knowledge efforts, it is likely to stifle future efforts as well as this story of failure becomes folded into the culture of the organization.

Third, work should be done along multiple fronts (Davenport & Prusak, 2000). As this research has shown, there are many factors that affect the fitness of a KMS in a specific business environment. Not only must KMS designers match the capabilities of the KMS with the knowledge task requirements, but they must also take into account aspects of the social ecology within the organization.

The fourth bit of common sense provided by Davenport and Prusak (2000), is don't procrastinate with regards to elements that give you the most trouble. Most often, this advice applies to cultural challenges as senior management attempts to turn an organization away from the status quo. An organization's culture took years to establish and it won't be changed overnight. As such, this can be the most difficult aspect to work on. It is tempting to put it off until later in favor of something easier such as technology.

Success Framework

It has been stated many times in the course of this research that the social ecology within an organization significantly impacts the success or failure of knowledge-based initiatives, such a KMS, within the organization. In addition to the four points of advice from Davenport and Prusak (2000), it helps to study the social ecology within companies that are meeting success with knowledge-based initiatives. The social ecology within an organization was not established overnight and more than likely cannot be changed overnight neither. In their case study of Nucor Corporation, which is one of the world's most innovative and fastest-growing steel company, Gupta and Govindarajan (2000) come to the conclusion that the social ecology within organizations comprises "…a crucial requirement for effective knowledge management" (p. 71). To this end, Gupta and Govindarajan propose a framework for the establishment of an effective social ecology.

Set Stretch Goals

In order to spur employees to generate new and use existing knowledge, they should be challenged to meet goals that cannot be solved with knowledge readily available to them. Gupta and Govindarajan (2000) maintain that the starting point for fostering a culture conducive for KM is "…to set targets that cannot be achieved without some innovation" (p. 78). Stretch goals cause employees to reach out to their colleagues for ideas or look for ideas on their own through an experimentation process.

Establish High-Powered Incentives

In addition to establishing goals that cause employees to reach beyond their own spheres of influence, the proper incentives to meet those goals should be provided. According to Gupta and Govindarajan (2000), "Stretch goals without high-powered incentives are likely to end up as lofty exhortations lacking power to stir people to seek new approaches" (p. 78). When asked whether or not the DAC had an incentive program in place to recognize and reward knowledge sharers, the vast majority of respondents answered that they were unaware of any such incentive program. The authors maintain that stretch goals increase an individual's level of risk. The incentives provided should match this increased level of risk.

One way to provide incentives is to recognize employees who both utilize and create knowledge successfully. These "heroes", as termed by Gupta and Govindarajan (2000), "…do not merely invent leading-edge practices but also facilitate their adoption by other individuals and units within the corporation" (p. 79). Showcasing these heroes can have two benefits. First, it shows that individuals who share their knowledge are indeed rewarded for the knowledge that they give away. Second, it points out the positive role models within the organization who are doing it right. Many people may have an idea of what KM entails; they just may not understand how to go about it. These positive roles model can help light the way.

In addition to highlighting the achievements of individuals who are on the right track with KM, organizations should also focus on providing incentives for functional groups as well. Focusing on groups discourages "knowledge hoarding" where individuals gather as much knowledge as they can and are extremely selective as to who can receive it. In a hoarding situation, knowledge is treated as an instrument of power. Therefore, whoever has the most knowledge by definition has the most power. Groups incentives "…direct attention to maximizing the performance of the entire system rather than that of an individual unit" (Gupta & Govindarajan, 2000, p. 79). Nucor Corporation utilizes a group-based incentive strategy. For instance, shop-floor workers are not rewarded for their own performance; they are rewarded instead for the performance of their 25 to 40 person group (Gupta & Govindarajan). This grouping provides the motivation to share new ideas and discoveries with colleagues instead of seeking individual power and prestige.

Incentives have an incredible impact on the social ecology within an organization. Incentives facilitate the flow of knowledge within the knowledge networks of employees. Incentives also reduce any barriers to entry within the market for knowledge. Take for instance a new employee. In the absence of an incentive system, the new employee has very little to offer in the way of currency that can be exchanged for knowledge. When an incentive system is put in place, the emphasis is not so much placed on currency but instead success of the group. New employees are brought into the fold much quicker and their fresh ideas are taken more seriously.

Cultivate Empowerment

Employees may not rise to the challenge set by stretch goals if they do not feel empowered to do so. Employees that are o For example, Gupta and Govindarajan (2000) cite the "15% Rule" in use at 3M Corporation. Scientists working at 3M are allowed to utilize up to 15% of their time working on projects of their choosing without having to pre-approve the projects with their supervisors. This rule employed at 3M serves as a good way to empower employees to create and use knowledge in the attainment of stretch goals.

Establish a Well-Defined "Sandbox"

Employees attempting to attain stretch goals are destined to fail from time to time. Gupta and Govindarajan (2000) state that fostering a culture of experimentation means encouraging a willingness to take risks. This risk should be managed so that failures do not have adverse effects upon the organization. One way to manage this risk is to allow experimentation within a "sandbox." Gupta and Govindarajan (2000) use the analogy of a sandbox as an area where employees can feel safe to experiment with new ideas and concepts. Experiments that fail are not likely to imperil the entire company provided that the experiment did not exceed the boundaries of the sandbox.

Limitations

When designing any sort of study, it is important to consider the potential sources of error that can influence the data collection process. By doing so, the method can be designed in such a way as to reduce or eliminate these influences during actual data collection. A survey of the literature suggests that there are four things that can introduce unwanted variance in an interview methodology. These are rapport, random error, bias, and social desirability.

Interpretation Error

As suggested in Chapter 4, one source of error in this study arose from respondents interpreting the definitions of constructs differently than those presented to them for consideration. For instance, when asked to articulate the relationship between cognitive barriers and the knowledge task, a total of four respondents stated that the presence of cognitive barriers impacts the knowledge task. When their supporting anecdotes were analyzed, it was clear that of the four respondents who indicated a relationship, two had articulated the knowledge task in terms of performance (doing or accomplishing the knowledge task). For instance, one respondent stated, "If there are barriers in place to begin with, then you can't perform your task." Here, the respondent is clearly centering on task performance rather than the nature of the task.

A similar situation occurred when respondents were asked to articulate the relationship between knowledge markets and the knowledge task. Originally, four respondents indicated that the presence and/or strength of the knowledge markets impact the knowledge task. Upon closer inspection of the perceptual reports, it was noted that three of the four respondents were again talking about performance. For instance, one respondent stated, "If you've got your knowledge shared from your knowledge markets it's going to make doing your task easier." Again, the respondent was clearly speaking of the knowledge task in terms of performance of the task. These errors or misinterpretations may have obscured the underlying relationships between the elements of the research model and the Knowledge Task construct as it was originally defined.

Sample Size

Due to logistical constraints, only seven interviews were accomplished in this research effort. In order to perform a statistically-robust IQA, more respondents were needed. According to Turner (2006), “Larger focus groups (15 members or more) are desirable for a number of reasons related to the statistical analyses of the results; and also because there exists a tacit assumption that the larger the number of participants, the more likely the focus group is to produce an inclusive picture of all, or at least the most relevant, factors of a given phenomenon” (p. 48).

Random Error

When performing semi-structured interviews where the interview protocol allows some degree of flexibility, interviewers must be weary of introducing random error into the data collection process. According to Dooley (2001) random error “…can occur when the interviewer makes haphazard mistakes such as misread questions or misrecorded answers” (p. 134). These errors can influence the answers of respondents in an adverse way.

Although it is impossible to remove all sources of random error, steps were taken within this research to minimize the effects of random error. For this research effort, the same interviewer interviewed all participants in the study. This reduces any sources of error that can be attributed to different interviewer personalities and different interview styles. By utilizing only one interviewer, all respondents were exposed to the same personality traits and interview style. To guard against misrecorded answers, the interviews were recorded via audio tape provided the consent of the respondent was given. These steps were taken to reduce the occurrence of random error in the data collection.

Bias

In an ideal situation, the actions and behaviors of the interviewer would not affect how the respondent answers, and the same answer will be given regardless of who performs the interview (Neuman, 2006). In reality, this seldom occurs. Dooley (2001) suggests that interviewers introduce bias into their research in a variety of ways. First, Dooley states that interviewers may ask questions differently to different respondents. Second, Dooley says that the personal manner of interviewers can introduce bias into data collection.

Since this research employed semi-structured interviews, the interviewer was free to inject questions that sought to uncover a richer and deeper meaning. There was a chance for bias in that each respondent was not asked each question in exactly the same manner. The interviewer had a generalized interview schedule but was not held to a strict reading of each question. To help reduce bias, the wording of the questions was carefully considered. Questions intended to probe for deeper meaning are constructed ahead of time in order to provide further standardization. These actions were taken in an effort to reduce bias during the interview process.

Social Desirability

Phillips (1966) suggests that many of the answers given by respondents may be strongly influenced by their perception of the social desirability of their answer. In other words, the respondent's desire for social acceptance may cause them to respond in a manner that may not be truly indicative of their feelings. Social desirability arises when respondents feel that they are being judged based upon their answers. This perception can manifest itself due to the behavior of the researcher and the wording of the questions. To combat the influence of social desirability, the behavior of the interviewer remained as mild as possible. The interviewer did not express any personal reaction to the answers given by respondents. Also, the wording of the questions was carefully considered to avoid potentially controversial answers.

Recommendations for Future Research

Due to this research's focus on a specific group of people within the DAC, it would be extremely difficult to generalize the results from this research to other departments and directorates within the DAC let alone other organizations. The first recommendation for future research is to broaden the pool of potential interview respondents to include other directorates within the DAC. It very well could be that the attitudes and opinions expressed by the respondents in this study are unique to their directorate and thus not shared by others within the DAC. It would be interesting to explore if these same feelings exist elsewhere in the organization.

Another interesting area of research entails refining the TTF model as proposed in Figure 4.2 above. This could be done by administering the relationship table given in Appendix A to a wider range of respondents. Considering the number of respondents in this research, it would be statistically impossible to say that Figure 4.2 represents the true and definitive TTF model as it applies to KMS. By administering the relationship table to a larger audience, it can be said with more certainty that TTF applied to KMS does in fact look this way.

After the model is further refined, another area of research would be to take the refined model of Figure 4.2 above and attempt to validate it using quantitative methods. Survey questions that measure each construct could be developed and administered to a pool of respondents in an effort to measure the strength of the relationships between each construct within the model. By performing this quantitative analysis, credibility would be given to the model. If it is found to be credible, then the model could be presented to the research stream as a potential TTF model for use when measuring the fitness of KMS to a business context. The end result could be a derivative model much like the Jennex and Olfman KMS Success Model.

Conclusion

Based upon the findings and analyses provided by this research, it is reasonable to conclude that when employing the TTF model to determine KMS fitness, additional factors other than the knowledge task requirements and KMS capabilities should be considered. This research has demonstrated that the social ecology present within the organization has significant impacts on KMS fit. The capabilities of the KMS may fit the requirements of the knowledge task, but dynamics comprising the social ecology may present factors that inhibit the knowledge processes of creation, storage/retrieval, transfer, and application. In an adverse social environment, the KMS is unlikely to be effective.

This research also lends credibility to the idea that KMS are indeed a unique subset of IS and that traditional IS models (such as TTF) should reflect the unique nature of KM. In extending DeLone and McLean's (1992) IS Success Model to the KM context, Jennex and Olfman (2004b) implied that KMS were indeed unique – hence the development of the Jennex and Olfman KMS Success Model. In a like manner, this research suggests that the traditional TTF model should be extended to address the context specific constructs which govern KMS.

Appendix A

Part I – Construct Background

The goal of the first round of questions is to explore the respondent's feelings on the constructs related to task/technology fit (TTF) as well as the four social aspects of knowledge management (KM) that are being examined by this research.

Demographics

How old are you?

How long have you worked at the DAC?

Knowledge Task

Definition: The knowledge task represents the nature of the work and the kind of knowledge involved in the work.

Questions

How do you define knowledge? What is it?

How is knowledge created at the DAC?

How is knowledge stored at the DAC?

How is knowledge transferred at the DAC?

How is knowledge applied at the DAC?

Describe the last time that you felt as if you did not have enough information to make a decision or perform some action.

Knowledge Management System (KMS) Functionality

Definition: Functionality represents the capabilities or features that a knowledge management system is designed to support.

Questions

What would a KMS have to do in order to support your knowledge needs?

Can you give me an example of a good KMS that you have worked with?

What features or functionality made it good?

Can you give me an example of a bad KMS that you have worked with?

What made it bad?

In order to assist you with your knowledge needs, what one function should the KMS absolutely have?

Task / Technology Fit (TTF)

Definition: TTF is the degree to which the functionality of a KMS fits the requirements of the knowledge task.

Questions

What are your thoughts regarding the definition of TTF?

What changes would you make to the definition?

Have you ever used a computer system (either at the DAC or elsewhere) that you felt **did not** fit the purpose it was designed for?

What factors caused it not to fit the purpose?

Have you ever used a computer system (either at the DAC or elsewhere) that you felt **did** fit the purpose it was designed for?

What factors caused it to fit the task well?

Intent to Use

Definition: Intent to use is defined as the likelihood that you will use a system.

Questions

What factors must an information system possess in order to influence your intent to use it?

Can you give an example where intent to use a system did not translate into actual use?

Cognitive Barriers

Definition: Cognitive barriers are those things that make it difficult to share knowledge. Cognitive barriers not only affect knowledge "senders" but they affect knowledge “receivers” as well. Not only can it be difficult to share knowledge, but it can be difficult to understand another person’s attempt to share knowledge with us.

Questions

What makes it difficult to share knowledge in your organization?

What makes it easy to share knowledge in your organization?

On a scale from 1 to 10 with 10 being extremely complex, how complex would you say your job is?

What makes your job complex?

How complex is the information that you deal with?

Do you ever feel that you have difficulty articulating your knowledge to other people? Do you have to put it in generic terms?

Is there a shared vocabulary among the specialties within the DAC?

Could you write an instruction manual describing your method of instruction so that someone who reads it could duplicate your style?

Do the various agencies within the DAC generally understand each other or not?

Organizational Culture

Definition: Organizational culture is defined as the set of values, beliefs, norms, and expectations that are widely held in an organization. Organizational culture is made up of a company’s strategic intent, vision or mission statement, strategies, and core values.

Questions

How do you learn about new things in the organization?

As a whole, do policies and procedures within the DAC assist or hinder your efforts to share what you learn with others? Can you give an example?

Do you feel that employees are rewarded more for keeping the status quo or for thinking outside the box?

How important is the status quo and why?

Explain the commitment conveyed by the DAC leadership with regard to knowledge sharing? Can you give any examples?

What type of strategy and/or goals, if any, has the DAC leadership provided that is associated with knowledge sharing?

Is there an incentive program in place that rewards knowledge sharing? If one exists, do you feel that it is effective?

What kind of training is available with regards to sharing knowledge?

Knowledge Networks

Definition: A knowledge network is defined as a community comprised of individuals brought together by a common interest.

Questions

How does your organization recognize expertise and provide contact information of experts within the DAC community?

What makes someone an expert?

How big is your knowledge network?

Explain how you would search for and contact an expert?

What sorts of things help your search for an expert? Can you provide an example?

What sorts of things hinder your search for an expert? Can you provide an example?

Are there any issues, positive or negative, with locating an expert for the information/knowledge you need?

How often do you consult with other experts?

Does your schedule allow you to interact with your peers?

Knowledge Markets

Definition: Knowledge is exchanged for currency in the form of repute (the exchange of knowledge to gain a reputation as a knowledge sharer), reciprocity (the exchange of knowledge now in hopes that knowledge will be available later when needed), and altruism (knowledge is shared without concern for anything in return).

Questions

What do you think about this concept of a knowledge market?

In addition to the forms of currency already identified what other currencies might be at play?

Overall, how willing are the individuals in your organization to share knowledge internally? With other organizations supported by the DAC? How do you feel about sharing knowledge with others?

Explain how you would search for knowledge related to a problem that you haven't seen before.

Are there any issues, positive or negative, in finding lessons learned? How is it made available? Is it accessible?

If you share your knowledge, do you feel that you are recognized as a knowledge sharer?

If someone requests your knowledge and you give it to them, are they likely to help you in return?

Performance

Definition: Performance is the degree to which an individual is able to accomplish a task or number of tasks.

Questions

Can you give an example where a KMS or other information technology system **improved** your ability to do your job?

Can you give an example where a KMS or other information technology system **did not improve** your ability to do your job?

How might a KMS help your job performance?

How might a KMS hurt your job performance?

Key Term Definitions

Cognitive Barriers (CB) - Cognitive barriers are those things that make it difficult to share knowledge. Cognitive barriers not only affect knowledge "senders" but they affect knowledge "receivers" as well.

Knowledge Management System Functionality (F) - Functionality represents the capabilities or features that a knowledge management system is designed to support.

Intent to Use (IU) - Intent to use is defined as the likelihood that you will use a system.

Knowledge Markets (KM) - Knowledge is exchanged for currency in the form of repute (the exchange of knowledge to gain a reputation as a knowledge sharer), reciprocity (the exchange of knowledge now in hopes that knowledge will be available later when needed), and altruism (knowledge is shared without concern for anything in return).

Knowledge Networks (KN) - A knowledge network is defined as a community comprised of individuals brought together by a common interest.

Knowledge Task (KT) - The knowledge task represents the nature of the work and the kind of knowledge involved in the work.

Organizational Culture (OC) - Organizational culture is defined as the set of values, beliefs, norms, and expectations that are widely held in an organization. Organizational culture is made up of a company's strategic intent, vision or mission statement, strategies, and core values.

Performance (P) - Performance is the degree to which an individual is able to accomplish a task or number of tasks.

Task / Technology Fit (TTF) - TTF is the degree to which the functionality of a KMS fits the requirements of the knowledge task.

Construct Relationship Table			
Relationship		Relationship	
CB	F	KM	OC
CB	IU	KM	P
CB	KM	KM	TTF
CB	KN	KN	F
CB	KT	KN	IU
CB	OC	KN	KT
CB	P	KN	OC
CB	TTF	KN	P
F	TTF	KN	TTF
IU	P	KT	TTF
IU	TTF	OC	F
KM	F	OC	IU
KM	IU	OC	KT
KM	KN	OC	P
KM	KT	OC	TTF

Do you feel that A impacts B directly or that B impacts A directly?

Can you give an example of how this relationship works?

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14. ABSTRACT

Task/Technology Fit (TTF) posits that as the intersection of the task domain and the capabilities of an information system (IS) increases in magnitude, the performance gains experienced by user through use of the IS will be positively impacted. While rooted in the traditional IS literature, this research proposes that TTF be extended to incorporate additional factors unique to the context of Knowledge Management (KM). Based upon the findings of this research, it is reasonable to conclude that when employing the TTF model to determine KMS fitness, additional factors other than the task requirements and KMS capabilities should be considered. This research also shows that the social ecology present within the organization has significant impacts on KMS fit. Finally, this research lends credibility to the idea that KMS are indeed a unique subset of IS and that traditional IS models (such as TTF) should reflect the unique social nature of KM.

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