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Abstract

Organizational memory (OM) is becoming increasingly important as a key to organizational learning, which in term, is considered to be an aspect of maintaining competitive advantage. Technology can help or hinder OM and learning, depending on its proper reflection of the organization's needs. This paper examines different organizational forms and their OM needs by examining the underlying philosophies of Churchman's five inquirers as discussed in The Design of Inquiring Systems (Churchman, 1971). These inquirers provide insight into the OM technology needs of organizations with different structures. This insight leads to the conceptualization of learning systems and their representative technologies.

Introduction

While research exists in organizational memory (OM) and organizational memory information systems (OMIS), little of it has been directed toward studying OM with consideration of *different* types of organizations and units. In two studies, organizational form has been shown to impact OM. In a simulation-based study, Sandoe and Olfman (1994) used three forms (hierarchy, network, and hub) and found that different organization forms had differing sensitivity to various influences (IT, environment, etc) on OM. Karsten's (1996) case study also found impact to OM in different organizational forms (entrepreneurs, hierarchy and network) in which interdependence and collaboration are the key issues in network forms, and the common information space is the main manifestation of OM. According to that case study, the role of individuals is central to an entrepreneurial form, but some transformation mechanisms and a common information space are also needed. In the hierarchical form, the focus is on transformation mechanisms (the enforced routines), although the common information space, while limited, is still important for top management in this form.

Discussion in organizational memory seems to exclude discussion that acquisition of OM may be different between organizations or unit(s). Organizations have different histories and experiences (Levitt and March, 1988) that are reflected in mental models and consequentially lead to different learning styles. These learning styles also create different organizational knowledge bases. Levitt and March believe that some organizations rely more heavily on tacit knowledge than do bureaucracies. Organizations in complex and uncertain environments rely more on informal knowledge than do organizations in stable environments. Generally, higher-level managers rely more on ambiguous information rather than formal procedures and rules.

The literature in organizational memory seems to consider only one type of OM and OMIS for all types of organizational forms. This may lead to neglect of the need for different information technologies to support different OM or organizational knowledge bases within organizations or units with different learning styles. For example, a learning style based on shared understanding is likely to result in consensus-based knowledge that might be different from idiosyncratic knowledge created from a conflictual learning style. As a result, the classification system of the OM may differ and there may be the need for different OMIS that would be suitable for different OM and knowledge types.

This paper examines the process of outlining the role of information technologies systems (IT) for organizational memory within organizations or units having forms or different learning styles by considering these from within a framework of Churchman's (1971) inquiring systems and Courtney et al.'s (1996, 1997, 1998) inquiring organizations. It is believed that Churchman's inquiring systems can provide valuable insight into OM and IT to support OM containing different structures of organizational

knowledge created by different organizational forms or learning styles. These inquirers lead to the conceptualization of learning systems. This paper is organized in the following manner. The role of organizational memory for organizational learning is described. Next, five learning systems in the context of inquiring organizations are developed. Finally, the role of IT to support different learning styles and OM is discussed.

Organizational Memory and Organizational Learning

Many organizational learning researchers define organizational memory as the key to the success of organizational learning (e.g., Argyris and Schon, 1978; Huber, 1991; Levitt and March, 1988). Without OM, organizational learning may be impeded. Poor OM is likely to make organizational learning slow and inefficient. Levitt and March (1988) (and others) view organizational learning as routine-based and history-dependent. Organizations learn only through the experiences and actions of individuals. It is not until individual knowledge becomes part of the OM (and therefore accessible by other components of the organization) that organizational learning really occurs (Argyris and Schön, 1978). Garvin (1993) states that learning organizations should be skilled at learning from their own experiences and the best practices of others, and in transferring knowledge quickly and efficiently throughout the organization. Grant (1996) says learning is not only about transferring knowledge, but also about integrating it throughout the organization. Argyris and Schön (1978) maintain that memory is necessary to organizational learning. OM is considered distinct from individual memory in the same way that organizational learning is distinct from individual learning. Huber (1991) describes OM not only as one of four constructs to organizational learning but also as a determinant of organizational learning and decision-making. Stein (1995) states that OM is essential to organizational learning, while learning is a necessary condition for memory.

We suggest that the use of organizational memory can support Huber's (1991) four assumptions about organizational learning: existence, breadth, elaborateness, and thoroughness. More learning occurs in an organization if:

- any of its units acquire knowledge that it recognizes 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 (thoroughness).

Well-designed organizational memory will enhance knowledge acquisition, knowledge interpretation, and knowledge sharing. Ideally, all employees can use OM, which is a concept behind "informating" (Zuboff, 1988). Corbett et al. (1999) claim, however, that use of OM may jeopardize organizational learning, as the exclusive use of OMIS may reinforce organizational status quo. It is generally agreed that single-loop learning is more tightly related to organizational memory (Argyris and Sch , 1978). Organizational memory directly helps single-loop learning to take place by allowing past experience to be easily accessed but is essential to any organizational learning. On the other hand, Stein (1995) believes that OM may produce barriers to double-loop learning. Because OM can provide a clear view of the past (Walsh and Ungson, 1991) and of corporate tradition (Kantrow, 1987), it may obscure the generation of alternative views and the questioning and modification of existing underlying assumptions, norms, procedures, and strategic objectives. Consequently OM, if not continually questioned, may reinforce single-loop learning. Grant states that organizations should challenge assumptions and "truths" in the workplace to allow the knowledge base to evolve. When what is known is continuously challenged, the organization is exhibiting characteristics of the Singerian inquirer (Churchman, 1971).

Stein and Zwass (1995) believe that OMISs can efficiently support single-loop learning, but also suggest that an OMIS can support double-loop learning in two ways. OMIS can support double-loop learning by 1) providing a partial record of existing norms and standards, and 2) by providing a means to encode the outcomes of higher-level learning for future use. Thus, the OMIS should keep not only the outcomes of the decision-making, but "assumptions on which the expectations are based and the processes by which the decision was reached, by whom it was reached, and when (Ackoff, 1999)."

An OM and OMIS Framework

In his book The Design of Inquiring Systems, Churchman (1971) presents an excellent exposition of different models of Western epistemology. Each of these models in epistemology - the Leibnizian, Lockean, Kantian, Hegelian and Singerian inquiring systems - can be considered a problem formulation model as each of these systems is a knowledge-producing system and a problem formulation process is a knowledge-producing process. Mason and Mitroff (1973) have suggested the designing of information systems (IS) based on Churchman's models of inquiry. Mitroff (1974) notes that each inquiring system produces a radically distinct representation of conceptual model of it because of the different underlying philosophical bases. Following

Churchman, Mason, and Mitroff, Courtney et al. (1996, 1997, 1998) provide a new perspective on learning organizations by viewing them as inquiring systems or systems whose actions create knowledge. They interpreted inquiring models in the language of the design of learning organizations, or what they call "inquiring organizations." They suggest that Churchman's models of inquiring systems might form the basis for the design of effective learning organizations or units, which are represented in this paper as learning systems.

The framework being represented in this paper follows the work of Courtney et al. that has extended Churchman's models into organizational level. This framework assumes that organizations or units have different organizational knowledge structures within organizational memory because of different forms of knowledge creation and utilization. This study suggests the need for *different* information technologies to support *different* OM needs. This framework is useful because it 1) can show that each organization or organization unit may store and retrieve different types of organizational knowledge in OM, 2) can provide some guiding principles of information technologies to support the OM. Furthermore, this framework has benefits in terms of OMIS development concern. Ackoff (1999) points out that many IS are designed for all organizations without considering specific characteristics of each organization. This problem is seen in the development of OMIS and knowledge management systems (KMS). For system developers, this framework can provide guidelines for designing a specific OMIS for an organization or unit. For practitioners, this framework may provide guidelines with which to select appropriate OMIS or KMS for their organization or units. The five learning systems that form the basis of this framework are described below.

Leibnizian Learning System

Leibnizian learning systems are based on a closed, analytic-deductive learning mechanism and well suited for an organization or unit in a stable environment. Leibnizian organizations can be referred to as egocentric, bureaucratic, or mechanistic organizations (Morgan, 1998), hierarchical (Sandoe, 1998), and the rayon mill (Burns and Stalker, 1961). The commonality of these organizational forms is their existence in a stable environment. The nature of organization is autocratic, or "we will do it this way" (Morgan, 1998). Leibnizian organizations will work best when the same product and service to be produced or rendered will continue to meet customer needs and a readily understood and highly structured set of tasks are needed to convert inputs to outputs. Leibnizian organizations are capable of functioning with precision, speed, clarity, and efficiency. Examples may include an airline, an automobile manufacturer, or other organization with specific, repetitious functions.

Lockean Learning System

Lockean learning systems are well suited for an organization or unit in a relatively stable environment where "a priori agreements" can occur. Lockean objective knowledge is the result of implicit prior agreements on the nature of reality (Mitroff, 1974), which is the organization's worldview. Lockean organizations can be referred to as network organizations (Sandoe, 1998), group-oriented organizations (Courtney, 1999), and the switch-gear firm (Burns and Stalker, 1961). In network organizations, sharing information and cooperation is a norm. They emphasize lateral communication sharing interpretation and meaning. The switch-gear firm also sees meetings as a means of exchanging information and coordination. The nature of Lockean organizations may be "we're supposed to do it this way" because of the implicit, prior agreements on the reality and the conception of the origin and growth of knowledge. Lockean organizations may be best suitable for small organizations, an organizational unit, or a team, because it is difficult to expect prior agreements (consensus) in either a large organization whose structure is complicated and includes many units or stakeholders. Consensus and information sharing depend on a spirit of collaboration, which is more likely to develop in a smaller unit. Lockean organizations function best when relatively little change of products and service is necessary to meet customer (or organizational) needs. Courtney et al. (1997) suggest that this form of organization may be suitable for companies that need to stay in close contact with elements of the environment, such as retail stores, advertising firms, and service firms.

Kantian Learning System

Kantian learning systems are well suited for an organization or unit in a moderately turbulent environment where the product and service to be produced or rendered may require changing and only a few well-defined rules are evident. The nature of Kantian organization is "what if" and "it's best to do it this way based on the models." Kantian organizations can be referred to as holographic organizations (Morgan, 1998), the radio & television manufacturing firm (Burn and Stalker, 1961), and matrix or divisionalized organization (Mintzberg, 1993). Holography demonstrates that reality (organizational world view) can be encoded in models, so that each and every model can represents the reality. According to Morgan, a holographic organization has a capacity for double-loop learning through the process of changing objectives in response to what has been learned. Examples

of Kantian organizations can be found in 1) a large group or project team involving people from multifunctional units and many disciplines, and 2) idea generating companies or an organizational unit consisting of people with different mental models, backgrounds, and experiences.

Hegelian Learning System

Hegelian learning systems will fail without positive conflict that seeks a win-win condition among organizational members and teams. Dialogue is required, and uncovers assumptions and beliefs and incorporates different viewpoints. A crucial element of dialogue, however, is the deliberate inclusion of critical reflection and inquiry into assumptions (Preskill and Torres, 1999). Hegelian learning systems are best suited for an organization or unit in a highly complex, uncertain, unpredictable, and "wicked" environment. The nature of Hegelian organization is "why and how shall we do it" and "why not?" Hegelian organizations can be referred to as hub organization (Sandoe, 1998), the electronic firm (Burn and Stalker, 1961), an adhocracy (Mintzberg, 1993), and as a political organization. In a hub organization it is expected that members have their own opinion (thesis) and participate in the decision-making process. The adhocracy is characterized by sophisticated innovation that requires creative destruction. A political organization is one that is highly sensitive to many stakeholders. Examples of such organizations are utilities, telecommunication firms, software companies facing high competition and (de)regulation, and organizational units whose functions include strategic planning, policy formulation, or research and development.

Singerian Learning System

Singerian learning systems are the archetype of "messy" learning. The system learns from "sweeping in" variables from any discipline or profession, ways of knowing, or perspectives from the Leibnizian, Lockean, and Kantian learning systems. The sweeping-in process can be expanded to include ethics and aesthetics. The sweeping-in process seeks to integrate the knowledge from "everyone" and attempts to include many perspectives in the process of considering a problem (Mitroff and Linstone, 1993). It attempts to include every individual within an organization or community. Singerian agreement differs from Lockean consensus because it is open to disagreement (which is highly encouraged). The Singerian learning style is multi-level (Courtney et al., 1998) as the refinement process and agreement cycles may lead to incremental learning and disagreement may lead to radical learning. It is necessary that organizational knowledge is available and shared among every organizational member so that it leads to personal mastery of each individual. One would not expect to find Singerian learning in bureaucratic or divisionalized organizational forms. Instead, it is suitable for organizations facing new and changing environments, such as organizations involved in e-commerce or deregulated industries, or in organizations where knowledge creation is a basic objective, such as consulting firms (Richardson et al., 1999).

IT Support for Learning Systems

IT Support for Leibnizian Organizational Memory

Leibnizian OM can be referred to as "logical memory" or "routine memory." It can be supported by information technologies (systems) used for automatic processing of routine work. It is expected that people who use the systems share knowledge that is needed to make sense of the outputs generated by the system (Tuomi, 1999). An organization or unit can store frequent questions or formal procedures for a particular context in a database or an expert system and make them available for everyone in the organization to prevent recreation. IS or structured repositories of knowledge (Bock, 1999), such as rule-based expert systems and simple database systems may be ideal for this type of OM. Expert systems are designed to capture knowledge in particular domain and to automate a task to the extent that knowledge in a domain can be completely formalized (Terveen et al., 1993). Expert systems may be ideal for acquiring, retaining, maintaining, and retrieving Leibnizian OM. Lean communication media, such as e-mail, telephone, or documents may be rich enough to share Leibnizian OM within an organization or unit. Among implemented OMIS, Answer Garden (Ackerman and Malone, 1990) would be an example of IT support for Leibnizian OM. The system was used in a diagnostic branching network. Even though Answer Garden uses multiple technologies and has much greater capabilities, the type of OM that the system was designed to support is similar to Leibnizian OM. The system (Coppeto et al., 89), designed to aid technical support personnel, allows for answers to new questions to be added to a database that can be accessed by other support personnel.

IT Support for Lockean Organizational Memory

The multiple technologies such as AI repository technologies and GSS are needed to support Lockean OM. Many groupware systems, GSS and electronic meeting systems (EMS) can be used to capture Lockean OM. EMS can help people reach complete consensus and a meeting or team memory can be stored and accessed. Several information systems for Lockean OM have been proposed or implemented, such as group memory (Satzinger et al., 1999; Nunamaker et al., 1991), team memory, and project memory (Morrison, 1993; Weiser and Morrison, 1998). Concept-based meeting memory systems or smart meeting memory systems (Chen et al., 1994) can be designed to index, classify any textual electronic meeting information, and permit retrieval. These types of systems can help managers and decision-makers draw inferences from past experiences and decisions that reside in OM. It is difficult to index and classify meeting memory because it is semantically rich; however, Chen et al. (1994) suggest several AI and information retrieval algorithms, such as automatic indexing, cluster analysis, and Hopfield's net classification. Case-based reasoning (CBR) may be used to support Lockean OM. CBR can store each meeting history as a case and make them accessible to organizational members as needed.

IT Support for Kantian Organizational Memory

Linger and Burstein (1998) claim that IS should be able to support multiple viewpoints of history (transactional or experiential) and that plurality of memory is required to provide the episodic history of OM. Both the repository and the communication perspective must be combined to support Kantian OM which may require multiple technologies. Knowledge Cache or environmental memory systems (Stein and Zwass, 1995) would be examples of IT support for Kantian OM. Knowledge Cache is a knowledge management architecture designed to gather, classify, and distribute environmental monitoring knowledge that may be used by experts in their day-to-day activities (Elofson and Konsynski, 1991). It can automatically assimilate the area specialist's knowledge, organize it by classes or categories, and make it available to decision-makers. The architecture includes a machine-learning algorithm for knowledge acquisition, a knowledge base of rules for knowledge retention, and a hybrid blackboard architecture for knowledge representation. Each expert's analysis would be stored as a model for environmental monitoring. The models from different experts would be stored, maintained, and be available for retrieval. Terveen et al.'s concept of "folk memory" or "living design memory" (1993) would be another example of Kantian OM. The authors point out that knowledge of facts is not enough; it also is necessary to know how the knowledge is be used. The prototypical system was developed in the domain of software design process for which there is a lack of accessible general design knowledge and wherein the result of the design process creates new knowledge. A knowledge base is always subject to additional refinement and re-interpretation because the world changes (Terveen et al., 1993). This new knowledge are added to the knowledge base after being reviewed by a knowledge integrity analyst (equivalent to Paradice and Courtney's (1986) experiential knowledge component) to find any biases in the experiential knowledge through statistical tests.

IT Support for Hegelian Organizational Memory

Among available information technologies, hypermedia and multimedia may be ideal for capturing knowledge that is hard to formalize and for linking ideas raised by team members. Conklin (1993) suggests the use of a display system based on hypertext. Multimedia databases (MDB) and advanced case-based reasoning techniques may be helpful for storing and retrieving dynamic or unsanctioned knowledge gained in Hegelian organizations. MDB store knowledge in the smallest semantic forms and in the largest semantically ambiguous components (such as concept maps, and images), and use the fixed component for retrieval (Tuomi, 1995). Rana and Turoff (1996) point out that a rich medium of communication is critical to the successful performance of group tasks involving conflictual approaches.

IT Support for Singerian Organizational Memory

Many information technologies or "new" IS are needed to support Singerian OM. Information technology capable of integrating many views and individual's assumptions as well as organizational assumptions is necessary. Intranets, extranets, and the Internet would provide organizational members, stakeholders, and others with a common information space for creating and sharing knowledge and diverse perspectives. These technologies also offer decentralization, the absence of authority, and interconnectedness of "every man." The common information space would provide fast responses from other individuals, organizations, and disciplines about whether measurement systems are replicable and accurate. Through these technologies it would be possible to know if a "solution" is right for the larger system. The Internet permits individuals to share knowledge (mental models, perspectives, assumptions, etc) created from *different* methods (Technical), people (Personal), and/or

organizations (Organizational). Through sharing and understanding a Singerian community or organization can create "comprehensive", "ethical", and "future responsive" knowledge.

Implementation of OMIS (KMS)

Because of the lack of experience in implementing OMIS (KMS) there has been very little research done in this area. Some authors (e.g. Lehner et al., 1998) believe that at this point there are no real OMIS available. It is believed that their claim is true if we adopt Ackerman's (1994) definition of an idealized OM, that is, that "organizational memory functions like human memory." However, if we adopt his definition of organizational memory constrained organizationally, technically, and definitionally (Ackerman, 1994), OMIS do exist. Like the implementation of conventional IS it is clear that the implementation of OMIS may experience problems with organizational contingencies. Stein and Zwass (1995) note the major contingencies of OMIS implementation and use of an OMIS in the context of organizational problems surfaced by the broader theory of organizational IS implementation. These contingencies must be understood in terms of organizational behavior, motivation, leadership, and political power. Tuomi (1996) asserts that careless implementation of OMIS may destroy value production processes, structure organizational knowledge where ambiguity is needed, slow down competence generation, and cause unintended power struggle. It also seems clear that there are differences in developing conventional IS (for data and information) and OMISs. This is largely because 1) OMISs are dedicated to organizational learning and knowledge management of an organization, 2) deal primarily with organizational knowledge, not data or information, and 3) require the integration of multiple technologies. Therefore it is more difficult to design and develop.

Interdisciplinary knowledge and a coherent understanding of organization and management, group and behavior psychology, as well as the cooperation of the respective experts in a team (such as computer scientist) are mandatory for all phases of development, implementation and use of OMISs (Lehner et al. 1998). It is believed that OMIS development projects are more than simple systems development and are truly projects for organizational development. Table 1 describes the mastery of the lower levels of development as prerequisites for success of OMIS development.

Table 1. Developmental Levels of Information Systems

Level	Name	Type of System
4	Knowledge Management	OMIS
3	Information as a resource	Advanced DB technologies
2	Data Management	Data (base) architecture of the company
1	File and Data organization	Data system

Adapted from Lehner et al. (1998)

Once development and implementation of an OMIS has occurred, researchers must develop a model to measure the success of OMIS implementation. Recent research on information technology implementation such as the IS Success Model from DeLone and McLean (1992) and the Process of Technology Structuring model from Orlikowski et al. (1995) may help to formulate such a measure. However, there is very limited study specifically for OMIS success except Jennes et al.'s (1998) extension of DeLone and McLean's IS Success model.

Conclusion

This paper has reviewed relevant literature in organizational learning and organizational memory and developed a new framework to understand OM and the role of the extant information technologies in that arena. The review of the literature indicates that there appears to be a lack of consensus on the definition and role of OM and thus the role of information technology support for managing knowledge. The authors' motivation for this study, following Sandoe and Olfman (1994) and Karsten (1996), stemmed from two premises. First, *different* organizations, organizational units, or groups may have different inquiring (learning) styles that are deeply based on *different* ways of solving problems and knowing the world. Secondly, *different* organizations, units, or groups are likely to rely on *different* organizational knowledge and organizational memory. It is believed that the framework offered here can offer better understanding of *different* organizational learning, knowledge, and memory characteristics may appear between or even throughout organizations. Furthermore, the framework provides system developers and managers with some guidelines for managing OM and designing and implementing OMIS. The authors suggest that the concept of inquiring

systems provides a philosophical basis for the future roles of information technology, especially in regard to OM and knowledge management.

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