

Processes and Tools to Support Knowledge Management in a Virtual Organization

Timothy G. Kotnour, Ph.d.
(407) 823-5645

Department of Industrial Engineering and Management Systems
University of Central Florida
Orlando, FL 32816-2450

Michael Proctor, Ph.d.
(407) 823-5296

Department of Industrial Engineering and Management Systems
University of Central Florida
Orlando, FL 32816-2450

This paper's contribution is a description of a knowledge management process and tools for a virtual organization. A virtual organization is described as an interconnected set of management systems. The first connection is conceptual in nature and is seen through a project which defines the need for knowledge management. The second connection is informational and is experienced through electronic management tools. Knowledge management is composed of knowledge creation, assimilation, and dissemination. Management tools connect management systems for improved information flow and rapid knowledge growth to effect project execution. These concepts are demonstrated using a project view of a virtual organization's tasks.

Introduction

Organizations are moving to a virtual organization structure due to the competitive advantages gained by advances in electronic communication/information technology and competitive pressures that force a focus on core products. A virtual organization is viewed as an organization in which workers are not physically but electronically connected (Fulk & Desanctis 1995). Grenier and Metes (1995) described a virtual organization as a disperse (in geography and familiarity with other members of the group) set of groups and individuals organized and coordinated based on their core knowledge needed to complete a project (i.e., a virtual project). After the project is completed the team is disbanded and the virtual work group disintegrates to pursue other opportunities. A virtual work group includes members from the "parent" organization as well as partnering organizations. Supporting the virtual organization and work group is an evolving foray of essential tools and capabilities that enable near instantaneous communications and rapid yet knowledgeable responses for communication, coordination, and learning. Technical, product or directional knowledge become key elements in executing a "virtual" project that address customer needs. Partnerships of knowledge workers predominate in virtual relationships. Their productivity is based on system knowledge and integration. Knowledge growth and synthesis is essential to continued performance for a virtual organization (Boland & Tenkasi 1995). A productive organization utilizes the virtual organization knowledge management process and tools in a way that creates knowledge growth and enables synthesis to generate constructive decisions.

A MSM View of a Virtual Organization

A conceptual model called the management system model (MSM) (Kurstedt 1994) is adapted to describe the virtual organization as an interconnected set of management systems. The MSM contains three components ("who manages", "what is managed", and "what is used to manage" or "management tools") and three interfaces ("decision to action", "measurement to data", and "information portrayal and perception"). The "who manages" represents a virtual worker who makes a decision leading to action for completing a task on a virtual project. The "what is managed" component represents what the virtual worker is responsible and

accountable for on the project. A “who manages” component acts on the “what is managed” component through the “decision to action” interface. The “measurement to data” interface collects data from the “what is managed” component. The “what is used to manage” component uses the data to produce and portray information. “Information portrayal to perception” is the third interface. The portrayed information is perceived by the “who manages” component to make decisions. The “what is used to manage” component includes the management tools we discuss later for knowledge management. We use this model to develop two connections between virtual workers.

The first connection is made through the “what is managed” component or tasks on the virtual project. We discuss the second connection through the “what is used to manage” component when discussing the role of management tools for knowledge management. As shown in Figure 1, management domains A and B are connected through their shared responsibilities for “what is managed”. One of the primary resources in any organization and especially the virtual organization is the knowledge used in executing a virtual project. In a virtual organization, individuals are selected based on their knowledge for the project tasks. These individuals are connected through electronic channels for information and knowledge management.

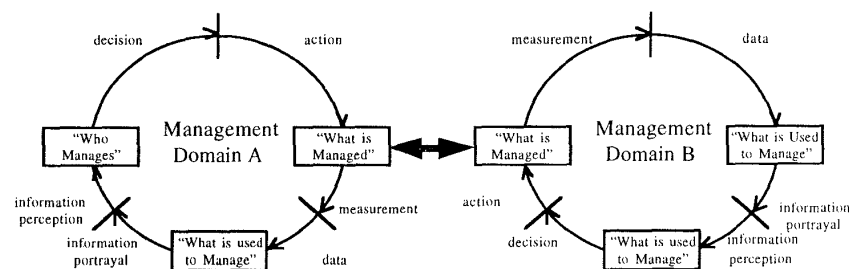


Figure 1: Workers Connected by Shared Responsibilities for “What is Managed”.

Knowledge Management for Organizational Learning

Virtual organizations, as all organizations, need to continually produce and share knowledge including using knowledge gained from past projects to solve current projects (Cohen & Sproull 1991). The knowledge is placed in and taken from organizational memory. Organizational memory is the data, information, and knowledge from the past that can be used on present problems (Walsh & Ungson 1991). The process for updating and using organizational memory is organizational learning (Huber 1991). Organizational learning is the naturally occurring process, where as knowledge management is the proactive and purposeful management of the organizational learning process. Knowledge management functions of creation, assimilation, and dissemination are the proactive methods for updating and using organizational memory. For knowledge creation, the organization must have a sub-process to connect the planned actions with the results to learn from the project. Knowledge assimilation is the sub-process to collect the created knowledge and store and refine the knowledge with past organizational knowledge. This knowledge assimilation sub-process adds support to best practices and decreases the support for less effective practices. Knowledge dissemination is the retrieval and distribution of the knowledge to use on another project. The organizational learning process which knowledge management supports is described along two dimensions: modes and timing.

Nonaka (1994) described four modes for organizational learning. Three of the modes (socialization, externalization, and internalization) emphasize direct human-to-human interaction. Socialization is the process for transferring tacit knowledge to tacit knowledge between individuals and includes culture or shared experiences, mentors, and on the job training. Externalization is the mode by which an individual shares his

or her tacit knowledge with others by making the knowledge explicit. Internalization transfers explicit to tacit knowledge through learning by the individual. The fourth mode, combination, relies on formal electronic communication methods for sharing explicit knowledge between individuals.

Taking a project view of organizational actions, organizational learning takes place at two time periods: intra- and inter-project. Intra-project learning is the learning existing team members complete on the tasks within the project. Inter-project learning is the sharing of the knowledge between projects. The intra-project learning serves as the foundation for the inter-project learning by providing the experiences to be assimilated for the end of the project learning.

The intra-project organizational learning process focuses on the tasks within a single project. The creation of organizational memory during intra-project takes place during the project planning, execution, and close-out phases. Knowledge is created in 1) the definition of the project plan and 2) the comparison of the actual results to the plan. Explanations for both performance variances and non-variances offer opportunities for learning. Innovative approaches for completing a task should be documented as well as any major problems encountered and the approaches used to overcome the problems. Knowledge creation produces a lesson learned (Juran 1988) which includes the following components: plan (goals, conditions, and steps or actions); results; and recommendations (what worked and why, and what didn't work and why) (Kotnour 1995). Knowledge assimilation occurs through the continuous capture and storage of the lessons learned. Knowledge dissemination occurs through the virtual workers sharing amongst themselves what has been learned on their given tasks and sharing the gained knowledge for inter-project learning. The intra-learning focuses on the tasks within a project.

Inter-project learning focuses on taking the knowledge created, assimilated, and disseminated from the intra-project learning and assimilating and applying appropriately new knowledge with past project knowledge to support knowledge dissemination to and creation in other projects. The inter-project knowledge creation is the drawing of lessons learned from a single project (i.e., lessons learned for the project). The knowledge assimilation is the combining of lessons learned across projects to develop new knowledge. The dissemination function is the sharing of lessons learned across projects to support intra-project learning for the next project. The cycle begins anew for each project.

The characteristics of the virtual organization pose possible barriers and enhancements to the organizational learning modes and timing. We hypothesize that the socialization, externalization, and internalization modes are most exhibited by the high levels of informal communications exhibited in the physical co-location of workers in communities of practice (Brown & Duguid 1991). Traditional balances and expressions between these three modes may be modified for sharing knowledge in the virtual organization because the very nature of the virtual organization relies on electronic communication; that is, during the project the communities of practice may be primarily electronic communities. An analogy may be drawn between the dynamic changes that occurred in the actors when the entertainment industry shifted from radio to television or silent films to talking films. Immediately the dynamics changed the qualities needed for success. These three modes may be modified for inter-project learning because workers within a virtual organization will be consistently changing from project to project. Therefore, the combination mode of sharing explicit to explicit knowledge may be a primary source for sharing knowledge within and between projects. Based on the characteristics of the virtual organization and the need for organizational learning in the virtual organization, we offer the following hypotheses to base our description of knowledge management tools to support organizational learning in a virtual organization:

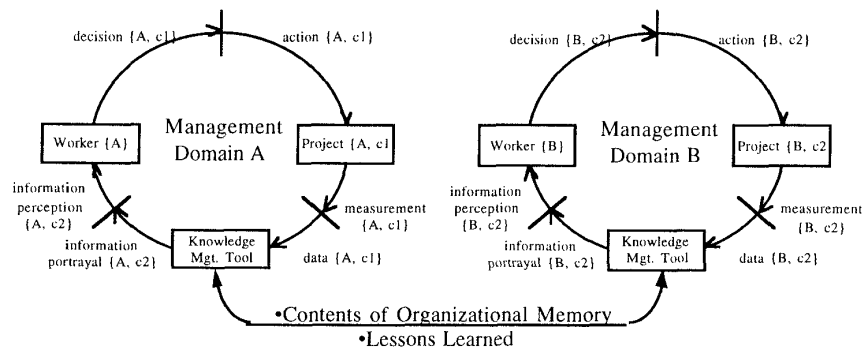
- Learning takes place within and between projects.
- Virtual communities of practice are dispersed and ever changing.

- The combination mode of Nonaka (1994) will be the primary mode for sharing knowledge within and between projects in the virtual organization because the physically located “communities of practice” of the traditional organization which provide the mechanisms for the sharing of knowledge between workers will not exist. Instead, presence will be experienced in a virtual manner.

Knowledge Management Processes and Tools

In the virtual organization, there are now electronic communities of practice and the primary means of knowledge sharing is through the “combination” mode. The second connection of virtual workers in a virtual organization is through management tools (i.e., the electronic workflow and communications tools). The role of tools in this connection is for the sharing of knowledge between the management systems (Kotnour 1995). This sharing may take place intra-project as the project is being completed or inter-project between projects after they are completed. The notation {management system, cycle} is used to distinguish the components and interfaces of the two different systems and cycles. The concept of Figure 2 is illustrated with two cycles. The first cycle begins with a decision and ends with the update of organizational memory. The first worker {A} during the first cycle {c1} makes a decision {A, c1} that leads to an action {A, c1} on a project {A, c1} all within the first cycle {c1}. Measurement {A, c1} on the task performance produces data {A, c1} for the worker to use in creating a lesson learned. The second cycle {c2} begins with the updating of organizational memory with a lesson learned.

The contents of organizational memory at the beginning of cycle {c2} are shared between management domains {A} and {B}. The information portrayal of both domains {A} and {B} at the beginning of the second cycle {c2} is a set of lessons learned in domain {A} to be shared with domain {B} and, therefore, is the same for each domain. The second cycle begins when the second worker {B} uses this information {B, c2} to make a decision {B, c2} leading to an action {B, c2}. The action on the project {B, c2} produces a lesson learned through measurement and data. For intra-project learning, the c1 and c2 occur within the given project. For the inter-project learning c1 and c2 are used to denote separate projects.



Figure_2: Workers Connected by Knowledge Management Tools.

To support this sharing across management domains, three groups of functions of a management tool need to be defined: creation, assimilation, and dissemination. Creation for intra-project learning focuses on guiding the worker through the construction of a plan, collection and analysis of the actual results, and creation of recommendations (i.e., creating a lesson learned). The assimilation function is the integration of the lesson learned across all tasks within a given project. Dissemination is the function in which the lessons learned are communicated with the other workers. For inter-project learning, the creation function is the development of project-focused lessons learned based on the assimilation of the task-focused lessons learned. The assimilation function is the integration of a project lesson learned across projects and

can take place using artificial intelligence techniques. The dissemination functions focus on supporting the worker working on a new project by sharing the lessons learned. The outputs of the tool support the worker in planning a project by providing answers to the following questions:

- What are the actions or set of steps to take?
- What are the alternative sets of steps?
- What are the expected results?
- How do I change the past plans to fit the current situation?
- What should I do that others have done and found to work?
- What should I not do that others have done and found not to work?

As more projects are created information overflow becomes a major problem. Intelligent advisors and search tools can be used to help disseminate the knowledge (Ragusa 1994). The tool should provide a complete set of cases which represent both positive and negative examples.

Conclusions

Given the nature of the virtual organization and the increasing importance of knowledge, organizations need to be proactive in the management of their knowledge. We have offered a description of two related knowledge management processes and a functional description of management tools within these processes. However, there are further virtual knowledge management research issues which must be addressed including: understanding the factors which support and act as barriers to people sharing knowledge; ensuring the quality of the knowledge shared; and understanding how the four modes and timing dimensions of knowledge management differ for a traditional versus virtual organization. The users of a virtual organization need to be aware of the processes for knowledge management and the need to deal with the barriers of electronic communication for knowledge management. This paper provided a framework to understand knowledge management when developing electronic communication technologies for virtual organizations.

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