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OMIS-Based Collaboration with Service-Oriented Design

Kam Hou Vat
University of Macau, Macau

INTRODUCTION

The success of today's enterprises, measured in terms of their ability to learn and to apply lessons learned, is highly dependent on the inner workings and capabilities of their information technology (IT) function. This is largely due to the emergence of the digital economy (Ghosh, 2006; Turban, Leidner, McLean, & Wetherbe, 2005), characterized by a highly competitive and turbulent business environment, inextricably driven by the intra- and inter-organizational processes and the knowledge processing activities they support. One consequence is the increase in organizations' efforts to deliberately manage knowledge (Tapscott, 1997), especially the intellectual capital (Stewart, 1997) of their employees (De Hoog, van Heijst, van der Spek, et al., 1999), which necessarily deals with the conceptualization, review, consolidation, and action phases of creating, securing, combining, coordinating, and retrieving knowledge. In fact, such efforts must be instrumental to creating an efficient organization model based on some innovative initiative, and then enable the organization to launch and learn. In a knowledge-creating organization (Nonaka & Takeuchi, 1995), employees are expected to continually improvise, and invent new methods to deal with unexpected problems and share these innovations with other employees through some effective channels of communications or knowledge transfer mechanisms. The key is collaboration, implying that organizational knowledge is created only when individuals keep modifying their knowledge through interactions with other organizational members. The challenge that organizations now face is how to devise suitable information systems (IS) support to enable such collaboration, namely, to turn the scattered, diverse knowledge of their people into well-documented knowledge assets ready for reuse to benefit the whole organization. This article presents some service-oriented perspectives of employee-based collaboration through the design of specific IS support called the Organizational Memory Information System (OMIS) in light of the peculiar open-source development initiative of Wiki technology (Leuf & Cunningham, 2001).

BACKGROUND

Lately, an organization's ability to learn is often considered a process of development to organizational memory. By organizational memory (Walsh & Ungson 1991), we are referring to various structures within an organization that hold knowledge in one form or another, such as databases and other information stores, work processes, procedures, and product or service architecture. As a result, organizational memory (OM) must be nurtured to assimilate new ideas and transform those ideas into action and knowledge, which could benefit the rest of the organization (Ulrich, Von Glinlow, & Jick 1993). Through understanding the important components of the OM (Vat, 2001), an organization can better appreciate how it is currently learning from its key experiences, to ensure that relevant knowledge becomes embedded within the future operations and practices of the organization. In practice, creating and using an OM is a cooperative activity necessarily involving many members of an organization. If those individuals are not adequately motivated in contributing to the OM initiative, and the organizational culture does not support knowledge sharing (Orlinkowski, 1992), it is not likely to turn the scattered, diverse knowledge present in various forms into well-structured knowledge assets ready for deposit and reuse in the OM.

Consequently, it is important to distinguish between the organizational memory (OM encompassing people) and the OMIS that captures in a computational form only part of the knowledge of the organization. The OM captures the knowledge of the organization. The associated OMIS makes part of this knowledge available either by providing direct access to it (e.g., codified knowledge assets such as experience reports) or indirectly by providing knowledge maps (e.g., tacit knowledge assets such as personnel with specific expertise). Managing the OM deals first of all with the question of "Which knowledge should go into the OMIS?" Answering this question requires determining what knowledge is owned by the members of the organization, what knowledge is needed now, what is going to be needed in the future, and for what purposes. This helps the organization to define not only a strategy for acquiring the needed knowledge, but also to establish validation criteria in relation to the defined goals. Besides, we also need to deal with "who needs the knowledge, when and why," as well as the policies for accessing and using the OMIS. This contextualization of the OMIS with respect to the organization's ability to learn is essential to implement the mechanisms of organizational knowledge transfer, examples of which are discussed in Vat (2006). In fact, in this modern age of information technology and swift change, learning has become an integral part of

the work of an organization run along principles intended to encourage constant reshaping and change. An OMIS-based organization can be characterized as one that continuously transforms itself by developing the skills of all its people and by achieving what Argyris (1992) has called *double-loop learning,* which helps transfer learning from individuals to a group, provide for organizational renewal, keep an open attitude to the outside world, and support a commitment to knowledge. One of the missions of the OMIS is to facilitate and bring about the fundamental shifts in thinking and interacting and the new capabilities needed in the organization.

SERVICE-ORIENTED DESIGN FOR OMIS

When designing an OMIS to nurture an organization's ability to learn (Vat, 2001, 2002), we consider the following modes of learning behavior: (1) individual, (2) group, and (3) repository. Individual learning is characterized by knowledge being developed, and possibly the result of combining an insight with know-how from other sources in the organization, but it is often not distributed and is not secured for reuse. Group learning is centered around the concept of communication in two possible modes: supply-driven or demand-driven. The former is characterized by an individual who has found a way to improve the work process and communicates this to one's coworkers. The latter refers to a worker who has recognized a problem in the current process and asks fellow workers whether they have a solution for this problem. In each case, knowledge is developed, distributed, and possibly combined with knowledge from other parts of the organization, but it is seldom secured. In repository learning, the communication element is replaced by collection, storage, and retrieval of knowledge items. Namely, it is typified by storing lessons learned in some information repository so that they can be retrieved and used when needed. Overall, in repository learning, knowledge is developed, secured, distributed, and is possibly the result of knowledge combination. It is convinced that the requirements of an OMIS design should be formulated in terms of some typical usage scenarios. Namely, an OMIS should facilitate individual workers to access the knowledge required by combination, to submit a lesson learned, and to decide which of the coworkers would be interested in a lesson learned. Also, there should be criteria to determine if something is a lesson learned, how it should be formulated and where it should be stored, and how to distribute some newly asserted knowledge piece to the workers in need. The perceived technical issues, nevertheless, could include the following: How are we to organize and index the OM to enhance its diffusion? How does an organization retrieve relevant elements of the OM to answer a user request or proactively push relevant elements towards users? How does an organization adapt the answer to users, in particular to their tasks, according to the knowledge contexts? These problems are largely related to the OM framework for knowledge distribution, whose goal is to improve organizational learning, with the aid of the previously mentioned OMIS support whose discussion through the idea of service-orientation is our major concern in the following section.

The Context of Service-Orientation

The term "service" has existed for some time (Chesbrough & Spohrer, 2006), and its attendant "service-oriented" connotation has also been used in different contexts and for different purposes (Rust & Miu, 2006). According to Erl (2005), one constant characteristic of this term currently identified among the research community is that it represents a distinct approach for separating concerns. Simply stated, the effort or logic required to solve any problem can be better constructed, executed, and managed if it is decomposed into a collection of smaller, related pieces. Each of these pieces addresses a concern or a specific part of the problem. Indeed, this thinking is not new and it does transcend technology and automation solutions, especially in the IT field, but what distinguishes the service-oriented approach to separating concerns is the manner in which it achieves separation. Consider our city that is full of service-oriented businesses, each of which provides a distinct service that can be used by multiple consumers. Collectively, these businesses comprise a community, decomposable into specialized, individual outlets, providing all possible business services. More importantly, individual outlets are encouraged to interact and leverage one another's services. Nonetheless, we want to avoid a model in which outlets form tight connections that result in constrictive inter-dependencies. Preferably, businesses are empowered to self-govern their individual services so as to evolve and grow relatively independent of each other. Meanwhile, it is also important to ensure that service providers must adhere to certain baseline conventions that standardize key aspects of each business for the benefit of the consumers without significantly imposing on the individual provider's ability to exercise self-governance.

The Promise of Service-Oriented Computing

With the rapid increase of software applications for the daily running of modern businesses, service-oriented computing (SoC) (Dijkman & Dumas, 2004) is emerging as a promising paradigm for enabling the flexible interconnection of autonomously developed applications operating within and across organizational boundaries (Alonso, Casati, Kuno, & Machiraju, 2003). Under the SoC paradigm, the functionality of existing applications can be expressed as services or a network of services called service compositions (Casati & Shan,

2001; Benatallah, Sheng, & Dumas, 2003). Currently, the SoC paradigm is mainly associated with enabling technology founded on such standards as SOAP (Simple Object Access Protocol), WSDL (Web Services Description Language), WS-Security, and BPEL (Business Process Execution Language). Such technology enables businesses to describe the services they offer, to publish these descriptions online, to find other services based on their descriptions, and to build applications using those services. The term "service-oriented design" was coined by Dijkman and Dumas (2004) to represent the set of modeling languages, methods, and techniques used to design such services, to verify the conformance of services to their requirements, and to enable a model-driven approach to service development and composition.

The Challenge in Service-Oriented Design

In anticipation of the emerging service opportunities to provide enterprise solutions that can extend or change on demand, Dimmermann, Krogdahl, and Gee (2004) enumerated three major levels of abstractions to be managed within the service-oriented design process:

- **Operations:** These are transactions that represent single logical units of work (LUWs). Execution of an operation will typically cause one or more persistent data records to be read, written, or modified. SoC operations are typically comparable to object-oriented (OO) methods. They have a specific, structured interface, and return structured responses.
- **Services:** These represent logical groupings of operations. For example, if we consider *KnowledgePortfolio* as a service, then *Lookup knowledge objects by reference number, List knowledge item by name and call reference,* and *Save data for new knowledge* represent the associated operations.
- **Business Processes:** These represent a long-running set of actions or activities performed with specific business goals in mind. Business processes typically encompass multiple service invocations. Examples include: *Initiate New Student, Create StudentPortfolio, Showcase StudentPortfolio,* or *View StudentPortfolio.* In SoC terms, a business process consists of a series of operations executed in an ordered sequence according to a set of business rules. The sequencing, selection, and execution of operations is termed a service or process choreography. Typically, choreographed services are invoked in response to business events.

From a modeling standpoint, the challenge in service-oriented design for OMIS is how to characterize in a well-specified manner those operations, services, and process abstractions systematically for such architectural components as individual learning, organizational learning, and intellectual property management.

FUTURE TRENDS

Much of earlier literature review (Ghosh, 2006; Badaracco 1991; Hamel & Prahalad 1994; Quinn 1992; Pinchot & Pinchot 1994) supports the supposition that intellectual material in the form of information, knowledge, and any other form of intellectual property is a valued organizational asset, and organizations are increasingly dependent on information technology (IT) for the transfer of knowledge and information. Conspicuously missing, however, is often a discussion of collaboration (Tabaka, 2006; Schrage 1990) as a regenerative source of ideas that will advance organizations to learn, change, and excel (Menon, 1993; Stewart, 1994). To collaborate is to work in a joint intellectual effort, to partition problem solving to produce a synergy such that the performance of the whole exceeds that of any individual contributor. The central issue in organizational learning is how individual learning is transferred to the organizational level. In this regard, the use of Wiki technology (*www.wiki.org*) as a collaborative tool within an organizational setting renders an excellent example. Yet, only with a clear understanding of the transfer process can we manage learning processes consistent with organizational goals, issues, and values. If this transfer process was indeed actualized in the design and practice of the OMIS, we could well have a knowledge organization with the capability of capturing learning in its different paths and incorporating that learning into the running of its daily operations.

The Service-Oriented Aspects of Wiki Technology

Wiki technology is based on open-source software. The software that operates any Wiki is called a Wiki engine (Kille, 2006). A variety of free Wiki engines (also known as Wiki clones) are available from the Web (*www.wiki.org*). There are also Wiki hosts offering Wiki service with a minimal fee, such as the Seedwiki (*www.seedwiki.com*), and JotSpot (*www.jot.com*). The first Wiki application invented by Ward Cunningham in 1995 was to publish information collaboratively on the Web (Leuf & Cunningham, 2001), and this first Wiki Web site (*c2.com/cgi/wiki*) is still actively maintained today. Leuf and Cunningham (2001, p. 14) define a Wiki (Hawaiian word meaning *quick*) as a freely expandable collection of interlinked Web pages, a hypertext system for storing and modifying information. Cunningham's original vision was to create a Wiki as the simplest online database that could possibly work. Today, Wikis are interactive Web sites that can offer numerous benefits to users (Wagner, 2004), in the form of a simple editing and publishing interface that can

be used and understood easily. Anyone can create a new Wiki page, add or edit content in an existing Wiki page, and delete content within a page, without any prior knowledge or skills in editing and publishing on the Web. In fact, the major distinguishing factor between Wikis and regular Web sites is the ability of Wiki users to easily edit all aspects of a Wiki Web site. Fuchs-Kittowsk and Kohler (2002, p. 10) interpret a Wiki as an open author system for a conjoined construction and maintenance of Web sites. They suggest that Wiki technology can facilitate cooperative work and knowledge generation in such contexts as content management systems, discussion boards, and other innovative forms of groupware. Indeed, members of a Wiki community can build and develop meaningful topic associations by creating numerous links among Wiki pages. To make the Wiki technology useful for collaborative work in organizations, Wagner (2004, p. 270) suggested 11 principles that govern the functional design of a Wiki application:

- **Open:** If a Wiki page is found to be incomplete or poorly organized, any reader can edit it as he or she sees fit.
- **Incremental:** Wiki pages can cite other pages, including pages that have not been written yet.
- **Organic:** The structure and text content of the site is open to editing and evolution.
- **Mundane:** A small number of (irregular) text conventions will provide access to the most useful but limited page markup.
- **Universal:** The mechanisms of editing and organizing are the same as those of writing, so that any writer is automatically an editor and organizer.
- **Overt:** The formatted (and printed) output will suggest the input required to reproduce it.
- **Unified:** Page names will be drawn from a flat space so that no additional context is required to interpret them.
- **Precise:** Pages will be titled with sufficient precision to avoid most name clashes, typically by forming noun phrases.
- **Tolerant:** Interpretable (even if undesirable) behavior is preferred to error message.
- **Observable:** Activity within the site can be watched and reviewed by any other visitor to the site. Wiki pages are developed based on trust.
- **Convergent:** Duplication can be discouraged or removed by finding and citing similar or related content.

The Potential Benefits as a Collaborative Tool

According to Wagner (2004) and Raman, Ryan, and Olfman (2005), the use of Wiki technology can address some knowledge management goals for collaborative work and organizational learning. Here, a knowledge management system refers to any IT-based system that is developed to support and enhance the organizational processes of knowledge creation, storage, retrieval, transfer, and application (Alavi & Leidner, 2001, p. 114). In particular, any Wiki clone can be designed to support such basic functions as searching and indexing capabilities for effective retrieval and storage of knowledge attributes. The most often cited benefits of using Wikis to support collaborative work thereby include the simplicity of learning and working with the technology, and the free download through the Wiki engines of all the necessary knowledge items of interest throughout the organization. More importantly, Davenport and Prusak (1998) provide three essential reasons why organizations need such a technology to implement its knowledge management systems:

1. To enhance visibility of knowledge in organizations through the use of maps, hypertexts, yellow pages, and directories;
2. to build a knowledge-sharing culture, namely, to create avenues for employees to share knowledge; and
3. to develop a knowledge infrastructure, not confined solely to technology, but to create an environment that permits collaborative work.

CONCLUSION

If designed and implemented effectively, Wiki technology can support a portion of an organization's collaboration and knowledge management requirements — specifically, knowledge sharing, storing, and support for the communication process within organizations. A key advantage of using Wikis to support knowledge management initiatives is that the technology is free. Nonetheless, issues such as sufficient user training, the availability of resources and skills to support the technology, and effective customization of Wiki features must be considered before the value of using the technology to support collaborative work within any organization is to be realized. Meanwhile, the use of service-oriented design is yet to be explored in terms of a more systematic methodology to enable enterprises to describe, publish, and compose application services (in the specific area of collaborative work and knowledge management), and to communicate with applications of other enterprises according to their service descriptions. The current development of SoC (Quartel, Dijkman, & Sinderen, 2004) promises to deliver the methods and technologies to help business partners link their software applications. This should facilitate the introduction of richer and more advanced applications (other than the Wiki applications), thereby offering new collaborative opportunities. Currently, we consider service-oriented design as the process of designing application support for one or more

intra- and/or inter-organizational processes using the SoC paradigm, which is characterized by the explicit identification and description of the externally observable behavior (service) of an application. Thereby, applications can then be linked, based on the description of their externally observable behaviors. According to this paradigm, developers in principle do not need to have any knowledge about the internal functioning of the applications being linked. This peculiar feature of separation of concerns forms the basis of service-orientation that has been elaborated in this article as a promising means of designing collaborative work within an organizational setting in the immediate future.

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KEY TERMS

Collaboration: To facilitate the process of shared creation involving two or more individuals interacting to create shared understanding where none had existed or could have existed on its own.

Double-Loop Learning: Together with single-loop learning, describes the way in which organizations may learn to respond appropriately to change. Single-loop learning requires adjustments to procedures and operations within the framework of customary, accepted assumptions, but fails to recognize or deal effectively with problems that may challenge fundamental aspects of organizational culture, norms, or objectives. Double-loop learning questions those assumptions from the vantage point of higher-order, shared views, in order to solve problems.

Knowledge Management: The broad process of locating, organizing, transferring, and using the information and expertise within the organization, typically by using advanced information technologies.

Learning Organization: An organization that focuses on developing and using its information and knowledge capabilities to achieve the following: to create higher-value information and knowledge, to modify behaviors to reflect new knowledge and insights, and to improve bottom-line results.

Organizational Learning: A process of leveraging the collective individual learning of an organization to produce a higher-level organization-wide intellectual asset. It is a continuous process of creating, acquiring, and transferring knowledge accompanied by a modification of behavior to reflect new knowledge and insight, and produce a higher-level asset.

Organizational Memory: A learning history that tells an organization its own story that should help generate reflective conversations among organizational members. Operationally, an organizational memory has come to be a close partner of knowledge management, denoting the actual content that a knowledge management system purports to manage.

Organizational Memory Information System (OMIS): An information system supporting the development of organizational memory, whose design philosophy is often organization specific. An example philosophy is to consider the OMIS as a meaning attribution system in which people select certain resource items out of the mass potentially available and get them processed to make them meaningful in a particular context in order to support their purposeful actions.

Service-Oriented Computing: A field of research focusing on the development of such technology that enables enterprises to describe the services they offer in a textual, mostly XML-based form, to publish these descriptions online and find services of other enterprises according to these descriptions, to compose services into new services, and to communicate with applications of other enterprises according to their service descriptions.

Service-Oriented Design: The process of designing software application support for one or more business processes, using the service-oriented computing paradigm.

Wiki Technology: Technology based on open-source software in the form of a Wiki engine. The Hawaiian word "Wiki" means "quick," with the connotation that this technology is easy to use once installed. Wikis run over the World Wide Web and can be supported by any browser. The technology is governed by an underlying hypertext transfer protocol (HTTP) that determines client and server communication. Wikis are able to respond to both requests for data (GET) and data submission (POST), in a given Web front, based on the HTTP concept.