Integrating Knowledge and Processes
in the Learning Organization[1,2]

Linda Levine
Software Engineering Institute

This is the first part of a two-part article. Part one explores the adaptations needed in the process movement and knowledge-creation approaches to achieve the vision of a learning organization. Part two, to be published in the January issue, will look at learning in practice by examining some frameworks and tools that pull together process, knowledge management, and technology to support learning and effective change.

Introduction

When we ask people to change — as we do in improvement or technology adoption efforts — we are asking them to learn. If you pay attention to how people learn, you will be capable of more effective change management. Learning and technology change management reinforce one another. If you are smart about working on how you manage change, you will help to make your workplace a learning organization, and that will pay off in many ways. We assert that learning organizations require not just one or two of these, but all three: process management, knowledge management, and technology.

Technology Change Management and Learning

Technology change management (TCM) is not a single isolated process. In its most robust form, TCM touches many of the socio-technical activities performed in an organization. This picture of technology change management extends beyond systematic, high-control approaches to technology adoption, encompassing the creative exploration and exploitation of technology, knowledges, and processes. The enlarged picture includes business and work processes, and technical systems — as well as processes related to group dynamics and collaboration. To realize technology change management in this far-reaching manner is, in effect, to construct a learning organization.

What About TCM in the CMM?

Rethinking of technology change management can be seen in proposed changes to the Capability Maturity Model® for Software (SW-CMM). Whereas version 1.1 defined the purpose of technology change management as "to identify new technologies (i.e. tools, methods, and processes) and transition them into the organization in an orderly manner," Draft C of the SW-CMM has enlarged the scope for technology change management with a new name for the activity and greater breadth in the description. Here, in Draft C, the purpose of organization process and technology innovation "is to identify process and technology improvements and innovations that would measurably improve the organization's software processes and thereby help achieve the organization's software process improvement goals." Organization process and technology involves "identifying, selecting, and evaluating new technologies, and incorporating effective technologies into the organization."

The refinement of technology change management in terms of organization process and technology innovation takes a step toward a more innovative and opportunistic approach. However, much remains to be understood about this complex phenomenon — especially about how these activities are made operational. In this article, we consider some of the ingredients to making TCM a part of daily work, relating to socio-technical activities across the organization. When we use the term "technology change management," we intend a forward-looking perspective in the spirit of current work on adaptive, flexible, self-organizing systems (an approach most likely to be realized in higher maturity organizations).

Matching Management to the Pace of Change

Learning organizations and work groups of the 21st century must become expert in managing change in dynamic situations [1]. Older "freezing" and "refreezing" models and metaphors from organization development theory are insufficient to guide us here. Multimedia technologies and practices supporting process change, modeling, simulation, and collaborative and distributed work will be key. Skill sets in the new work force that allow for flexibility, speed, experimentation with rival hypotheses, and collective responsiveness will prevail.[3]

Overall, TCM represents the fusion of technology innovation and process management as it is fully defined, operationalized, and enacted in a learning organization. Are we ready for technology change management and learning organizations? What is involved? These questions form the basis of our present inquiry.

Two Movements: Process Management and Knowledge Creation

Over the last several decades, organizations that specialize in technological innovation, including technical knowledge and expertise, have experienced two important developments. These developments, emphasizing the roles of processes and knowledges, have evolved in parallel more or less separately. On one hand, the process movement has favored a trend toward establishing fairly formal business and work processes to ensure that highly technical work gets done on time, within budget, and with quality assured and customer satisfaction maintained [2, 3, 4]. In

a sense, the emphasis on processes represents a modification and extension of principles of Taylorism and Fordism; and while more flexible, the new approach still remains largely managerial- and control-oriented [5]. We might argue that adaptive organizations need a process focus that balances discipline and innovation, an environment where many voices can be heard and exclusionary interests are resisted.

Defining work processes has made inroads into practice over the last 10 years and extends to process modeling, simulation, and automation, as understood in the context of the organization's larger business processes [3,4,5]. In parallel, a second trend in response to the coming of the knowledge society [6,7], has seen the creation of knowledge-based organizations [8] as being enhanced by integration of quickly evolving information technology [9,10].

Advances in information technology directed toward organizational knowledge and learning — dating to the 1960s — and visions like Doug Engelbart's have provided a revolutionary opportunity for information technology as a medium for facilitating and improving group communication and knowledge creation. Rapid advances have continued [9,10,11,12]. IBM (Lotus Notes), Microsoft and Netscape (intranets and extranets) are capturing a huge projected market based on the use of the World Wide Web. Products that enable conferencing and brainstorming at a distance, as well as multimedia information capture, structuring, visualization, and retrieval are available at fairly minimal costs. Such products extend Engelbart's views of the potential of computer technology even further.

Getting Process Knowledge to Work Together

To be practical, we maintain that local adjustments within both of these movements are necessary. Within the process arena, it is time to counterbalance process formalization with process creation by leveraging individual knowledge through information exchange and by reconciling diverse perspectives. An organization that supports information sharing and knowledge creation amongst its members and is committed to including and reconciling multiple viewpoints is likely to establish effective and efficient processes as well as improve organizational life.

Within the knowledge creation arena, the challenge is to filter and channel information — without loss — for knowledge-based decision-making. Information technology has in some cases made matters worse by exacerbating information overload in the form of e-mail glut, for example, rather than realizing knowledge-based organizations in practice. Far behind technology's rapid evolution are approaches for its use in enacting knowledge-based and learning organizations.

These necessary adjustments within the process-based and knowledge-based movements pave the way for a more dramatic synthesis: technology change management depends upon integrating technology and process management for innovation and learning. To make learning organizations an everyday reality, the software community can build on its successes at putting information sharing, knowledge creation, and work processes into practice. To date, work flow research has focused on formalized business processes and process-enactment technologies. Unfortunately, this fails to take advantage of the chaotic but potentially rich communication in the workplace. Until process automation taps these information flows, and is aligned with knowledge creation technologies, its potential will be limited to quick fixes, partial solutions, and inadequately informed decision making.

We need to stimulate new communities of practice made up of people and organizations experienced in technology implementation, cooperative work (collaboration technology and practice), organizational learning, and process initiation and improvement.[4] Most importantly, those familiar with the workings of processes in their local situations must be involved [13,14,15].

What is Organizational Learning?

Approaches to organizational learning starting in the late 1970s [16] have generated significant interest, but discussion has not yet led to widespread application. Many of these ideas have not been piloted or implemented in everyday work practices of organizations [8,17]. Nor have organizations tapped advances in information technology to create a sense of learning history or corporate memory, except in highly innovative business environments.

Researchers and practitioners have written about this for decades, and yet issues debated in the field 20 or so years ago bear a striking resemblance to those still debated today. For example, we continue to discuss distinctions between adaptive and generative learning [18], between single- and double-loop learning [16,19], between "know-how" and "know why," and so on.

How is it that organizational learning has persisted, running parallel to the stream of fads in business and management practice? The concept has survived while a whole cadre of consultants and organizational mechanics have paraded by, selling everything from management by objectives, quality circles, total quality management, and management by results to statistical process control, business process re-engineering, business process reinvention, and more recently high performance teams, self-directed teams, empowered teams, and integrated product/process/practice teams.

Is organizational learning just a catch-all, a vessel for goals and related thinking on strategy, productivity, and innovation? Perhaps organizational learning holds true generally and the variation that we see resides in methods, techniques, and practices — the particular means for instantiating a kind of organizational learning. The question remains: Is the staying power of organizational learning in its emptiness or its elasticity? Have we advanced in this area over the last three decades or not, and if so, how or how not?

To add to the fuzziness around the concept of organizational learning, researchers and practitioners also talk about "learning organizations." For some, the difference is captured between organizational learning, which can be taken to mean learning by individuals and groups

in the organization vs. learning organization, which emphasizes learning by the organization as a total system [15, 20]. By the organization as a total system, we mean there are systemic features to learning beyond the activities of particular individuals who may come and go. This does not mean that people are not important or needed in the learning process; rather, organizational learning is not reducible to individual learning. In this article, we use the terms interchangeably but we are concerned with the second condition — learning by the organization as a total system. We envision a learning organization as one where:

- the organization remembers and learns
- public recording is unobtrusive and useful in the execution of work processes and decision making
- principles and concepts may refer to a group, an organizational unit(s), or a community, suggesting notions of scalability and tailoring
- the notion of learning is different from the additive sum of individual contributions, $a + b + n$ (instead, the whole is more than the sum of the parts)
- learning is applied to produce or modify individual dispositions, policies, processes, and procedures

Can We Get It Into Practice?

We believe that we are poised, more ready than ever, for learning organizations. We are at a watershed — with the potential to get leverage from our intellectual investment in organizational learning, matching our interests with enabling information technology. Current thinking in the discipline of organizational learning offers guidelines for use. However, because of the limitations already noted, we emphasize that constructing learning environments requires that we apply knowledge and capability in related areas, such as processes and systems thinking, group dynamics and performance, education and distance learning, and community memory. Together, these comprise the backbone for communication and cooperative work necessary for a learning organization.

Silver Bullets and Basics

Too often, we observe a premature inclination to jump to a technological solution without paying attention to the basics. For example, development teams may be over-eager to automate processes, which have not been fully defined or used in manual operations [5]. Similarly, doing computer-supported cooperative work does not guarantee that contributors are collaborating, in the best sense of the word, or working productively as a team. These tendencies reveal wishful thinking that adding technological support will magically allow users to bypass a host of needs and constraints. The technology is seen, naively, as a silver bullet.

No technology can compensate for bad practice, nor can it substitute for an understanding of basics or fundamentals. However, experimenting with and piloting new technologies can help co-evolve fundamentals and technologies. For all of these reasons, we underscore the importance of related knowledge in several disciplines and in local practice. Initially, one may focus on the technology and thinking about systems and processes. In the end, a learning organization must reckon with good practice in teaming, education, sharing information and archiving lessons, and corporate memory — recording and analyzing decision-making and related history [21] — for recurring and problematic themes, and all in a manner that is coherent, yet streamlined and accessible.

All organizations inevitably enter this problem space from somewhere — with prior knowledge and experience in many of the areas identified. Local understanding may be fragmented or isolated but it represents organizational learning, even if that learning is somewhat sparse or dislocated. In many organizations, learning efforts have simply not been strategically conceived, or with any intent for integration. This may have occurred for any number of reasons, including the relative immaturity of the technologies in question and risks associated with the same.[5]

Working on Learning

A learning organization establishes the capability to understand its environment and culture, including its current activities and work processes to evaluate what is understood, and to initiate improvements where necessary. These metaprocesses centered on the capability to learn are both independent of and dependent on the people in an organization. This capability enables decision making and affects outcomes, representing the combined experience, expertise, and knowledge of all participants involved in a group activity. Group activities may pertain to a team, project, department, or program. In such an effort, a strong leader may be best able to summarize or express the voice of the group, but what is being expressed is the product of uninhibited information flow, analysis, and negotiation. Our goal in this article is to support organizational dialogue. All organizations are capable of learning; it remains for the organization to find its own medium and voice.

Organizations are *independent* of their members because work processes — along with associated policies, values, mechanisms, and techniques — may exist long after people have left the organization or before new people have come on board. Moreover, viable and effective processes are not dependent on extraordinary individuals to carry them out. Organizations with a strong process focus have an increased potential for democracy. By mobilizing multiple perspectives, experiences, and expertise from across an organization, and channeling these for decision making, the organization, as a whole, can monitor relevant market conditions, continuously adapting its processes to satisfy changing technical and business needs. By the same token, an organization's culture and the identity of its members is derived, in part, from these articulated processes. They determine the quality of life and the loyalty of members, and must be adjusted continuously to gain and keep the commitment of the organization's members.

Organizations are *dependent* on their members and in the free flow of ideas. These interactions form the creative source for organizational learning and are necessary conditions for the ongoing viability of the processes that are created. A number of researchers have pointed to the importance of talk and interaction as

a basis for mutual understanding [22], for narrative exchanges as the basis of learning-in-working and innovation [14], and of records, documents, visualizations, and artifacts to accomplish work and to engender shared ways of viewing the world [23,24,25,26]. Talk, stories, and documents serve a dual role — information bearing and social bonding — in single exchanges and multiple, connected instances. Most organizations will have to undergo structural and cultural changes to reap the potential benefits of talk, where members of different projects or programs contribute to the same discussion or branched threads. These changes cannot happen overnight. This is just as well, for it is unwise for organizations to attempt a unilateral shift all at once.

Tools, alone, will not create the organizational cultures, structures, and conditions that are needed for their best use. Rather, the necessary mutual adaptation of the technology and organizational processes and forms must come through trial and experimental use [27, 28].

In part two of this article, we look at technology change management in practice — by considering the role that learning plays in process models and improvement frameworks. We illustrate with several examples, including IDEAL^SM, a model for software process improvement, and the IDEAL^SM-Based New Technology Rollout (INTRo).

Technology change management can contribute to building a learning organization. But for technology change management to become part of daily work, these activities must be integrated with evolving socio-technical and business needs and processes. New communities of practice must be nurtured, including people and organizations experienced and knowledgeable in technology investigation, change management, and collaboration practice. ◆

About the Author

Linda Levine leads the effort on the IDEAL^SM transition framework development, aimed at extending improvement models into structured processes for technology adoption and rollout at the Software Engineering Institute (SEI). She is a process developer for INTRo, a web-based adaptable process guide with proven practices for introducing new technology into software-intensive organizations, co-developed by the SEI and Platinum Technology. In addition to working on the diffusion and transfer of software technologies and change management, she researches technology suppression, reasoning and communication, design disciplines, and the relationships between organizational learning and the use of collaboration technology. Dr. Levine holds a doctorate in rhetoric (communication) from Carnegie Mellon. She publishes widely and is the co-founder of the Working Group (8.6) on Transfer and Diffusion of Information Technology, part of the International Federation for Information Processing.

Software Engineering Institute,
Carnegie Mellon University,
Pittsburgh, Pa., 15213
Voice: Tel. 412-268-3893
Fax: 412-268-5758
E-mail: ll@sei.cmu.edu

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Notes

1. This work is sponsored by the Department of Defense. Some of the ideas expressed here can be found in an earlier work: see Levine, L. and Monarch, I. (1998). Collaborative technology in the learning organization: Integrating Process with Information flow, access, and interpretation. In J.F. Nunamaker, Jr. (Ed.), Collaboration Systems and Technology Track, vol 1., Proceedings of the 31th Annual Hawaii International Conference on System Sciences, (pp. 444-459). Mauna Lani, Hawaii: IEEE Computer Society Press, Los Alamitos, Calif.

2. The Software Engineering Institute is a federally funded research and development center sponsored by the Department of Defense.

3. In "This Organization is Dis-organization," Polly Lebarre describes the transformation at Orticon Holding A/S, a company that makes hearing aids in Denmark. Lars Kolind, CEO, reflects on how he began to share his vision for reinventing the company, as drafted in his four-page (New Year's 1990) memo. It amounted to a declaration of disorganization. Orticon needed breakthroughs, Kolind wrote, and breakthroughs require the combination of technology with audiology, psychology, and imagination. The ability to "think the unthinkable" and make it happen. In organizations of the future, he continued, "staff would be liberated to grow, personally and professionally, to become more creative, action-oriented, and efficient." What was the enemy of these new organizations? The organization itself (*Fast Company*, June/July 1996, p. 80; italics Lebarre).

4. When we use the phrase "collaborative technology," we mean an alignment between process and information-sharing technologies.

5. At the SEI, for example, we have experimented with an empowered team and built practices for chartering teams. We have conducted experiments with groupware to characterize knowledge integration in software development. The institute's education program and master's program in software engineering employed its media studio to offer courses by satellite. Two CD-ROMs have been developed for just-in-time learning. There is interest in an environment that might incorporate the notion of shared virtual space, a library of process assets, various repositories, and support for asynchronous collaboration. Like others, we need to realize our intellectual investments and our organizational learning, if we are to become an organization that learns.