To produce organizational memory, knowledge management systems must transform individual knowledge into organizational knowledge, sometimes grudgingly.

**Systems Requirements for Organizational Learning**

Organizational learning is as important as positive cash flow for an organization’s survival in today’s global market. With the range of information technology available today, the potential roles of IT in organizational learning are increasingly evident and important. One definition [5] says a learning organization is “skilled at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights.” Organizational learning has also been identified as one of the key issues in information systems research. Among researchers there seems little doubt that IT has tremendous potential for facilitating and enabling organizational learning. However, not much research has been reported, and available IS support is limited. This follows from the elusive nature of organizational learning.

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Analyzing OLSS requirements involves several concepts in organizational learning:

*Operational vs. conceptual learning.* The Lewinian model of experiential learning theory maintains that learning may be broken down into two processes: operational learning and conceptual learning. The former is described in [6] as the acquisition of skill or know-how to perform some action; the latter is the acquisition of know-why.

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Discussions on organizational learning typically ignore the role of individual learning by either inappropriately anthropomorphizing organizations or by treating organizational learning as a simplistic extension of individual learning. Our objective here is to examine organizational learning from an IT-support perspective, analyze requirements for organizational learning support systems (OLSSs), and discuss current developments and trends in these systems.
Together they form a spiral cycle of mutual dependence. Operational experience is the basis of conceptual understanding. Conceptual knowledge provides mental models to guide, absorb, and integrate operational experience. In Lewinian experiential learning, these two levels of learning are implied in the cycles of experiencing, observing/reflecting, forming concepts and generalizations, and testing concepts and generalizations.

**Higher- vs. lower-level organizational learning.** The two types of organizational learning are higher-level and lower-level. The former occurs when members of the organization challenge underlying assumptions, values, and procedures, attempting to replace existing paradigms with new ones. The latter involves detecting performance deviations from standards and goals, reducing the variance through systematic problem solving. Organizations have more difficulty nourishing higher-level learning because it requires they change the patterns of thinking and questioning of their operating principles.

**Individual and organizational memory.** Organizational learning is reflected in changing organizational behavior that in turn results from changes in the behaviors and beliefs of the organization’s members; an organization cannot learn without continuous learning by its members. However, individual learning is not organizational learning until it is converted into organization learning. The conversion process can take place through individual and organizational memory. Memory is inextricably bound to the learning process. The results of individual learning are captured in individuals’ memory, including personal diaries and reports. Individual memory contributes to organizational memory and is reflected in organizational routines, policies, procedures, and norms. Individual learning becomes part of organizational learning only when individual memory becomes part of organizational memory.

Organizational memory is broadly defined as consisting of everything retrievable within an organization. Organizational memory is more specifically defined as “the means by which knowledge from the past is brought to bear on present activities and may result in higher or lower levels of organizational effectiveness” [9]. Organizational memory includes goals, plans, handbooks, manuals, and standard operating procedures.

Analogous to individual memory, organizational memory is indispensable for organizational learning. However, not all elements of organizational memory are equally useful in the context of organizational learning. One view is that the parts of organizational memory relevant to organizational learning constitute active memory, or shared mental models [6].

**Components of individual memory.** Among the various theories of individual memory, at least one views it as consisting of declarative memory and procedural memory. The former contains generalized knowledge independent of specific events and episodic memory specific to an event. The latter refers to implicit skill-based knowledge about how to do things step-by-step.

In a similar vein, [6] distinguishes between stored memory and mental models affecting our innate human thinking process and the actions we take. Stored memory is equivalent to procedural memory and is related to the operational learning process. Mental models are deeply held assumptions and beliefs.

**Mental models and organizational learning.** Organizational learning depends on the quality of the mental models of its members and the degree to which they share these models. The quality of mental models is judged by how well the models represent business reality. Since mental models reflect knowledge and experience over a range of business functions and activities, shared mental models may be classified into organizationwide models and domain-specific models. The former reflect the general understanding of a business—its vision, purpose of operations, environment in which it operates, and corporate culture and values—shared by all members in the organization. The latter, domain-specific mental models, are the assumptions and beliefs pertaining to specific business functional areas or professions.

Support for organizational learning and competitive advantage depends on the storage and maintenance of organizational memory. The storage and maintenance of static organizational memory may not constitute a major technical difficulty. Eliciting and maintaining shared mental models is, however, a challenging task.

**Support Requirements**

We recommend that information systems for organizational learning meet the following four support requirements:

1. **Integrated organizational memory.** Organizational learning rarely occurs without access to organizational knowledge. In contrast to individual knowledge, organizational knowledge must be communicable, consensual, and integrated [3]. Being communicable means the knowledge must be explicitly represented in an easily distributed and
understandable form. The consensual requirement stipulates that organizational knowledge is considered valid and useful by all members. Integrated knowledge represents the requirement of a consistent, accessible, well-maintained organizational memory. Knowledge representation and integration are two important issues in building organizational memory.

The two most popular methods for representing reasoning knowledge are production rules and predicate logic. Mechanisms for representing declarative memory include semantic networks and frames. However, they might not be appropriate for representing organizational memory because any format of knowledge representation is difficult for ordinary people to understand. Scripts and an organized library of cases are suitable for representing episodic memory. A script can be useful for documenting organizational decision making and decision outcomes. An organized library of cases is simply a collection of documented successful and failed business cases. Several studies have used cognitive maps as a knowledge-representation technique [1, 7]. A cognitive map is a graphical representation of causal relationships among interacting factors, reflecting the decision maker's perception and understanding of a problem.

An integrated organizational memory routinely updated and easily accessible is vital to organizational effectiveness. Integrated memory connotes both spatial and temporal integration of organizational knowledge [9]. Most organizations adopt a piecemeal approach to knowledge management. Valuable expertise and knowledge are lost due to the lack of mechanisms needed to capture them. Even if they are captured, they exist in isolation, inaccessible to the people who most need them. An integrated organizational memory provides mechanisms for compatible knowledge representation, as well as a common interface for sharing knowledge.

Individual learning. OLSSs also need to support individual learning at both the operational and the conceptual levels. On the former, individual learning may be supported by making organizational memory (such as standard operating procedures and domain-specific expertise) readily accessible to an organization's members. Examples of learning systems include computerized training systems and expert systems. System features that enhance conceptual learning include organizationwide communication support, access to decision-support modeling, and computerized aids for identifying and capturing individual learning experiences.

Lower- and higher-level organizational learning.
Lower-level organizational learning is similar to behavior-level learning in that both are concerned with controlling the firm as it adjusts to the environment [2]. Information systems play an important role in facilitating such learning; for instance, various reports generated by these systems can be used in performance evaluation and planning.

Higher-level learning is concerned with identifying and challenging deeply rooted assumptions, rules, and norms rather than specific activities. An OLSS must be able to help identify and challenge these norms and rules, as well as facilitate the building and distribution of shared mental models within organizations. In order to improve organizational learning, an OLSS must also have features for representing individual members’ personal beliefs through cognitive maps, updating individual and/or organizational cognitive maps in changing environments, and communicating the shared cognitive maps among organizational members [7].

Organizationwide knowledge management system. Organizational knowledge creation and distribution demands a disciplined approach. Organizational knowledge is the accumulation of synthesized individual knowledge accepted by an organization’s members for its validity and utility [3]. To become shared knowledge, individual knowledge must undergo several steps: presentation of a problem; elicitation of opposing views and critiques from peers; and synthesis of the different views. An OLSS must be designed to facilitate this process by providing a platform for individuals to share and improve their knowledge and understanding of their problems and ideas without winding up with information overload.

IT Support and Research

Progress developing OLSSs is slow due to the scope of the required support categories (individual, group, organizational) and the two types of learning that must be supported (lower- and higher-level learning). The table here outlines existing support software and current research studies along these two dimensions.

IT support. Most traditional information systems are not designed primarily to support organizational learning. Even if decision support systems and executive information systems assist decision makers with their modeling capabilities and flexibility utilizing organizational information, none of these systems is capable of the systematic capture of knowledge or how to associate past actions and their outcomes with future actions [11].

Computer-mediated communication systems,
including email and bulletin boards, facilitate information sharing at both the organizational and the group levels. However, they are not intended for enabling group collaboration or shared knowledge accumulation. Groupware is a relatively new class of IT for collaborative work environments. Lotus Notes from IBM is a representative and highly popular application of commercial groupware, allowing users to transform unstructured textual documents, including email messages, and import them into databases. It provides a hierarchical categorization scheme based on topics and a network of electronic space for creating a shared understanding of business problems and decisions. However, a study of the effect of groupware reported there is no evidence of changes in the degree of collaboration among organization members [10].

Commercial IT appears to contribute little to higher-level organizational learning, as it lacks support for integrated organizational memory. It provides easy access to goals, procedures, and rules, as well as aid in the business-performance-evaluation process. But it does not aid organizations and their individual members in capturing and documenting their learning.

Research. Existing research on organizational learning indicates a trend toward developing higher-level learning support systems utilizing artificial intelligence technologies. One notable example is the framework for an organizational memory information system, or OMIS, aiming to preserve organizational memory and increase organizational effectiveness [9]. It includes four subsystems that support activities leading to organizational effectiveness. And it directly supports lower-level learning while providing only limited support for higher-level learning.

The electronic performance support system model described in [11] addresses the evolving nature of organizational knowledge. It treats organizational memory as a collection of evolving goal-condition descriptors and their associated actions, producing a “living library” of organizational decision-making history.

The prototype system described in [4] is based on a three-layer apprentice model and uses intelligent agents to identify patterns of activities that represent an opportunity or threat to an organization. The agents, acting as machine apprentices to area specialists, gather knowledge from them (or from the area specialists) and intelligence analysts through structured messages. The system captures area specialists’ mental models (perceptual filters) by forming new concepts and classifications derived from interactions with the specialists and intelligence analysts. Though this system addresses only the organizational learning in environmental scanning, it provides insights on capturing organizational mental models in other areas of organizational function.

Information equivocality, or information ambiguity and uncertainty, may be the central problem during organizational learning [7]; instead of filtering out the diversity of views, organizational learning systems should assist individual organizational members in expressing their diverse views through cognitive maps by comparing these views with those of their peers and then synthesizing shared views. The prototype system described in [7], called the Collective Cognitive Mapping System, has four main components: a local (or episodic) memory as the container of individual cognitive maps; a global (or organizational) memory as the container of collective cognitive maps; a local cognitive map generator converting individual beliefs into graphical maps; and a central cognitive map generator collecting cognitive maps of all members and providing a collective view of business problems.

Organizational memory can be defined as a collection of case studies, cognitive maps, and scenarios. According to this model, called the cognitive decision support system [1], the case memory subsystem assists executive learning by making a large repository of case studies accessible through a few keystrokes. The model’s Assumptions Surfacing subsystem provides executives intelligent aids in identifying tacit assumptions, representing them in graphical form.
A consultative approach to organizational high-level learning employs a learning laboratory, or simulated learning environment for a particular business problem; such an environment is also known as a microworld or “microcosm of how real organizations function, where you can see the consequences of your decisions play out more clearly than is possible in real organizations” [8]. A major drawback of microworlds is that users may not think carefully about the actions they might take, as microworlds are more like simulation games than they are like reality.

**Conclusion**

Developing an OLSS is an increasingly important concern for organizations. With the advent of new types of IT, including groupware, intranets, and multimedia, organizations should make every effort to adopt an integrated approach to organizational learning to better survive in today’s global competition when planning for technology support. The current generation of organizational information systems is not expressly designed to support high-level organizational learning, even though such learning is more important than ever in today’s turbulent business environments.

Building an integrated organizational memory and supporting an organizationwide knowledge management system are challenging tasks. We recommend as a guiding principle the transformation of individual knowledge into organizational knowledge, a dynamic process involving six knowledge management tasks: knowledge identification, acquisition, validation, maintenance, dissemination, and interpretation. Organizations might have to perform them iteratively to foster shared knowledge and understanding.

IT can be a catalyst in organizational learning, though it is ineffective without incorporating the human and organizational considerations of an existing infrastructure for organizational learning. How might an organization capture its members’ knowledge while still dealing with the possibility that at least some of them will resist sharing their own knowledge with the rest of the organization? In organizations with hierarchical structures, knowledge often translates directly into power, and hoarding knowledge may be a way to help oneself advance within the organization. Those who know the most might feel they have the most to lose by sharing. Similarly, an organization’s reward system might affect how its members use its information systems. To assure a successful implementation of an OLSS, an organization might also need to reengineer its business processes.

**References**


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