CONSIDERATIONS IN ACQUISITION LESSONS-LEARNED SYSTEM DESIGN

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This article describes issues affecting the design of lessons-learned systems for defense acquisition organizations. It draws both on studies of existing lessons learned systems and the literature of organizational learning and knowledge management. The exploration of these issues suggests that attention to social processes within organizations is as important, if not more so, as the development of information technology processes in the success of lessons-learned systems. The article's conclusions can assist in the determination of appropriate requirements and resources for an acquisition lessons-learned system.

Though the idea of learning from experience is timeless, formalized systems for capturing and disseminating lessons within organizations have received increased attention in recent years. Interest in such lessons-learned systems (LLSs) has grown through the popularization of concepts such as the "learning organization" (Senge, 1990), through developments in knowledge management (Davenport & Prusak, 1998; Nonaka, 1991), and through information technology advances that hold out the promise of wider, more efficient distribution of lessons within an organization. This growth is especially evident in the private sector, where a firm's learning capabilities and knowledge are viewed as strategic resources that give it a competitive edge (Davenport, 1997a; Zack, 1999a).

Amid this growing interest, a variety of forms of LLS have emerged, from static database collections of lessons (U.S. Army, 1997), to "groupware" tools (e.g., Lotus Notes) for electronic collaboration (Davenport, 1997c), to heuristics-driven expert or "intelligent" systems (Aha, 2000). Yet, as Zack (1999b) notes, very little research has been done regarding the most appropriate LLS form for a particular organization. With an inadequate understanding of design issues and alternatives, leaders may implement systems that fit their organizations poorly.

Defense acquisition presents particular challenges for design of LLSs. Particularly

with major weapon systems, acquisition is a highly complex enterprise that encompasses multiple contexts — those of politics, business, technology, and the military, to name a few — and multiple stakeholders with often competing interests (Mayer, 1991; McNaugher 1989). Its processes are idiosyncratic (i.e., different parties improvise different solutions to unique challenges) and contextual (i.e., different projects pose different kinds of challenges). Acquisition also has a highly interdisciplinary character in that it entails the integration of a broad range of technical and management skills, including contracting, system engineering, finance, and many others (Fox, 1988). Thus, successful acquisition professionals may be viewed as knowledge specialists, in that they have unique experiences in solving specialized kinds of problems. They master a complex kind of knowledge in which they improvise solutions to challenges for which procedural knowledge offers limited guidance. How might such knowledge be transferred to others in defense acquisition?

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This article focuses on two questions to address this issue:

- What design aspects and issues are indicated by analysis of existing LLSs?
- What do organizational learning and knowledge management concepts suggest are key aspects of LLS design for acquisition organizations?

This article begins with an overview of organizational learning concepts to establish the intended benefits of LLSs. It then describes operation and characteristics of LLSs to develop a set of factors and issues to be considered in design. Next, it turns to the literature of organizational learning, communications, and knowledge management to describe issues relating to how organizations learn and how they transfer knowledge among their members. The article concludes with some specific implications for LLSs in acquisition organizations. Although the discussion focuses on defense acquisition, the conclusions extend to lessons learned and knowledge management systems in other areas as well.

LLS

The term *lessons-learned system* in this article refers to the activities, people, and products that support the recording, collection, and dissemination of lessons learned in organizations. These systems may focus on "negative" lessons of failures, deficiencies, and other problems to be avoided, or on "positive" lessons of innovative techniques and "best practices" to be emulated. Definitions of *lessons learned* vary. Although the Army defines them as "validated knowledge and experience derived from observations and historical study of military training, exercises, and combat operations" (U.S. Army, 1997, p. 1), in the Marine Corps they are "procedures developed to 'work around' shortfalls in doctrine, organization, equipment,

training and education, and facilities and support" (U.S. Marine Corps, 1994). Most systems in current use are web-based.

Intended Benefits – Organizational Learning

Organizational learning (Argyris, 1999) is usually defined in terms of members learning from each other, that is, when members share "theories of action" (Argyris & Schön, 1978) or "mental models" (Senge, 1990). Lipshitz, Popper, and Oz (1996) take a structural approach by focusing on organizational mechanisms that facilitate, make explicit, or routinize such sharing. These mechanisms are the "institutionalized structural and procedural arrangements that allow organizations to systematically collect, analyze, store, disseminate, and use information that is relevant to the effectiveness of the organization" (p. 293). Such mechanisms include organization histories, project reports, after-action reviews (Busby, 1999) and more generally, LLSs. These mechanisms are intended to allow an individual's learning to become recorded in an organization's documents, processes, and other "memory" media in such a way that other members may learn from it, thereby contributing to improved effectiveness or facilitating an organization's adaptation to a changing environment (Argote & McGrath, 1993; Myers, 1996). Many see the idea of a learning organization as inextricably tied to an organizational culture that reflects such sharing through honest and open communication (Cook & Yanow, 1993; Schein, 1985).

Center for Army Lessons Learned

One of the earliest and best-known LLSs is the Center for Army Lessons Learned (CALL) at Fort Leavenworth, KS, established in 1985 for the purpose of collecting lessons learned during simulated combat training exercises (U.S. Army, 1997). Over the years, CALL's mission has expanded to encompass lessons from actual combat and other military operations (e.g., JUST CAUSE in 1989). CALL also employs dedicated expert observer teams to collect lessons from selected high-priority operations. CALL is staffed with resources necessary to accomplish a variety of lessons-learned functions, including collection; analysis; processing; dissemination; archiving; and research. It publishes tailored lessons-learned products in a wide variety of media, including newsletters, handbooks, bulletins, and the Internet (including both secure and public on-line databases).

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LLS Characteristics

Zack (1999a, pp. 48–49) describes the general sequence of operation of LLSs: generation, submission, processing, and dissemination. Specific aspects of design and operation vary widely. Table 1 adapts Aha's (2000) characterization, developed from an analysis of existing LLSs, to group system characteristics under lesson, operational, and organizational factors.

Lesson factors describe the "product" of the system, that is, whether it produces lessons only (pure) or includes other products such as best practices or information updates (hybrid). The other lesson factor describes the type(s) of processes addressed by the lesson or other product.

Table 1.
Lessons Learned System Characteristics (adapted from Aha, 2000)

Lesson	Content Process type	Pure Technical	Administrative	Hybrid Planning
Operational	Access Formality Locus Process relation Acquisition Handling Dissemination	Open Formal Centralized Embedded Active Rigorous Active		Closed Ad hoc Distributed Standalone Passive Open Passive
Organizational	Interpretive context Type	High Adaptable	Medium	Low Rigid

Technical processes usually deal with scientific, engineering, or other highly technical matters. Administrative processes usually involve fairly routine procedures or decisions made by a single individual, for example, a purchasing specialist. Planning processes entail more complex and strategic matters involving multiple stakeholders. CALL, for example, focuses mainly on "tactics, techniques, and procedures" for operational forces rather than on "macro-issues" or strategic operations; hence, its processes would be classified as "technical."

Operational factors describe how LLSs function. Access refers to the extent to which those outside an organization may use its system. Open systems may be accessible to the general public, whereas closed systems have security features that limit their use to members of the organization. Formal systems have established procedures and processes of operation, such as those described for CALL. The U.S. Geological Survey has taken a more informal approach in generating lessons that are based on analysis and synthesis of the findings of more than 250 scientific studies of the environment (U.S. Geological Survey, 1995). These assist local natural resource managers in policy making and decision making. Another example of an informal system was the Navy Acquisition Reform Office's (ARO) recent Change Through Ex-Change Initiative. Every three months, ARO solicited acquisition organizations to provide two approaches, ideas, process innovations, or lessons learned, which were distributed via diskette and posted on the ARO web site (U.S. Navy, 1999).

CALL is an example of a centralized LLS that serves the Army worldwide from its offices at Fort Leavenworth, KS. The Department of Energy (DoE) operates a distributed system with a networked infrastructure of systems and lessons-learned "coordinators" at various sites and contractor facilities. LLSs are embedded if they operate in an integrated fashion during other organizational activities, as in the case of Army units conducting after-

action reviews in the course of training exercises (Baird, Holland, & Deacon, 1999). Embedded systems usually feature active acquisition and dissemination ("pull" and "push") of lessons, whereas standalone systems "wait" for user input and retrieval of lessons. The U.S. Marine Corps Lessons-Learned System (MCLLS) relies heavily on decentralized reporting (i.e., passive acquisition) from unit after-action reports of exercises and operations.

Handling refers to the level of treatment given a lesson after it has been generated. Rigorous handling implies significant control through some review and approval process, whereas open handling implies little or no control of lessons. Fundamentally, handling involves decisions as to whether one individual's learning, as reflected in the lesson, should be shared with others.

Questions that arise here may include: Does the information in the lesson need to be verified, substantiated, or validated? Is additional information or discussion necessary to make it understandable to others? Does it sufficiently describe context and circumstances so that other members of the organization can judge the lesson's relevance under differing conditions? Is it consistent with organizational goals and policies?

For example, CALL includes in its process of lesson development a coordination step to solicit comments from agencies and commands that may be affected by or have interest in dissemination of a lesson. The MCLLS features a process of lessons-learned reviews by various working groups and committees, which assign responsibilities for analysis, action, and disposition. DoE lessons-learned coordinators, among their other duties, perform a validation function before a lesson is submitted for publication.

Two organizational factors may be considered when determining how handling should occur. Interpretive context (Zack, 1999a, p. 50) refers to the extent to which members of an organization share similar knowledge, backgrounds, and experiences. In an organization with a high interpretive context, most members are likely to understand the content and significance of lessons generated by other members. Lessons generated in an organization with a low interpretive context may need to include more detail in terms of description and explanation, and may need to be "translated" during handling for broader understanding.

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The other organizational factor to be considered is how rigid or adaptable an organization is in terms of changing its "habits of action" in response to lessons learned by its members. An organization may have a culture that inhibits its ability to change, or it may be constrained by laws, professional standards, or by other organizations. Such constraints indicate the potential need to review, validate, and perform coordination on lessons before they are disseminated to and shared with the rest of the organization.

LLS Issues

Though the benefits of knowledge management systems are widely accepted, their success is not guaranteed. One of the most significant pitfalls, according to Davenport (1997b), is the "if you build it, they

will come" fallacy. That is, merely implementing an LLS does not ensure that members of an organization will use it, either to generate lessons or to seek out those learned by others. Reasons for such lack of use are usually attributable to issues of motivation or organizational culture. Individuals may simply not have time to generate lessons after a learning experience, or perhaps they feel unwilling to acknowledge that problems have occurred. Some who are facing new situations may be unwilling to seek out lessons learned by others if they feel their problem is unique and not amenable to solution by past methods. Such participation issues may be addressed through a "championing" of the system by the organization's leaders or through rewards and incentives designed to institutionalize use of the system (Fulmer, 1999).

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The effectiveness of an LLS might also be affected by the substance of lessons, particularly if handling is not rigorous. Individuals may generate lessons containing problematic information such as unsubstantiated opinions, controversial findings, or self-serving claims, to name but a few. They may be poorly written, perhaps with little background or context that would allow others to judge the wider application, or with too much detail that bores or confuses readers. Such problems point out the need for some degree of rigor in handling.

Clearly, too much rigor in handling may squelch participation. Processes of review, editing, validation, and approval may become so burdensome that organizational members lose interest in submitting lessons. This indicates the need for LLSs to include some feedback mechanism so that those involved in handling can keep members apprised of the status of their submissions.

Finally, LLSs require maintenance. For example, databases need to be reviewed for outdated content, and periodic upgrades may be needed to incorporate new technology. Of course, such maintenance requires resources, which means that LLSs must "compete" with other organizational programs for scarce resources. The failure of leaders to provide adequate resources may be perceived as a lack of organizational commitment, leading to low participation levels.

Summary

The foregoing discussion has illustrated a range of alternatives available to designers of LLSs. This range indicates the need to examine several different factors of an organization and its knowledge needs to arrive at a system design that fits the organization well.

Knowledge Transfer in Defense Acquisition

Putnam, Phillips, and Chapman (1996) described several differing perspectives on organizational communications held by managers and theorists. Probably the most ubiquitous of these is the *conduit* perspective (Axley, 1984), in which communications are thought of as objects or

transmissions that flow through organizational channels from a source to a receiver. Such a view is often reflected in a managerial emphasis on communications tools (e.g., information systems) and techniques to enhance the speed, efficiency, and accuracy of knowledge flow within an organization (Eisenberg & Phillips, 1991). Against the conduit view is the idea of knowledge as socially constructed (Berger & Luckman, 1967), or put another way, as the product of interpersonal relationships. This *constructivist* perspective emphasizes social processes that lead to knowledge creation and sharing (Putnam et al., 1996). Giddens' (1979) theory of structuration — the production and reproduction of social systems through members' interactions — has been particularly influential (Orlikowski, 1992; Poole & DeSanctis, 1990). For example, Orlikowski and Yates (1994) describe how, over time, a distributed group of knowledge workers produced a rich, varied, and changing structure ("genres") of communicative practices. From such a view, "organizing" is not a one-time event, but rather a continual process carried out through the social interactions of members (Weick, 1979).

Recognizing this distinction has profound implications for the design of LLSs. From the conduit perspective, one may design a system to emphasize the ease of lesson input and extraction by organization members, whereas from the constructivist view, one may focus instead on the texture and development of interpersonal relationships within an organization. The following sections draw on research from several fields — organizational learning, knowledge management, and organizational communications — to explore such issues in greater detail. This is not intended to be a comprehensive synthesis of the literature, but rather a leveraging of selected research to shed light on LLS design issues.

Knowledge Complexity and Interdependence

Theorists of knowledge management have distinguished between different kinds of knowledge. These determine the most effective method of transfer. For example, learning how to solve an algebra problem can be understood via the transmission of abstract concepts. Learning carpentry, on the other hand, involves purposeful activity and experimentation, a kind of learning that is beyond verbalization. Many (e.g., Nonaka, 1991) have built on the work of Polanyi (1966) to create a distinction and a continuum between explicit and tacit knowledge. Knowledge that is considered complex or difficult to verbalize or codify in writing, is tacit knowledge; it can be acquired only through experience. Tacit knowledge is highly personal, deeply rooted in action, and consists of mental models, beliefs, and perspectives so ingrained that they are often taken for granted and not easily articulated (Argyris, 1999). Explicit knowledge is that which can be codified (Zack, 1999b). It is acontextual and corresponds to "banking concepts" of learning, which assume that knowledge can be transferred from one party to another regardless of context. Most studies agree that explicit knowledge is easier

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to transfer than tacit, complex knowledge (Hansen, 1999).

Tyre & von Hippel (1997) emphasize the situated nature of knowledge. They claim that knowledge is not absolute, but rather is dependent on context and setting. Actors draw on codified, abstract theory in their local, informal routines, but they adapt them as they work on problems within particular circumstances. Looking at the "situated" nature of learning raises the issue of knowledge representation. Organizations may fail to recognize the complexity of knowledge by describing jobs in simple, canonical steps, which inhibit how managers' interpret and value the importance of noncanonical practices. Actual on-the-job practice requires interpolations between abstract knowledge and practical, situated demands.

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Orr (1996) points out the dichotomy between managers' understanding of job requirements and actual practices: "Although the documentation becomes more prescriptive and ostensibly more simple, in actuality the task becomes more improvisational and more complex" (p. 42). This point is illustrated in his study of Xerox's training of service representatives. The trainers attempted to document every imaginable breakdown in copiers, so that when technicians arrived to repair a machine, they simply referred to the manual and followed a predetermined decision tree to perform a series of tests that dictated a repair procedure. Trainers believed that a diagnostic sequence could be devised to respond to predictable problems. However, the study revealed that no amount of documentation could include enough contextual information to make every problem understandable. Orr describes a technical representative confronting a machine with error codes and malfunctions that were not congruent with the diagnostic blueprint. This machine's malfunction did not fit the kind of errors that were documented nor had anything like this problem been covered in his training. Both he and the technical specialist he called in to help were baffled. To simply give up the repair effort and replace the machine would have been a solution, but would have meant loss of face with the customer — an unacceptable solution. After exhausting the approaches suggested by the diagnostic, they attempted to make sense of this anomaly by connecting it to previous experiences and stories they had heard from others' experience. After a 5-hour troubleshooting session of trials and errors, they developed a solution.

Many jobs require this type of improvisation — a patching together of bits and pieces of experience to gain understanding of problems that do not provide definitive solutions. In Orr's account, the technicians go through constructing a coherent account of malfunction out of the incoherence of the data and documentation. They go through a long storytelling procedure, talking about the machine's erratic behavior, their memories of other technicians' stories, and information from users, which they try to put together in a composite story. The process of forming the story actually becomes an integral part of the diagnosis (Watzlawick, Beavin, & Jackson, 1967; Weick, 1979). This process begins and ends with communal under-

standings that are not available from canonical documents; narration is an important element in integrating the various facts of situation.

This suggests the necessity of informal interactions between individuals for complex knowledge to be transferred. Members must engage in informal, unstructured communications and processes of "sensemaking" (Weick, 1979); discussion, negotiation, and argument are central to the learning process. Daft and Lengel (1984) addressed the role of so-called rich media (e.g., face-to-face communications) in resolving uncertain and equivocal situations. Such studies led Brown and Duguid (1991) to identify "communities of practice," small, informal, collaborative groups that generate a common understanding of events and a shared orientation for acting in the future. To foster learning, they contend, organizations must see beyond conventional, canonical job descriptions and recognize how learning occurs in the rich context of practice.

Relationships Between Learners

According to Lucas and Ogilvie (1999), group heterogeneity is an important factor in the dissemination of knowledge. Homogenous groups usually have access to the same information and therefore offer limited opportunities for learning. Potential for knowledge transfer is increased when members' backgrounds and experiences are varied and complementary. However, the price for this richer learning potential is the cost of maintaining relationships among individuals who do not have common experiences (e.g., greater potential for conflict).

According to social network theory, knowledge transfer works best in organizations with weak ties (i.e., distant and infrequent relationships) among members. Granovetter (1982) claimed that weak ties are efficient for knowledge sharing because they provide access to novel information by bridging disconnected groups. Strong ties, on the other hand, lead to redundant information, because members know each other well. Hansen (1999) argued, however, that network theory is focused on access to new information, which overlooks the issue of complex knowledge transfer. Weak ties, he claimed, indeed facilitate the processing of explicit knowledge, but they slow down the processing of complex knowledge, because there are fewer interactions for transferring complex knowledge. "[T]ransferring noncodified and dependent knowledge is less difficult to the extent that the parties to the transfer understand each other" (p. 88).

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In a similar vein, Fulk (1993) found a positive relationship between group members' technology-related attitudes and behaviors and their attraction to their work groups. The implications are significant regarding productivity. In Hansen's study, in which units were exchanging explicit knowledge, those with weak links (i.e., connected only by e-mail) completed their projects 25 percent faster than those with strong links. When tacit knowledge was exchanged, however, units with weak links were at a disadvantage; they took 20 percent longer to complete projects than did units with strong links.

Two Cases

Although many organizations in the past decade have adopted information systems in attempts to enable knowledge transfer, there are few empirical studies that actually document the enablers and constrainers in these efforts. Most of the literature is anecdotal and prescriptive. Two studies illustrate some issues that arise when organizations attempt to implement "lessons learned" through the adoption of groupware systems.

Orlikowski (1993) studied an accounting firm, Alpha Consulting, which adopted Lotus Notes, a documentary support system with bulletin board, posting, discussion group, and electronic mail capabilities. Alpha's leaders were concerned that its consultants, spread among different offices across North America, were working on similar problems but not sharing their expertise. They hoped that Notes would provide a system for storage and sharing of solutions to a variety of problems.

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Alpha's junior consultants used Notes infrequently. They seemed uninterested in learning how to use the program and gave up easily when faced with frustrations. Orlikowski found that the younger consultants had less incentive to learn to use the program. Their promotions were based on billable hours tied to client work, and they could not justify billing clients for the time it took them to learn this new system. Also, they did not understand potential applications of Notes in their work.

Senior consultants, on the other hand, used Notes more often. Because they had job security they were more willing to invest time to explore and experiment with Notes. Because of their experience, they were able to see how the system would benefit their work.

Another group of tax consultants in Washington, DC, adopted the Notes program. The study suggests that they had significant incentive to show that they were visible and valuable within the firm, and using Notes was an opportunity to broadcast their visibility, to electronically publish their advice and make it available to many of the consultants around the firm. Their motivation was to show that the Washington office was an important part of the firm. Orlikowski's conclusion is that organizational incentive systems need to be taken into account when adopting information systems.

Davenport (1997c) documents how another large consulting firm (Ernst & Young) successfully adopted a Notes program. They created a miniorganization (the Center for Business Knowledge) that organized Ernst & Young's consultants into specific areas. This organization was staffed with consultants from other offices, who were given 6-month assignments to play a special role as "knowledge networkers." Within a short time, 22 networks of consultants with expertise in certain industries and technology sectors were in place. Each network was assigned a half-time person who codified the Notes databases, organized the insights from different projects, prompted line consultants to add their own insights, and edited the project's discussion and document databases. These knowledge networkers came to understand consultants' needs and

topics very well. Because the knowledge networkers were on short-term assignments, they were expected to use this new expertise to advance their careers when they returned to their consulting positions.

Taken together, these studies suggest that it is important to pay attention to the social context in which people use information technology, as well as the particular incentive systems for knowledge transfer. The groups in Alpha Consulting and Ernst & Young had different incentives to share information, and their respective outcomes were different. An aspect central to the second case is the presence of a group that facilitates the learning process. It is notable that this group came from the very consultant group for whom the program was designed. They were able to bring field expertise to bear, and were able to build ongoing relationships in the field to prompt users to contribute. They became familiar with the dilemmas and challenges in the field and were able to guide the users to various resources in the program.

These studies reflect issues mentioned earlier, particularly issues of motivation, which inhibit use of LLSs. Other barriers such as low priority, resistance to change, lack of commitment, and turf protection are also cited. However, another study of knowledge transfer offers a somewhat different perspective. Szulanski (1996) studied the phenomenon of "knowledge stickiness," the extent to which problematic situations are experienced during knowledge transfer. He found that the primary obstacles to transfer of best practices in organizations are (1) lack of absorptive capacity, which refers to the ability of the recipient to identify, value, and apply new knowledge; (2) causal ambiguity, or the uncertainty regarding cause-effect relationships on the part of the knowledge recipient; and (3) arduous relationship between the source and recipient, which is described by the degree to which the relationship serves as a conduit for knowledge and the degree of communication and intimacy in the relationship between the source and the recipient. This suggests the benefits of attention to aspects of organizational culture, such as developing the learning capacities of organizational units, fostering closer relationships between units, and understanding more systematically the practices and learning readiness of organizational units.

Much studying remains to be done. Some factors have received little or no attention by researchers of organizational learning and knowledge management. For example, much of the knowledge management literature relies on cases from private sector firms, and so unique aspects of public organizations may have been neglected. Private firms typically have clearer goals, such as market share and profitability, than public organizations. Indeed, the knowledge management systems for private firms are often "closed" and unavailable to outsiders so that the firms can protect their knowledge and learning to achieve a competitive edge. Public organizations, particularly large ones, have less clear-cut goals and perhaps even conflicting and competing goals among their constituent elements.

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Clearly, a level of competition exists within the Department of Defense (DoD) among the services, programs, and depots, test centers, and smaller organizations (Kronenberg, 1990). It seems likely then that such competition could adversely affect the nature and extent of participation in an LLS that spanned several acquisition organizations. Conversely, competition might promote participation in a "closed" LLS within an organization. Such effects could be manifested more widely in DoD's current policy drive to become more "business-like" in its operations.

Implications

The literature reviewed in this article indicates that organizational characteristics and issues have at least as much, and perhaps more, importance than information technology issues in knowledge transfer. A key first step in LLS design, then, is to specify the organization for which the system will be designed. This is especially critical in regard to defense acquisition organizations, which vary in many respects. One could design an acquisition LLS for the entire DoD; for any of the services; for a major command such as Army Material Command; for one of its subordinate commands such as Aviation and Missile Command; or for a local organization, such as a lab, test range, or engineering center. One also could design an LLS within any of these organizations for a particular specialty or acquisition career field, such as contracting, cost estimation, or program management. Clearly, learning will occur in different ways among members of these various organizations according to whether their relationships are strongly or weakly tied, the organizations' interpretive contexts, and many other factors.

Table 2 shows how organizations might vary according to some factors addressed in this article, which would affect design of acquisition LLSs. Design may be most

Table 2. Variations in Organizational Factors in Acquisition Lessons-Learned System Design

Organization	Ties	Interpretive Context	Organizational Goals
DoD[a]	Weak	Low	Ambiguous/conflicting
Career field across DoD[a] (e.g., all systems engineers)	Weak	High	Ambiguous/conflicting
Service	Weak	Moderate	Possibly mixed
Major command	Weak	Moderate	Possibly mixed
Subordinate comand	Moderate	Moderate	Clear
Local organization	Strong	High	Clear

[a] DoD, Department of Defense

problematic for a DoD-wide system. Because most DoD members have weak ties (i.e., distant, infrequent, or nonexistent relationships) and low interpretive context (e.g., due to dissimilar backgrounds), a system targeted towards sharing of explicit and codified versions of lessons learned would seem most appropriate. However, possibilities of competition among DoD organizations may inhibit participation in such a system. Members of an acquisition specialty or career field in DoD share a higher interpretive context, which signals greater potential for lesson sharing. To the extent members of the same field share a professional loyalty to their field over loyalty to their organizations, some of the deleterious effects of competition may be mitigated. Members of the services and of major commands have weak ties, though interpretive context in these organizations is certainly higher than that of DoD. Organizational competition may yet exist at these levels, particularly for scarce fiscal resources. Sharing of tacit and complex lessons would be, as expected, most effective in subordinate commands and local organizations.

Such variation points out the need for contingency approaches in LLS design. Achieving effective knowledge transfer between members of the acquisition community will require substantial investment of time and resources in determining what kind of knowledge is appropriate for different groups based on their relational histories and contexts.

An important question regarding LLSs is the possibility of creating a community of practice when members' connections are virtual rather than face-to-face. Virtual communities lack the synchronic feedback and reciprocal exchange characteristic of a discourse that creates and reflects a shared history. Transfer of tacit, complex knowledge requires a great deal of informal, face-to-face contact. Thus, if an organization relies on weak links such as intranets to exchange complex, tacit knowledge, it will likely meet with little success.

True communities of practice are probably not possible in larger organizations where members are weakly tied and interpretive context is low. In such organizations, members are more likely to search for novel information in explicit and codified lessons. Thus, leaders of larger organizations should focus their efforts on eliminating barriers to and encouraging members' participation in systems that target such lessons. Davenport's findings (1997c) may be especially significant in this regard. Leaders of larger acquisition organizations may consider assigning temporary duty to "knowledge networkers," who would actively seek lessons, map out knowledge needs, encourage inquiry, and make connections among members.

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When members of an organization share strong ties, close proximity, and frequent interaction, complex and tacit knowledge will be easier to transfer. However, explicit knowledge may be redundant. If attempts are made to transfer explicit knowledge between strongly tied members, they might lose interest in the LLS. Thus, leaders of smaller organizations should emphasize strong ties among

members, creation of a high interpretive context, and establishment of clear goals to maintain an environment that facilitates sharing of complex and tacit lessons among members of a true community of practice.

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