

## BUILDING A THEORETICAL FOUNDATION FOR A LEARNING-ORIENTED KNOWLEDGE MANAGEMENT SYSTEM

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### ABSTRACT

*This article proposes a theoretical foundation for the design of a learning-oriented knowledge management system and contributes to knowledge management theory by conceptualizing a learning-oriented knowledge management system (LOKMS) following the approach to design theory espoused by Walls, Widmeyer, and El Sawy (1992). Open systems theory, Churchman's (1971) theory of inquiring systems, and Simon's (1960) intelligence-design-choice model are integrated to form a kernel theory for the LOKMS. A system architecture consisting of eleven basic modules is developed based on an analysis of Churchman's five fundamental inquirers and a synthesis of the basic elements into an LOKMS model that supports knowledge management and the decision-making process. This foundation may be used by future researchers to test not only the integrity of design theory, but also the effectiveness of all or parts of the conceptualized system. Implementation of this knowledge management system should provide an organization with enhanced organizational memory through active information discovery and organizational learning, and should contribute to both the theory and practice of knowledge management.*

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## INTRODUCTION

Knowledge management and organizational learning are common streams of research, both from a practical viewpoint (Bolloju, Khalifa, and Turban 2002, Churchman 1971, Davenport and Prusak 1998, DiBella and Nevis 1998, King, Marks, and McCoy 2002, Markus, Majchrzak, and Gasser 2002, Tiwana 2001, von Bertalanffy 1950) and from a research viewpoint (Alavi 2000, Alavi and Leidner 1999, Barney 1986, Simon 1957, Simon *et al.* 1987). Organizations have adopted knowledge management and organizational learning as concepts that may help them align themselves within a new competitive environment. A recent article by Zhang and Faerman (2003) indicates that although organizational learning has been primarily a management issue and knowledge management is often considered an information technology issue, the two disciplines are beginning to merge with a mutual understanding of knowledge and its origins. However, it appears that neither has offered a comprehensive foundation on which to build (Zhang and Faerman 2003).

Few researchers have attempted to establish a theoretical framework for knowledge management systems. An exception to this is recent work by Bolloju, Khalifa, and Turban (2002) on the integration

of knowledge management into enterprise decision support systems. This work is based on the knowledge spiral theory advanced by Nonaka (1991, 1994, 1998) and Nonaka and Takeuchi (1995). Research in the design of knowledge management systems with a theoretical foundation is also generally lacking, yet the practitioners in a recent study (King, Marks, and McCoy 2002) consider proper design and development of the system to be one of the most important issues facing knowledge management today. This research addresses the practitioners' concerns by conceptualizing a knowledge management system on a theoretical foundation and by using design theory (Walls, Widmeyer, and El Sawy 1992) as a focus mechanism.

An interdependency of knowledge management and organizational learning is apparent in much of the literature (Alavi 2000, DiBella and Nevis 1998, Simon 1957, von Bertalanffy 1950). Thus, a knowledge management system must both *manage* and *expand* organizational memory. A knowledge management system with a strong organizational learning foundation is believed to increase an organization's potential for effective action (Alavi 2000, Davenport and Prusak 1998, Grant 1996, Pfeffer and Sutton 1999). A learning foundation is one that facilitates organizational knowledge creation. This learning is dependent on a dynamic, yet

## CONTRIBUTION

This research contributes to information systems research by building a foundation for a learning-oriented knowledge management system, by outlining how the development of such a system may be enhanced by design theory as presented by Walls et al. (1992), and by addressing practitioner concerns during the conceptualization process.

This is one of very few studies that focus on knowledge management system design from a theoretical perspective. The choice of theories on which this model is based enhances the conceptualized system by providing decision and learning support as well as explicit knowledge management. The use of a specific design theory indicates that while conceptually complex, knowledge management systems can be developed using accepted design techniques. Further, attention to the concerns expressed by stakeholders during the design stage leads to a conceptualized model that is more likely to be effective and accepted in the organizational workplace.

This research is expected to be of interest to the academic community and other researchers in knowledge management or organizational learning domains. Researchers can use the foundation discussed here to test not only the integrity of design theory but also the effectiveness of all or parts of the conceptualized system. This research may also be of interest to practitioners who are charged with the responsibility of conceiving and overseeing the building and implementation of such a learning-oriented knowledge management system.

accurate organizational memory that is easily accessible and contains multiple perspectives. Additionally, learning systems must provide for information acquisition and sharing, as well as knowledge transfer and integration. The architecture on which to base this process should include features for facilitating information/knowledge acquisition, discovery, and sharing as well as supporting codification, storage, and management of explicit knowledge. However, little has been done to establish a theoretical foundation on which to build a learning-oriented knowledge management system.

This article proposes a theoretical foundation for the design of a learning-oriented knowledge management system, beginning with an inquiring system foundation (Churchman 1971), and using the design theory espoused by Walls and his colleagues (1992). First, design issues for a knowledge management system are discussed. Next, following Walls et al. (1992), a design product (the conceptualized learning-oriented knowledge management system) and a design process are developed, followed by introduction and discussion of the conceptualized system. Then, a discussion of implications to both knowledge management and design theory is presented.

#### **THE LINK BETWEEN ORGANIZATIONAL LEARNING, ORGANIZATIONAL MEMORY, AND KNOWLEDGE MANAGEMENT**

There has been increasing interest in a firm's intellectual capital and collective knowledge, and the means by which to increase it (organizational learning), store it (organizational memory), and manage it (knowledge management). Although often discussed separately, these three concepts are tightly interwoven.

Crossan, Lane, and White (1999) argue that organizational learning research is rich in understanding but lacking in theory; they further argue that knowledge management adds to the understanding of organizational learning but does not properly emphasize the acquisition and reuse of organizational knowledge (Crossan, Lane, and White 1999). They suggest five premises of organizational learning: 1) that organizational learning must

be concerned with new knowledge acquisition and creation, 2) existing knowledge must be reused, 3) learning must work on all levels within the organization, 4) learning must have a social orientation, and 5) an understanding of the interaction of cognition and action is critical. It is this last premise that separates organizational learning from knowledge management (Crossan, Lane, and White 1999). Each of the premises outlined above can be found in the learning-oriented knowledge management system conceptualized here.

For instance, the first premise is most prominent in the information gathering unit itself, the knowledge storage unit provides the ability for knowledge to be reused at any level of the organization (premises 2 and 3), and social orientation (premise 4) is supported by the use of experience and tacit knowledge throughout the system. The understanding of the interaction of cognition and action (premise 5) is supported by the foundations of the inquirers, each of which requires a proactive approach to knowledge generation, particularly in its feedback routine that senses the gap between the effect of a given action and the desired state. Consequences of an action (or inaction) become part of organizational memory. This is of particular importance to Stein and Zwass (1995) who believe that organizational memory systems must keep records not only on outcomes, but also on the processes and assumptions that led to the outcomes.

Argyris and Schön (1996) maintain that memory is necessary to support organizational learning. Organizational memory is considered distinct from individual memory in the same way that organizational learning is distinct from individual learning. Huber (1991) describes organizational memory not only as one of four constructs of organizational learning but also as a determinant of organizational learning and decision-making.

Chae, Hall, and Guo (2001) suggest that using Churchman's (1971) inquirers as a foundation for an organizational memory information system can support Huber's (1991) four assumptions about organizational learning: existence, breadth, elaborateness, and thoroughness. More learning occurs in an organization when:

- any of its units acquire knowledge and recognize it as potentially useful to the organization (existence),
- more of the organization's units obtain knowledge and recognize it as potentially useful (breadth),
- more varied information allows interpretations about the focal data (elaborateness), and
- more organizational units develop uniform comprehensions of the various interpretations of the focal data (thoroughness).

Recognizing information as useful in a given context (existence), sharing information between organizational members (breadth), access to a variety of information (elaborateness), and developing uniform comprehensions (shared mental models) of the interpretation of both information and problem structure (thoroughness) require that a multitude of perspectives in organizational memory must be maintained. Additionally, when an organization encourages members to broaden their own perspectives base, a broadening of decision context also occurs.

Organizational memory systems have been linked to the success model of DeLone and McLean (1992). For instance, Jennex, Olfman, Panthawi, and Park (1998) developed a model for evaluating the effectiveness of organizational memory information systems based on the DeLone and McLean model (1992). DeLone and McLean proposed an IS success model based on a review and integration of 180 research studies that used some form of system success as a dependent variable. They identified six different system success constructs and showed how they relate to each other. Jennex et al. (1998) adapted their model to provide an explanation of why an organizational memory system increases organizational effectiveness. Jennex and Olfman (2003) then extended the DeLone and McLean model (1992) to knowledge management success.

Huber's four assumptions of learning are also closely tied to facets of, or success factors for, knowledge management. A framework developed by Holsapple and Joshi (2000, 2002) examines characteristics of

knowledge management that incorporate previous knowledge management frameworks as well as features that are evident in the literature. The authors propose a threefold framework of knowledge resources, activities that manipulate those resources, and influences on knowledge management within the organization. They collected data that indicates their framework is generalizable, complete, clear, accurate, and precise (Holsapple and Joshi 2002). The knowledge management activities component alone supports Huber's assumptions: existence through acquiring and selecting information and knowledge for a given context, breadth and thoroughness through information/knowledge transferal, and elaborateness through organizational resource and external environment monitoring. The other components overlap these assumptions and provide support for knowledge management within the system. A knowledge management system that supports these assumptions should create a learning environment that falls naturally into the knowledge management framework. The LOKMS conceptualized here supports both Holsapple and Joshi's framework and Huber's assumptions by providing similar support particularly through the information-gathering unit and the knowledge creation unit.

Davenport, DeLong, and Beers (1998) suggest eight key factors for knowledge management projects. These include creating a knowledge repository, encouraging and facilitating communication among organizational members, improving knowledge access, and enhancing the knowledge environment. Cross and Baird (2000) suggest that knowledge retention is the key to building organizational memory from which knowledge may be transferred and leveraged across the organization. Individual memory and relationships are important to organizational growth and retention; important also are a database of "lessons learned" and knowledge embedded in processes. Providing a dynamic, accessible knowledge storage unit and a knowledge creation unit are two of the ways that the LOKMS conceptualized here facilitates these success factors.

In a review of knowledge management literature, Schultze and Leidner (2002) suggest

a definition of knowledge management as being the “generation, representation, storage, transfer, transformation, application, embedding, and protecting of organizational knowledge.” The authors note that research in knowledge management is a complex interdependency of collaboration (both in knowledge/information sharing and work), organizational memory, and organizational learning and stress that the social aspect of these characteristics implies a need for research methodologies beyond the traditional normative approach.

Social construction of organizational learning is an underlying theme of two of the dimensions of organizational learning as developed by Templeton, Lewis, and Snyder (2002). Of the eight dimensions of organizational learning mentioned by the authors, both communication and social learning are directly based on the social construct. Other dimensions, such as awareness of organizational memory and intellectual capital management are necessary tenets of knowledge management.

The critical characteristics of organizational learning, memory, and knowledge management must be considered when designing a knowledge management system that has a learning orientation. Design of the system must include a conceptual architecture that allows the organization to implement these critical and intertwined activities.

#### **DESIGN CONSIDERATIONS FOR A LEARNING-ORIENTED KNOWLEDGE MANAGEMENT SYSTEM**

Recent research suggests that practitioners have a definite sense of what a knowledge management system should provide. For instance, firms in Tiwana's (2001) study indicate that their knowledge management needs include capturing, storing, and retrieving intellectual assets, quickly finding pertinent information, and facilitating information/knowledge sharing. Practitioners in a more recent study (King, Marks, and McCoy 2002) include as major issues the ability to use a system for strategic advantage, the ability to verify both the relevancy and legitimacy of organizational memory

components, and the ability to maintain organizational memory currency.

Four necessary abilities of a knowledge management system emerge when the above practitioner concerns are synthesized. First, a knowledge management system must be able to handle storing and retrieving explicit knowledge in a dynamic organizational memory environment while facilitating organizational learning. Second, the system must be able to provide its users with confidence in the organization's memory through facets such as verifying accuracy, maintaining currency, and encouraging growth. Third, the system must be able to discover and retrieve useful information. Fourth, the system must encourage interactivity between organizational members. Support for these activities must be addressed during the design of a learning-oriented knowledge management system.

There is little published research in design theory for information systems although it is becoming more visible in recent years. One of the earlier design works is *The Design of Inquiring Systems* by C. W. Churchman (1971). Churchman speaks of the necessity to design systems as human-oriented, knowledge creating, and morally responsible systems. His idea of an inquiring system is one that not only manages but also creates knowledge, particularly by invoking challenge or verification processes.

More recently, Walls et al. (1992) introduced their design theory approach and developed a design theory for vigilant Executive Information Systems (EIS); Markus, Majchrzak, and Gasser (2002) used the suggestions made by Walls et al. to develop a design theory for Emergent Knowledge Processes. The small amount of research in this area both promotes the need to focus on design and illustrates the difficulties inherent in designing a major system. Walls et al.'s design theory improves the design process by focusing designers on developing system requirements and finding applicable theoretical foundations for a system designed to achieve those objectives.



### **Design Theory as a Focus Technique for Knowledge Management System Designers**

The architectural development process of the learning-oriented knowledge management system discussed here relies on the theory of information system design advanced by Walls and his colleagues (1992), who distinguish the design *product* from the design *process*. The design product consists of meta-requirements (the ultimate objectives for the system being designed), the meta-design (the class of artifacts hypothesized to meet the meta-design requirements), kernel theories that govern design requirements, and testable design product hypotheses. The design process consists of the design method, kernel theories that govern the design process, and testable hypotheses developed to determine whether the designed artifact is consistent with the meta-design.

Walls et al. (1992) explain these terms by using a relational database example. The meta-requirement is to reduce anomalies in a data structure; the meta-design is a normalized table. On the design process side, the design method is normalization, and the kernel theory for normalization is relational algebra. These components of design theory (design product and design process) are necessarily dependent on each other; the process must produce the product.

#### **The Design Product**

According to Walls et al. (1992), one of the first steps in design theory is to list the goals (meta-requirements) of the system. To establish the meta-requirements for a learning-oriented knowledge management system, it seems natural to first examine theories of organizational knowledge creation. Many of these, including the models of Argyris and Schön (1996) and DiBella and Nevis (1998), describe knowledge creation as a cyclical and continual process, heavily dependent on a comprehensive, dynamic, and accurate organizational memory store. Organizational memory must be as accurate as possible and yet contain as wide a range of perspectives as possible to efficiently facilitate problem solving and learning (Churchman 1994, Keeney and McDaniels 1999, Vahidov and Elrod 1999). Organizational learning/memory systems must be able to create accurate

knowledge in a given context, retrieve context-specific information, discover new information, and provide avenues for information and knowledge transfer and integration.

Thus, drawing from organizational learning theories and current knowledge management practitioner's concerns, many meta-requirements for a learning-oriented knowledge management system for inquiring organizations are evident. Among them are the abilities to:

- store and retrieve explicit knowledge in a dynamic organizational memory environment
- facilitate organizational learning
- provide users with confidence in organizational memory through facets such as verifying accuracy, maintaining currency, and encouraging growth
- discover and retrieve useful information
- encourage interactivity between organizational members (for example, information sharing and feedback)

Components that support these goals are found within the philosophical bases of Churchman's (1971) inquirers and the system that accommodates them, making a learning-oriented knowledge management system based on inquiry particularly suited to satisfaction of these meta-requirements. The flexibility of each inquirer, in combination with the design of the knowledge management system, gives an organization the flexibility and adaptability suggested to maintain a competitive and sustainable advantage (Barney 1986, Fulmer, Gibbs, and Keys 1998). These characteristics are a critical consideration for the meta-design of the learning-oriented knowledge management system.

The meta-design is a system capable of physically managing data during simple times, providing timely, applicable, accurate, and multi-perspective information for decision support systems, and facilitating organizational learning through knowledge creation and adaptation, particularly in "wicked" (Rittel and Webber 1973) situations. The kernel theory to

support the design product must be a theory that shares these characteristics.

Adaptability may be found in open systems theory (OST) (Morgan 1997, von Bertalanffy 1950, von Bertalanffy 1968). OST examines an organization for its ability to look beyond its boundaries for information and material, and to make changes in response to environmental input and learning. These changes are based not only on what it has experienced, but also on combining new information with human experiential knowledge. Weick's Enactment-Selection-Retention (ESR) model of organizing (1979, 1995, 2001) is also concerned with flexibility and information sharing. One of the main premises of ESR is that an adaptive organization is a collective action, and that influence comes not from positions that people hold in organizations, but from the pattern of communication and relationships inherent in any social organization.

Churchman's inquirers, open systems theory (OST), and Weick's ESR model all stress the need for communication and information sharing, and propose that an effective organization is a product of its environment, acts on its environment, and ultimately shapes its environment. Thus, each of these systems is suitable for both stable and unstable environments and is a potential design product kernel theory. A knowledge management design that uses Churchman's inquirers as a theoretical foundation goes a step beyond OST and ESR by facilitating knowledge creation within a framework of multiple perspectives that is based on a given reality's "truths." This enables the organization to learn at multiple levels, including single-loop (information gathering), double-loop (modifying organizational goals in response to a changing environment), and triple-loop (inventive learning, or "learning to learn" (Argyris and Schön 1996, Isaacs 1993)). Thus, the primary selected kernel theory for the design product is Churchman's inquiring systems theory, which is discussed below.

In his book *The Design of Inquiring Systems*, Churchman (1971) presents a discussion of different models of Western epistemology, each of which is an information building and verifying system that maintains a

centralized store of both verified and unverified (potential) information. Mason and Mitroff (1973) have suggested designing information systems based on Churchman's (1971) models of inquiry. Following Churchman and Mason and Mitroff, Courtney, Croasdell, and Paradice (1998), Courtney (2001), and Richardson, Courtney, and Paradice (2001) provide a new perspective on organizations by viewing them as inquiring systems or "inquiring organizations" whose actions create and maintain knowledge. The above work has been extended here to show that inquiring systems may provide a basis capable of supporting a learning-oriented knowledge management system.

Churchman (1971) described five categories of inquirers based on the underlying philosophies of Leibniz, Locke, Kant, Hegel, and Singer. These inquirers share capabilities and can work together in a system designed to maximize both knowledge management and knowledge creation. The Leibnizian inquirer maintains a set of elementary axioms and stored knowledge. After the system identifies a potential truth (i.e., a candidate), it uses its fact net (i.e., a knowledge store) to deduce the candidate's legitimacy. If legitimacy is found, the candidate is added to the knowledge store. In the Lockean inquirer, external/internal observations can become "knowledge" (asserted into a classified observation store) by consensus. The Kantian inquirer is an extension of the Leibnizian inquirer with the addition of a multiple model generator that incorporates various perspectives.

The Hegelian inquirer can be thought of as a system consisting of opposing Leibnizian inquirers with a synthesizing component that combines the strongest assumptions of each Leibnizian inquirer. The Singerian inquirer is the most comprehensive; it incorporates multiple perspectives and provides a highly organized process of validating information. In the face of no information inconsistencies to eliminate, the Singerian system challenges existing knowledge and works to refine the measures on which that knowledge is based (Churchman 1971, Courtney 2001, Courtney, Chae, and Hall 2000, Courtney, Croasdell, and Paradice 1998, Hall, Paradice, and Courtney 2001). The Singerian system strives, through the challenge process, to increase the number

of alternative perspectives considered by a decision maker. The more perspectives that are considered by an individual, the broader that individual's worldview.

Churchman's (1971) inquirers together encompass the functional, interpretive, and critical perspectives of knowledge management discussed by Schultze (1998). The functional perspective supports the idea that organizations use knowledge management to achieve organizational objectives, relying on known processes and information to facilitate organizational goals and minimally increase organizational knowledge. Such a perspective is adequate in situations where there are known variables, the problem is at worst moderately unstructured, and a solution is likely to be attained. The Leibnizian and Kantian inquirers incorporate this perspective.

Current approaches to knowledge management, which primarily emphasize software, are decidedly functional although group decision support systems can function under the interpretive perspective. The Lockean inquirer may also operate under the functional perspective, but can recognize the social aspect of consensus. When operating under this mode, the Lockean system has adopted the interpretive perspective, which applies a social theory to information, stressing communication and interpretation in the system. Under the critical perspective, most evident in the Hegelian inquirer, knowledge emerges from conflict and inconsistency.

The inquirers provide validity through the use of comprehensive guarantors. The guarantor of the Leibnizian system is its consistency and comprehensiveness implicit in the application of a formal proof to derive new

knowledge. The Lockean guarantor is consensus among the community's members. The Kantian system is concerned with modeling data, so its guarantor is the fit between the data and the model. The Hegelian guarantors are the process of surfacing assumptions through conflict and the unbiased nature of the over-observer. The guarantor for the Singerian system is the consistency implicit in measurement and replication. An overview of the inquirers is presented in Table 1.

While Churchman's (1971) inquirers are separate entities, they are discussed in terms of an overall knowledge creation and sharing system. A knowledge management system, however, requires more than the creation and sharing of knowledge. While the inquirers form the basis of a knowledge creation module within the knowledge management system, it is necessary to conceptualize a system that also aids decision-making and information discovery, provides temporal guidance, and routinely provides feedback. The theoretical foundation (kernel theory) which best provides these capabilities is Simon's (1960) Intelligence-Design-Choice (IDC) model.

The intelligence phase is an important, and often overlooked, stage of Simon's model that provides information discovery capability. This is the stage during which Simon says the environment is scanned for "conditions calling for decision." The task of the intelligence phase is to perform information acquisition, combine the acquired information with useful stored knowledge, identify possible opportunities or needs, and present it to the

**Table 1. Overview of Churchman's Inquirers**

	Guarantor	Knowledge Management Perspective	Problem Type
<b>Leibnizian</b>	Consistency	Functional	Structured (has a solution, allows for analytical formulation (symbolic representation))
<b>Lockean</b>	Consensus	Functional, interpretive	Structured, has a strong consensual position
<b>Kantian</b>	Fit between data and model	Functional	Moderately unstructured, may not have clear solution, allows for analytical formulation
<b>Hegelian</b>	Conflict, over-observer	Critical	Unstructured, conflictual
<b>Singerian</b>	Measurement and Replication	Functional, interpretive, and critical	Structured, moderately unstructured, unstructured



decision maker. The design phase is the period during which the actions necessary to reach the desired state are determined; Simon also refers to this as the immediate problem space. Simon's design phase is the point at which a system is actively working to create the knowledge necessary to focus the problem space on the current problem, thus enabling the widest range of appropriate solutions to be generated. The most appropriate action is selected during the problem resolution, or choice phase.

Churchman's (1971) inquirers, in harmony with Simon's (1960) Intelligence-Design-Choice model, form the theoretical basis for the design product, which is the learning-oriented conceptualized knowledge management system. Now that the product has been defined, the elements of the process must be considered.

### The Design Process

In their paper, Walls et al. (1992) design an Executive Information System (EIS) using their two-part design theory. The design product consists of meta-requirements, a meta-design, kernel theories to govern design requirements, and testable product hypotheses. The design process includes the design method, kernel theories to support the design process, and testable hypotheses. The design process must support the meta-requirements and meta-design obtained from the design product. Meta-design and design method may be difficult to distinguish; examples included by Walls et al. (1992) include an information systems dependability model where the meta-design is cost effective controls and the design method includes procedures such as a morphological approach for identifying controls and pairwise comparisons for model parameters. The database example uses a meta-design of normalized tables and a design method of normalization procedures. The emphasis placed on the design method is that of "ability to" – that is, the procedures by which the meta-design may be realized.

The meta-design of the LOKMS includes data management, support for organizational learning and adaptation, and generating information that is applicable to the problem at hand, is accurate, is timely, and

conveys multiple perspectives. The design method for the LOKMS is the procedures necessary to guarantee management, applicability, accuracy, timeliness, inclusion of multiple perspectives, and support for organizational learning. The ability to produce the design product is handled collectively by the eleven components discussed later. These components are derived not only from the meta-design of the LOKMS, but also from the meta-design of the inquirers themselves.

In the case of Churchman's inquiring systems, each of the five inquirers contains both the design method (procedures to verify accuracy, timeliness, etc.) and the kernel theory (Churchman's (1971) philosophically founded system theory) required by Walls et al. (1992). The kernel theory is evident in the underlying philosophical foundations of each inquirer (Kant, Singer, etc.) while the design process is evident in the capabilities that make up the inquirers.

Churchman's detailed descriptions of each inquirer make interpretation of what is expected of that inquirer fairly straightforward. As described above, each inquirer has particular strengths and areas in which it most naturally functions. Separately, each inquirer is self-supporting and efficient. Incorporating all five inquirers into a working system, particularly a complex one that supports not only decision-making but also the creation and management of knowledge on which to base those decisions, requires that supporting components for that system be derived. These components are derived from both an understanding of the workings and underlying philosophy of each inquirer, and from a thorough reading and interpretation of Churchman's work.

To begin this process, one must consider those characteristics that are most critical to the effective operation of the inquirer. These components become evident when the inquirer is reduced to its most basic parts. Take, for example, the Leibnizian inquirer. This simple inquirer contains only three storage elements (fact net, axioms, and potential candidates) and one simple procedure – to match new information (potential candidates) against what is known (fact net and axioms). While simple in concept, this

system relies on several capabilities to work efficiently. For instance, the system must be able to rely on its axioms, indicating that some sort of error checking must be present. A component must be in place to prevent erroneous information from being placed in the fact net, and a component must be available to remove items from the fact net that no longer have temporal feasibility.

Churchman writes about the need for an inquirer to routinely examine itself in order to assure validity (Churchman 1971, p. 129) and maintains that an inquirer must contain a filter that ensures that valid assumptions are stored in the knowledge base and that potential assumptions are not lost or forgotten (Churchman 1971, p. 96). From these (and other) statements, the concept of verification components arises, and hence the conceptualization of the basis, environmental, self-adaptation, and analysis integrity verifiers. Other components that can be derived are the time/space assessor, resource monitor, hypothesis production monitor, best-fit analyzer, executor, best measures guarantor, and system guarantor. It is not implied that these components are the only ones that can be conceptualized from Churchman's (1971) work. However, these components appear to

be critical to support the work of the inquirers, and therefore, the work of the learning-oriented knowledge management system conceptualized here. Table 2 introduces the components that appear in each philosophical basis; a discussion follows.

The first component listed in Table 2, the basis verifier (1), is critical to organizational memory. Because organizations must rely on their knowledge bases as being true, assumptions and comparisons made as the system progresses and learns may be compromised if there is not a facility for accuracy. If any of the information in a knowledge base is incorrect, the system will reach the wrong conclusion about any item compared to the incorrect base item. Additionally, it will reach the wrong conclusion with all items subsequently compared to any aspect of the base built upon the initial erroneous conclusion.

The environmental verifier (2) is also critical. Much like the necessity to verify knowledge base information, knowledge store components of a system (basis or new knowledge) that have become outdated can cause errors to perpetuate throughout the

**Table 2. Critical Components and Suggested Components**

	<b>Critical Inquiring System Requirements/Meta-design Elements</b>	<b>Necessary Procedure</b>	<b>Suggested System Component</b>
1	Accuracy of system basis	Verification of system basis	Basis Verifier
2	Knowledge store continually reviewed for accuracy in changing environments	Pairwise, triplet, etc. comparisons	Environmental Verifier
3	New action requirements	Cross check between knowledge store components	Self-adaptation Verifier
4	Prevents other knowledge store components from being assimilated because of an error	Segregation of new knowledge store components until re-checked; requires relationships between knowledge store components	Analysis Integrity Verifier
5	Time/Space Assessment	Time delineation	Time/Space Assessor
6	Prevents resource exhaustion	System monitoring	Resource Monitor
7	Prevents over-production of candidates	Scope delineation	Hypothesis Production Monitor
8	Guarantees best fit	Model analysis	Best Fit Analyzer
9	Guarantees efficient executor	Model verification/guarantor invocation	Executor
10	Guarantees best measures	Challenge known measures or measure component	Best Measures Guarantor
11	Guarantees accurate system		System Guarantor

system. The environmental verifier ensures the knowledge base is not outdated by constantly reviewing information in the knowledge store and moving information that has become outdated to the potential knowledge store. The self-adaptation verifier (3) allows a system to support management by preparing reports of recommended action in the face of new knowledge or changing conditions. This component monitors knowledge base changes to identify new relationships or new knowledge.

The analysis integrity verifier (4) and the time/space assessor (5) are important to the efficiency and accuracy of a system in much the same way. Prevention of storage or use of knowledge based on error is obviously ill advised; however, many systems have been designed that do not verify the accuracy of their internal models and therefore propagate incorrect information. The time/space assessor provides an ability to mark a system's location in time and space. It refers to a system's ability to follow time-critical missions of the organization, and to ensure that all temporal considerations of the organization are met.

Because inquiring systems are dynamic in that they continuously test candidates to see if they can be added to the knowledge store, resource monitoring (6) is important. There can also be a problem with generating so many candidates for consideration that new ones are too closely related to existing facts to be of any new value, giving rise to the need for a hypothesis production monitor (7). When models are generated in an inquiring system, it is important to ensure that the best data-to-model fit has been found, requiring a formal analysis component and a component that monitors the results of the best-fit analysis and prevents models from being considered if the model is not performing efficiently (8). This process requires a model comparison component to determine each model's efficiency, and then prevent a model from working or allow each model to proceed as necessary. The last components work toward system and knowledge accuracy by examining outcome validity and system accuracy (9), and by looking for disagreements to resolve, and when no disagreements can be found, forcing disagreement by challenging known measures or a component of a measure (10, 11).

A short case that includes some of these components is presented following development of the model. The case discussion illustrates how the components discussed above fall naturally into the conceptualized model, and how lack of such components led to problems for an academic center.

While the entire learning-oriented knowledge management system outlined below is necessary to satisfy the meta-requirements outlined previously, it is the process of the inquirers themselves, particularly in the area of knowledge creation, adaptation, and verification that provides the pivotal process that underlies the final system. Each of the components has the ability to achieve the goals for a knowledge management system. For instance, the resource monitor and hypothesis product monitor achieve the goal of making the system stable. The best-fit analyzer achieves the goal of making the best decision given the context and current information. Confidence in both outcomes from the system and in use of the system is bolstered by knowing that the system's data is timely and as accurate as possible under a given context. The verifiers and the time space assessor all contribute to the integrity of the knowledge base. Lastly, the guarantors contribute to user confidence by guiding the system through appropriate paths and generally overseeing the sanctity of both the system and its knowledge base.

With the design product and the design process in place, most of the steps for Walls et al. (1992) design theory are complete. Before hypotheses can be generated and tested, however, the complete system must be conceptualized.

#### **THE CONCEPTUALIZED LEARNING-ORIENTED KNOWLEDGE MANAGEMENT SYSTEM**

The components discussed above are critical in designing systems that will enhance organizational decision-making, knowledge creation, and knowledge management, both now and in the future. It is therefore important to identify how the components described thus far could be integrated into a functioning system. Figure 1 illustrates a conceptual

model of a knowledge management system based on work by Paradise (1992) and Paradise and Courtney (1986, 1987). That work, originally based on the Kantian philosophy, was shown to perform knowledge management activities at a level comparable to human subjects. Additionally, the model has a strong managerial aspect indicative of its social perspective.

In Paradise's basic conceptual model (Figure 1), the manager or decision maker is the central figure, working closely with the system to define new knowledge that is valuable to the organization and place that knowledge in the knowledge base. The decision maker, using experiential knowledge, defines possible relationships between variables contained within the organization's database. The manager develops a hypothesis of the relationship. The analysis module tests this hypothesis and the results are returned to the decision maker. If the decision maker determines the results of the analysis to be valuable, the results are placed in the knowledge base. If not, the relationship is returned to the store of potential relationships for possible examination at a later date. The advisory module can produce models based on the hypothesis, and the discovery module can use existing knowledge in the system to generate new hypotheses.

The learning-oriented knowledge management system conceptualized here

enhances the conceptual model such that it is applicable to not only the Leibnizian, Lockean, and Kantian philosophies, but is capable of supporting the Hegelian and Singerian philosophies as well. For instance, the Singerian philosophy is very focused on the continual infusion of environmental variables. An environmental variable component within the information-gathering unit provides this necessary input. Additionally, the Singerian system is sensitive to units of information measurement, challenging and refining the units to find the most applicable information to use in problem solving. The Hegelian system accomplishes this by applying thesis/antithesis scenarios and applying a methodology to synthesize applicable information from both sides. These philosophies rely on the human component and recognize the value of multiple perspectives that are unique to individuals involved in a problem solution. The importance of the decision-making individual or organizational group is evident in the LOKMS; perspectives are evident not only in the human component but in the knowledge stores that include explicit knowledge (database), elements of tacit knowledge such as narratives, explanations, and links to experts (knowledge base), and miscellaneous stores of knowledge that may be useful should items in the knowledge base or database change (potential knowledge). Figure 2 extends the basic conceptual model to incorporate all of the components that are described here.

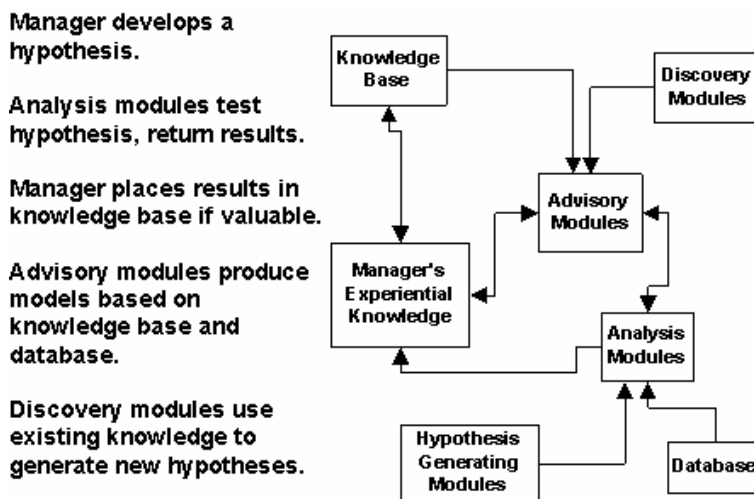


Figure 1. Basic Conceptual Model of a Knowledge Management System

The pattern of human/system interaction described above is also evident in the conceptualized knowledge management system illustrated in Figure 2. After the Information Acquisition/Hypothesis Generation module has generated potential opportunities or needs, the decision maker uses tacit knowledge to determine the value of the acquired information in the context of a given situation and possibly determines a new desired state. If the newly acquired information is valuable, the decision maker will formulate a hypothesis and pass it to the

advisory module that then can produce models based on the hypothesis. If the information is not considered valuable in the current context, the information is placed in the potential knowledge store for consideration under different circumstances. The result of these models may be a new desired state and the steps necessary to achieve a desired state, or the analysis of a hypothesized desired state specified by the decision maker. This result is then passed along with the relevant variables to the design phase.

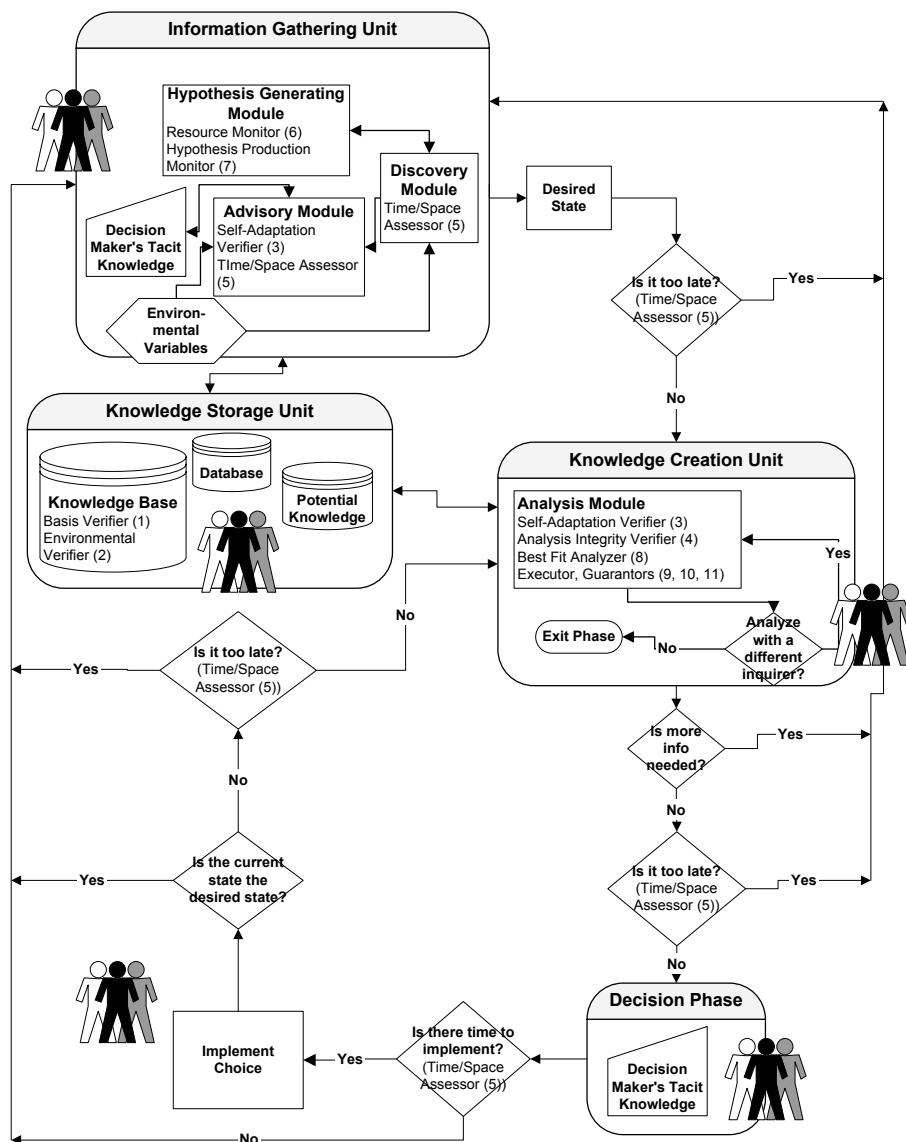


Figure 2. Conceptual Model of the Learning-Oriented Knowledge Management System



The design phase is responsible for analysis of the problem and the desired state, utilizing any one or more of the five inquirers implicit in the system. A decision maker is then able to use the results of the analysis from the design phase, in combination with that individual's tacit and experiential knowledge, to choose an action that will begin the movement from the current state to the desired state. Throughout the system are a number of loops that provide feedback and time/space analysis on the course of the chosen action toward the goal of the desired state.

The components merged into this model do not substantially change the way the conceptual model works. Each of the eleven inquiring components (see Table 2) serves as data integrity and system integrity checks. Four of the components (4, 8, 9, 10) are directly involved with analysis of hypotheses, while three of the components (5, 6, 7) are involved with hypothesis generation. Components 1 and 2 are both concerned with maintaining the integrity of the knowledge base. Component 3 plays an important role in supporting management by affecting the advisory module and component 11 impacts the knowledge creation portion of the system.

By expanding the conceptual basis of the basic model to include other philosophical bases, a broader range of problem solving capability is expected to emerge. This will enhance the ability of the decision maker to draw on a decision support system when making critical decisions, and should allow for routine problem solving at the machine level.

The learning-oriented knowledge management model itself (see Figure 2) follows the familiar Intelligence-Design-Choice (IDC) model (Simon 1960). Unlike many traditional support systems that emphasize choice, the emphasis in a knowledge management system based on an inquiring system is on information acquisition/discovery and hypothesis generation (intelligence phase), followed by knowledge creation (design phase), and then decision support (choice phase).

In a learning-oriented knowledge management system, the information gathering/hypothesis generating phase is an

ongoing phase that performs the actions necessary to update the existing knowledge base, detect an opportunity or need, develop hypotheses regarding relationships of newly discovered information, and define a desired state that may be a goal or direction recognized as possible after analysis of new information. The knowledge creation phase is responsible for analysis of the hypotheses and the desired states, utilizing any one or more of the five inquirers implicit in the system, adding to the knowledge stores as knowledge is created. A decision maker is then able to use the results of the analysis from either previous phase, in combination with that individual's tacit and experiential knowledge, to choose an action that will begin the movement from the current state to the desired state, which is in essence a decision support step.

While the system described here may, at first, seem to deal only with explicit knowledge, tacit knowledge is in fact an integral part of it. The technological system conceptualized here is by definition constrained to contain only explicit knowledge and pathways (links) to tacit knowledge via contact information for individuals with particular expertise. The overall system has two specific areas that are dependent on tacit knowledge. The first is the decision maker's tacit knowledge as input to the information-gathering unit, and the second is the decision maker's tacit knowledge as the only component of the decision phase. Additionally, the emphasis on individuals or groups in the decision process is shown throughout the model. Two elements required to support tacit knowledge are information acquisition and sharing. These are supported by the information-gathering unit of the model, and with organization wide access to the knowledge storage unit. The concept of organizational learning is truly one of growing organizational memory through both explicit and tacit knowledge expansion of individuals for which this system provides support.

Of particular importance to the development of this model is the notion of feedback in the overall process of knowledge creation and decision aid. Much of the decision support literature focuses on Simon's (1960) IDC model as a non-inquiring

philosophical basis for the development of decision support systems (DSS). "Choice" is interpreted as the selection of a particular DSS alternative, implying that a decision is made. However, Simon (1981) also notes that non-artificial, self-adapting systems (i.e., living systems capable of learning) exhibit feedback characteristics, and states that without the ability to continuously define the current state in its relation to the desired state and the actions necessary to close the gap, growth cannot occur. Important to this idea is the notion of a long-term memory that contains not only a set of facts, but information about those facts, such as what action each fact suggests (Simon 1987, Simon 1997, Simon *et al.* 1987<sup>1</sup>). When a long-term memory store (such as organizational memory) stagnates, growth is impeded. Unfortunately, humans have not effectively built this characteristic into the otherwise sophisticated artificial systems they have constructed.

The learning-oriented knowledge management system modeled above clearly is designed to satisfy the stated meta-requirements of a knowledge management system, as is required by the design theory utilized. The meta-requirements determined for a learning oriented-knowledge management system and the components or modules that facilitate the meta-requirements are summarized in Table 3.

### Applying the Model to an Academic Center

This model can be applied to an actual organization to explain why the organization failed to achieve its goals. The Center for the Management of Information Systems (CMIS) at Texas A&M University (Richardson, Courtney, and Paradise 2001) provides a good example. CMIS was successful in many ways, but it could have had greater success faster if a learning-oriented knowledge management system had been in place.

Consider first the knowledge storage unit in the model (see Figure 2). CMIS was established in 1989 as part of the Department of Business Analysis and Research in the College of Business Administration. This

particular department contained faculty in three disciplines: MIS, Operations Management (OM), and Management Science (MS). However, the first definition of the Center's *raison d'être* suffered from excluding any attempt to incorporate the views of the various stakeholders in the department. Specifically, the OM and MS faculty were not involved in the development of the original CMIS charter. Thus, the "basis" for knowledge in CMIS was flawed. A basis verifier could have avoided the problem. An environmental verifier would have exposed the incongruence between the Center's knowledge basis and the environment of the department. Notably, this oversight in the development of the Center charter led the slighted faculty members to be suspicious of CMIS activities and initiatives; these suspicions took years to abate. One such faculty member said the original charter was developed "under a cloak of darkness."

Many of the components for the information-gathering unit were in place. For instance, the academic environment required periodic reports of CMIS initiatives and activities (self-adaptation verifier). The academic calendar itself imposes a natural time/space constraint against which assessments may be made. Because Texas A&M University is a large state university, the resources of CMIS were carefully audited and funds were encumbered as necessary (resource monitor) to pay for activities and initiatives. A primary job of the CMIS Director was to develop new Center initiatives while still teaching and conducting academic research. The process of "hypothesizing" new ideas that would bring positive returns on investments or otherwise further the mission of CMIS was not an activity that required monitoring due to over-production. More often, the Director's challenge was to generate enough ideas to keep the Center's benefactors engaged and to motivate faculty and students to participate. Had the Center had an effective information-gathering unit, opportunities to engage benefactors and motivate participants may have been more evident to the director. While the lack of these components caused problems, a more evident lack of architecture comes from

<sup>1</sup> Simon, Dantzig, Hogarth, Plott, Raiffa, Schelling, Shepsle, Thaler, Tversky, and Winter 1987

**Table 3. Summary of Meta-requirements and Facilitators**

Meta-requirement	LOKMS System Facilitators
Dynamic organizational memory environment	Knowledge storage unit, feedback loops, information gathering unit
Facilitate organizational learning	Knowledge storage unit, feedback loops, knowledge creation unit, information gathering unit
Provide user confidence	Basis, environmental, self-adaptation, analysis integrity verifiers, time/space assessor
Discover and retrieve useful information	Information gathering unit
Encourage interactivity	Knowledge storage unit, feedback, social knowledge management perspective

the overall model. Lack of adequate feedback loops in the process subverted the effectiveness of the information-gathering unit.

This absence was a significant factor in the Center’s shortcomings. Often, feedback from students did not occur because they under-estimated its value to the Center. Feedback from faculty rarely occurred because the faculty was difficult to engage in CMIS activities and many were actively suspicious of the Center and its goals. Feedback from the corporate sponsors of the Center was spotty at best. Some sponsors were not actively engaged and some provided feedback only on activities or initiatives that interested them. Other sponsors, however, were always supportive regardless of the activity and thus their feedback lacked some veracity.

Turning finally to the knowledge creation unit (and omitting components already mentioned above), the model provides measurement-oriented components that could have greatly benefited CMIS. The basic measurement of CMIS performance was the level of corporate sponsorship. When it was stable or increased, CMIS performance was “good.” Other models of performance measurement were needed. The notion of a best-fit analyzer might have driven the CMIS Director to develop other measurement models. Because the CMIS Director served as the Executor, Best Measures Guarantor, and System Guarantor, the CMIS “system” lacked an objective overseer to challenge the Director’s measures. Here again, feedback from stakeholders in the system could have facilitated the Director’s learning about CMIS and the environment in which it operated. For

additional information, see Richardson, et al. (2001).

**Deriving and Testing Hypotheses for the Model**

To complete the steps outlined in Walls et al. (1992) design theory, hypotheses must be conceptualized and tested. In a system as broad as the one conceptualized here, there are many avenues of hypotheses available. Hypotheses may be derived from a user orientation, such as issues of confidence in, satisfaction with, or ease of use of the system. Such hypotheses could be tested once all or a substantial portion of the conceptualized model (design product) has been implemented. Similarly, other performance measures may be derived, such as ability to facilitate argument resolution or social construction of knowledge. Again, these are appropriate hypotheses for testing the design product.

When attempting to build theory, however, it is appropriate to first derive hypotheses designed to test the design process. These types of hypotheses may test the components of the system individually, or may test portions of the system based on a particular philosophical basis. Examples of such hypotheses are “a system with an environmental verifier is more likely to perform well beyond a stable environment,” or “implementing the Leibnizian philosophy will lead to better outcomes in a structured problem scenario (versus a non-philosophically based system).”

Some components of this model have been developed and tested. The basis and environmental verifier components have been tested to determine whether they reduce

redundancy and error in a fact net; this was supported. Elements of the Singerian inquirer have been tested to determine that inquirer's impact on use and generation of multiple perspectives; these were also supported. The ability of an element of the Singerian inquirer was also tested for its ability to reduce perspective-bias, which was also supported (Hall and Paradise 2002).

These tests show that a learning-oriented knowledge management system, based on a foundation of inquiring systems, function appropriately in a testing environment. The conclusion may be drawn therefore that the theoretical basis for this knowledge management system design is appropriate.

#### IMPLICATIONS AND FUTURE RESEARCH

Walls et al. (1992) called for the information systems field to begin to develop theory based on endogenous paradigms rather than based on other disciplines. This research, particularly the development of the conceptual model, is based heavily on the work of Churchman (1971), whose work certainly falls within the information systems discipline. Walls et al. (1992) illustrated the use of their design theory to conceptualize a vigilant information system based on expert systems theory and suggested that other systems may be designed using their process. This research has taken a much needed step toward specifying how a knowledge management system should be designed at a high level and how individual component testing is appropriate when testing kernel theories at the design process level.

This work illustrates the use of design theory to conceptualize a learning-oriented knowledge management system. Walls et al. (1992) talk about both the design *product* and the design *process*. This research presents the design product in whole (the conceptualized learning-oriented knowledge management system) and portions of the design process (the components). The method of design for the other potential components identified as a result of this research is the conceptualization of methods to achieve other meta-requirements. Such work would be analogous to the suggestion made by Walls et al. (1992)

that the normalization procedure is a design method that achieves the goal of reducing certain anomalies in a database. Each of the components identified in this research has the ability to achieve the meta-design for a knowledge management system. For instance, the resource monitor and hypothesis product monitor achieve the goal of making the system stable. The best-fit analyzer achieves the goal of making the best decision given the context and current information. Confidence in both system use and outcomes is bolstered by knowing that the system's data is timely and as accurate as possible under a given context. The verifiers and the time space assessor all contribute to the integrity of the knowledge base. Lastly, the guarantors contribute to user confidence by guiding the system through appropriate paths and generally overseeing the sanctity of both the system and its knowledge base.

Of particular importance in this model is the knowledge store that represents organizational memory. A centralized knowledge store is part of the design of an inquiring organization. Whether the knowledge resides in explicit form in a database or knowledge base, or resides in the tacit knowledge of its members, an inquiring organization manages knowledge so that all organizational members can either access the explicit knowledge or access the individual in possession of the tacit knowledge. The inquiring system supports organizational memory verification and expansion in three explicit ways. First, it allows for storage of explicit knowledge that is not yet useful, but might become useful in different situations or as new knowledge is acquired. These data stores are referenced continually throughout the learning process. Second, the models based on the data stores are updated continuously, and any information found in any of the stores is routinely examined to determine its continued accuracy or relevance, especially those items that are time sensitive. Third, a centralized knowledge store increases the capacity for storage of organizational knowledge and decreases the problems associated with de-centralized storage such as the existence of multiple heterogeneous data and knowledge bases, knowledge stores that



are inaccessible to some of the organization, and redundancy.

The model conceptualized in this study contributes to knowledge management system theory by virtue of its emphasis on information acquisition and discovery. The intelligence phase of Simon's (1960) Intelligence-Design-Choice model is often overlooked and yet it is an important (arguably critical) factor in information acquisition/discovery and hypothesis generation. The knowledge management system conceptualized here places much of its energy in its support of intelligence phase activities, and is heavily rooted in decision theory, particularly in its attention to current state vs. desired state issues. Additionally, a system based on this model will have a degree of autonomy, responsiveness, and proactiveness, allowing it to perform its functions in a continuous fashion as appropriate, reacting to changing conditions as well as to human requests. For knowledge management particularly, elements such as these are critical to the characteristics of continuous information gathering, responsiveness to changing conditions, and diligent knowledge integrity checking.

The knowledge management system conceptualized here contributes to efficient decision-making and effective use of knowledge and knowledge creation. These processes are critical to an organization in today's turbulent environment. It is not enough, however, to design and implement such a system. Interaction between the system and the users must be carefully orchestrated from the beginning. Mumby (2000) states that organizations are "intersubjective structures of meaning that are produced, reproduced, and transformed through the ongoing communicative activities of its members," which is a very humanistic definition.

An effective, accepted knowledge management system such as that conceptualized here can empower individuals or groups to make decisions with increased knowledge, can help organizations manage diversity through an increase in organizational common knowledge, and can support a wide array of knowledge creating behaviors. This system does not ignore the importance of developing and maintaining the tacit

knowledge of organizational members and the importance of encouraging communication between these members to improve the organization's common knowledge, or organizational memory. Information acquisition and sharing are critical to accurate problem definition, knowledge creation, and organizational learning, and must also be approached from the social perspective. The conceptualized knowledge management system presented here is fully capable of working within the social perspective.

Development of this model will ensure that organizations can utilize a system that is capable of creating and managing knowledge, aiding decision makers, and maintaining a verified store of knowledge ready to assist in both decision-making and knowledge creation. Further, the broadened scope of organizational memory that results from the perspective-generating component may provide organizations with increased creativity and innovative thinking, which will ultimately lead to effective organizational learning. By using such a system, managers can focus on the task of guiding an organization to its ultimate success rather than expending energy sorting through information to make accurate and timely decisions. The conceptualized knowledge management system presented here can offer expedient and accurate assistance in most organizational environments.

Much work remains to be done in the building and testing of the LOKMS. It will be necessary to further define each module of the system for inquiring organizations and to test the concepts against known organizational goals. A thorough review of available technology that can be assimilated into this system will be required. The way that those technologies will function together and provide support to the decision maker(s) and to other participating technologies must be considered. The impact of such a conceptual system on organizational culture must be examined. Eventually, such a system must be developed and tested prototypically.

The technological side of this process is fairly straightforward – it is estimating and testing the impact of the system on the organization that is a difficult yet critical step. For instance, how will organizational members



accept the system? What employee additions/deletions/changes will be required? At what point should the system be introduced to the employees? Is training necessary? These are not questions that are easily measured or easily resolved and are appropriate for future research endeavors. In addition, a knowledge management system is likely to affect changes within the organization, and inter-organizational communication will begin to play a larger role as organizations are forced to participate in a more global economy. With executives being less tied to decision-making processes, more time may be spent defining the organization's goals. The impact of this system on the organization's structure, processes, and communication modes should be examined.

An interesting research question will be how to time the feedback loop tests in this system. The system must be able to initiate this critical testing at the right time to ensure that the path being taken is the correct one. Assessment of the current state is another interesting issue. This is an issue of critical timing and of providing an appropriate analysis. Therefore, research into the appropriate assessment tool or tools is important.

Design theory also provides avenues of future research. Researchers may choose to continue to support design theory by designing and testing components and systems, and in doing so, may add to the theoretical foundations of information systems. Perhaps

development of new kernel theories, specific to information systems, is in order.

## CONCLUSION

This research has contributed to knowledge management theory by conceptualizing a learning-oriented knowledge management system with a theoretical foundation. This LOKMS is designed to address practitioner concerns that have become evident in recent research. In addition, this research contributes to design theory by showing that the design theory as presented by Walls, et al. (1992) can be used to conceptualize a theoretically based learning-oriented knowledge management system. By doing so, this research has established a theoretical foundation for knowledge management system design by combining Churchman's (1971) inquiring systems and Simon's (1960) Intelligence-Design-Choice model. This foundation may be used by future researchers to test not only the integrity of design theory but also the effectiveness of all or parts of the conceptualized system. Implementation of this knowledge management system should provide an organization with enhanced organizational memory through active information discovery and organizational learning. In addition, the organization may benefit from the use of a system strongly focused on both temporal and contextual feedback. By focusing on the issues espoused by practitioners today, this conceptual model provides both theoretical and practical application.

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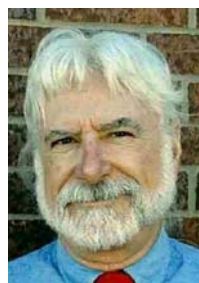
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