WIKI TECHNOLOGY AS A "FREE" COLLABORATIVE TOOL WITHIN AN ORGANIZATIONAL SETTING

Murali Raman

This article provides a brief tutorial of Wiki technology as a collaborative tool. A case example from a university administration context suggests that — like many other end-user technologies — training and support needs should be carefully considered before the potential value of using this "free" technology to support knowledge management efforts can be satisfactorily realized.

MURALI RAMAN received his doctorate in management of information systems from the school of information systems and technology, Claremont Graduate University. He is currently with Multimedia University Malaysia. His research interests are within the domain of collaborative technology and technology adoption within the realms of knowledge management. He can be reached at murali.raman @mmu.edu.my.

WIKI IS A HAWAIIAN WORD THAT REfers to being quick. Leuf and Cunningham (2001) define a Wiki as "a freely expandable collection of interlinked Web pages, a hypertext system for storing and modifying information — a database where each page is easily editable by any user with a forms-capable Web browser client" (p. 14). The authors also differentiate between the terms Wiki (uppercase W) and wiki: the former is used to describe the technology concept, and the latter is used to refer to an application. Ward Cunningham invented the first wiki in 1995. His objective was to publish information collaboratively on the Web (Leuf & Cunningham, 2001), and this first wiki Web site (http://c2.com/cgi/wiki) is still actively maintained. Cunningham's vision was to create a wiki as "the simplest online database that could possibly work" (p. 15).

Wikis are interactive Web sites that can offer numerous benefits to users (Wagner, 2004; Kille, 2006). 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 (Kille, 2006). Wikis offer a simple editing and publishing interface that can be used and understood easily (Leuf & Cunningham, 2001; Wagner, 2004; Kille, 2006).

Fuchs-Kittowsk and Köhler (2002) define a wiki as an "open author system for a conjoined construction and maintenance of Websites" (p. 10). These authors suggest that Wiki technology can facilitate cooperative work and knowledge generation. Specifically, they suggest that a wiki might be applicable in different contexts as a

- Content management system
- Discussion board
- Other form of groupware

The authors imply that Wiki technology can support the requirements for collaborative knowledge creation within both corporate and academic environments.

TABLE 1 Examples of Wiki Clones

Wiki Clone	Comments
Wiki	The original wiki developed by Ward Cunningham Easily available resources from the Web Easy to install Numerous varieties of implemented versions already exist Perl can be hard to use/understand for a novice
Twiki	Designed for corporate users More professional and powerful, with features such as automatic e-mails, file attachments, etc. Mainly for *nix, and depends on some UNIX tools
Squeak Wiki, Swiki, CoWeb	Runs in Squeak Virtual Machine environment with Squeak Web server Integrated Smalltalk environment Highly extensible because of access to Squeak code modules in open and OS servers Maps wiki pages to numbered rather than named files More prevalent in academic environment because the technology ties nicely with collaborative work in computer sciences
Plone	Supports corporate need for file storing system Easily downloadable and online PDF resources are available at www.plone.org
TikiWiki	Easy to install even for a novice Resources (online) for downloading and operating available at www.tikiwiki.org

TECHNICAL ATTRIBUTES

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 called "wiki clones" (Leuf & Cunningham, 2001) — are available from the Web. Examples of the more popular wiki clones are described in Table 1.

Although wikis are easy to use once installed, the installation stage requires some experience in working with databases and server configuration when downloading a wiki engine. An alternative to managing a wiki using an internal server is to obtain services from a variety of Wiki hosts or farms, usually for a minimal fee. Examples of wiki farms are Seedwiki (http://www.seedwiki.com), JotSpot (http://www.jot.com), and Socialtext (http://www.socialtext.com) (Kille, 2006).

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 (Leuf & Cunningham, 2001).

FUNCTIONAL ATTRIBUTES

Any member in a wiki community can edit any pages on the wiki Web site. The editing of wiki pages does not require additional functions in the Web browser. Members of a wiki community can build and develop "meaningful topic associations" (p. 16) by creating numerous links between wiki pages (Leuf & Cunningham, 2001). Originally, the technology was not meant to engage casual visitors; rather, it was designed to enable users to regularly update the wiki pages in a collaborative fashion, thereby continuously changing the nature of the wiki Web site.

Wagner (2004) describes 11 principles that govern the functional design of a wiki, as summarized in Table 2. 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. Wagner's design principles also suggest that wikis might be useful for collaborative work in organizations. However, given the open nature of the technology, the notion of trust becomes vital within a wiki community.

The appendix provides a short user guide to how to perform some of the basic functions.

POTENTIAL BENEFITS AS A COLLABORATIVE TOOL

The most often cited benefits of using wikis to support collaborative work are

- Simplicity of learning and working with the technology (Kille, 2006)

TABLE 2 Wiki Design Principles

Principle	Explanation
Open	If a page is found to be incomplete or poorly organized, any reader can edit it as he/she sees fit. Wiki is based on open-source technology.
Incremental	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. (For example, location of the page.)
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 messages.
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.

Source: Wagner (2004, p. 270).

- The technology is downloadable for free (Wagner, 2004)

Wiki technology can therefore also address some knowledge management goals for collaborative work and organizational learning (Leuf & Cunningham, 2001; Fuchs-Kittowsk & Köhler, 2002; Wagner, 2004; Wagner et al., 2006; Kille, 2006). Any wiki clone can be designed to support the following basic functions as a collaborative tool:

- Searching and indexing capabilities for effective retrieval
- Storage of presentations

The next section provides an overview of knowledge management systems and how Wiki technology as groupware can be categorized as a type of knowledge management system. Then a case example is provided to demonstrate benefits and implementation challenges in a nonprofit organizational context.

KNOWLEDGE MANAGEMENT SYSTEMS AND GROUPWARE

A single definition of knowledge management does not exist (Alavi & Leidner, 2001). Knowledge can be viewed from several perspectives: "as a state of the mind, as an object, as a process, a situation of having access to information or even as a capability" (p. 109). Knowledge can be tacit or explicit (Nonaka, 1994; Nonaka & Takeuchi, 1995). Here, a knowledge management system refers to any IT-based system that is "developed to support and enhance the organizational knowledge processes of knowledge creation, storage, retrieval, transfer and application" (Alavi & Leidner, 2001, p. 114).

Davenport and Prusak (1998) provide three reasons why organizations implement knowledge management systems:

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

Gupta and Sharma (2004) classify knowledge management systems (KMSs) into seven major categories, as summarized in Table 3. According to this classification scheme, Wiki technology is an example of a groupware technology to support collaborative work. The technology

TABLE 3 Categories of Knowledge Management Systems

Category	Purpose	Example of Technology within Category
Expert systems	Capture knowledge and perform analysis on existing knowledge base to assist in decision making Often associated with rule-based and pattern recognition systems	Artificial intelligence (AI) Neural networks
Groupware (computer-supported collaborative work)	Permit sharing and collaborative work Enable individuals and teams to share knowledge with each other via the support of information technology	Lotus notes E-mails Blogs Electronic logs (E-logs) Wikis Videoconference Instant messaging
Document management systems	Support the need for managing text and images, to make information much more accessible	Spreadsheet software (e.g., Excel) Word documentation software (e.g., Microsoft Word)
Decision support systems	Contain summaries of large amounts of data, filtered and synthesized particularly to support strategic decision making	Business application software
Semantic networks	Explain not just relationships between entities but the meaning based on how the entities are structured	Semantic Webs
Database management systems	Permit management of both structured (relational) and much more complex datasets	Relational database management systems (RDBMS) Object-oriented database management systems (OODBMS)
Simulation tools	Run computer-based simulations for a variety of purposes	OpNet network simulator

Source: Adapted from Gupta and Sharma (2004).

might be used to support knowledge management and collaborative work in general, given its simplicity (Kille, 2006). In particular, the technology might appeal to organizations faced with cost constraints in implementing a more robust knowledge management system for a specific objective.

A short case example of Wiki technology to support knowledge management and communication in a university setting is described below.

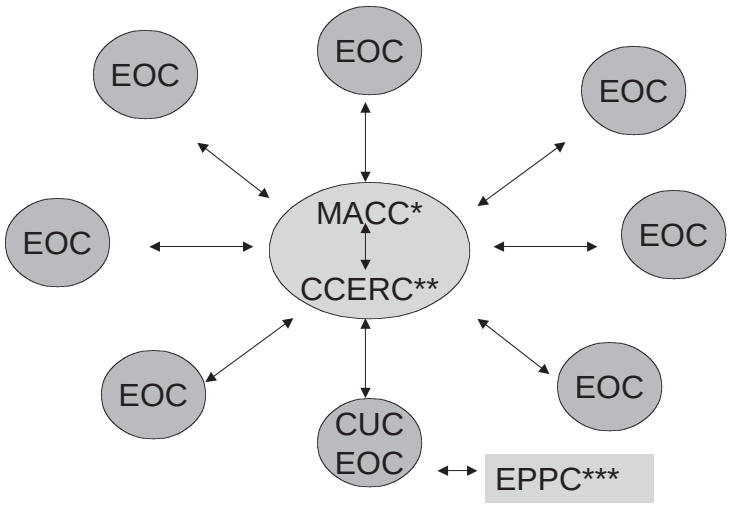
CASE EXAMPLE

The Claremont University Consortium (CUC) assists its seven member colleges on common issues such as campus housing, procurement of supplies and textbooks, facility management, payroll, and emergency preparedness. Prior to 2003, information about emergency preparedness was poorly organized. The majority of information pertaining to emergency planning was stored in several paper-based emergency manuals, and some of it was outdated. The CEO requested that the researcher organize the information better.

Figure 1 illustrates the emergency preparedness operations structure for the Claremont Colleges. Every college and the CUC has its own emergency operations center (EOC). An EOC is usually activated when an emergency occurs. The main objective of every EOC is to coordinate all emergency planning, response, and recovery assistance efforts.

The Multi-Agency Coordination Center (MACC) is a central coordinating entity for emergency response within the Claremont Colleges. When an emergency occurs, the MACC is activated. MACC members from each of the seven Claremont Colleges and CUC report to the MACC chairperson and begin working toward a coordinated emergency response initiative. MACC members receive information about the emergency situation from their respective EOCs. This information is channeled to the MACC operations coordinator, who then leads a consolidated response to a particular situation. The CCERC (Claremont Colleges Emergency Readiness Committee) is the planning entity for the MACC. The EPPC (Emergency Preparedness

FIGURE 1 Claremont College's Emergency Preparedness Operations Structure



*Multi-agency Coordination Center
**Claremont Colleges Emergency Readiness Committee
***Emergency Preparedness Planning Committee

Planning Committee) is the planning entity for CUC's EOC.

Information flow into the MACC, and from the MACC to the respective colleges EOCs, was originally maintained primarily through telephone and radio communication. The flow of information was also documented on a large white board, located in the MACC room. The author was involved in several drills that involved communication between the MACC and the college EOCs, in which several issues pertaining to communication and knowledge sharing were observed. Overall, the communication process can become too complex and chaotic:

- There are times when the scribe for MACC is not able to cope with the level of information flow into the MACC.
- The college representatives do not have a structured manner of documenting information from their respective colleges.
- Information within MACC, via the white board, cannot be shared with members of the college EOCs.
- Each college representative has information about only her/his college without any idea of what is happening in the other colleges.

On balance, the emergency preparedness initiatives within the Claremont Colleges could benefit from the use of information technology to

- Support communication
- Organize and make available information/knowledge to be used during training, drills, and tabletop sessions
- Support decision making during an actual crisis situation

Table 4 summarizes the advantages and drawbacks associated with four types of KMS technologies, including groupware. Wiki technology was selected as an instantiation of a knowledge management system using groupware technology to support the emergency preparedness efforts within the Claremont Colleges. This decision was made because of the technology characteristics of Wiki technology, the budgetary and resource constraints faced by CUC, as well as the availability of an assistant (the author) who was familiar with using wikis for teaching and learning (Raman et al., 2005).

A prototype wiki was developed and tested to aid emergency preparedness efforts at the Claremont Colleges. Called the Emergency Management Systems (EMS), the wiki was launched on the 25th of January 2005 and was tested by emergency responders from the Claremont Colleges during two emergency preparedness drills that were held in the month of February 2005. Interviews with the participants of these two drills highlighted the benefits and

TABLE 4 Comparisons of Four KMS Application Types

KMS Technology	Advantages of Using This Type of KMS	Drawbacks of Using This Type of KMS
Expert systems, artificial intelligence (AI), and knowledge-based management system (KBMS)	The systems develop intelligence over time, based on pattern recognition technology. Organizations that need to look for particular trends given voluminous data might consider using expert systems and AI.	This category of KMS might be too complex for organizations to use. Expert systems and artificial intelligence might not be necessary for structuring the emergency preparedness knowledge management process.
Groupware (computer-supported collaborative work, CSCW)	This KMS category permits collaborative work. Certain types of groupware can be customized based on open-source systems at no cost. Examples are wikis. Groupware and CSCW group processes and decision making. Wiki technology is an example of a groupware that can benefit organizations that intend to develop a cost-effective collaborative system.	Some level of familiarity in working with open-source systems is needed.
Document management systems (DMS)	The goal is essentially to enhance an organization's document management efforts.	May not be able to support group work effectively.
Decision support systems (DSS)	Provides summaries of large amounts of data, filtered and synthesized particularly to support strategic decision making. Useful when there is a need to analyze quantitative data.	This category of KMS might be too complex and expensive for organizations to use. DSS might not be necessary for structuring the emergency preparedness knowledge management process.

implementation challenges of the wiki application, as described below.

Benefits Achieved

The findings from the participant interviews suggest that Wiki technology can be effective in supporting cross-unit collaboration in two primary ways:

1. *Enhancing communication*. Individuals and teams involved in emergency preparedness now have a common platform from which to obtain emergency-related information. The wiki provides a central information base with reference to various emergency situations, activities, and events organized by the respective colleges. This supports the internal communication between members involved in emergency preparedness initiatives. The system also provides a structured approach to documenting emergency-related information, which can be used to support external communication with both federal (e.g., Homeland Security, FEMA) and local (e.g., fire, police, hospitals, etc.) agencies.
2. *Supporting knowledge sharing*. Wiki technology thrives on being an open system (Wagner, 2004). This means that anyone can edit any wiki page and share information with others. In the context of CUC, individuals trained in specific emergency response areas, such as search and rescue, CPR, and first aid, now have a central platform to document their respective knowledge and share it with others. Wiki pages can be edited by anyone, from anywhere, because of the technology's open nature (Wagner, 2004).

Implementation Challenges

The emergency knowledge management system implemented in this project received an average usability score of 69.5 percent, based on end-user responses to ten statements using Brooke's (1996) systems usability scale (SUS). A maximum score of 100 percent means that the system is very simple to use. In addition, the users mentioned issues such as the need for more training and greater familiarity with Wiki technology. Other participants provided suggestions about the application design and the cumbersome handling of e-mail (outside of the system). The majority of the users also wanted a written, step-by-step "cheat sheet" that guides how each component in the wiki can be used. In particular, they requested guidelines for creating new pages (links) and also editing information in a given page.

These case findings suggest that Wiki technology, when used as a collaborative tool to support the knowledge management requirements of an organization, is subject to potential

The technology may not seem very intuitive to everyone, because most users are used to "read-only" Web-based systems.

drawbacks. The technology may not seem very intuitive to everyone, because most users are used to "read-only" Web-based systems. The power of Wiki technology lies in its ability to capture dynamic changes within its pages due to the edit function. Using and working with this editing capability requires time and sufficient training.

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.

Nevertheless, although the majority of literature about wikis suggests that the technology is easy to use, this case indicates that, in reality, working with wikis might not be immediately intuitive to all users. 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 this technology to support knowledge management efforts within any organization is satisfactorily realized.

References

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge Management and knowledge management systems: Conceptual foundations and research issue. *MIS Quarterly,* 25(1), 107–136.

Brooke, J. (1996). SUS: A 'quick and dirty' usability scale. Retrieved March 24, 2004 from HCIRN Web site: http://www.hcirn.com/ref/refb/broo96.php

Davenport, T. H., & Prusak, L. (1998). *Working knowledge: how organizations manage what they know.* Boston, MA: Harvard Business School Press.

Fuchs-Kittowsk, F., & Köhler, A. (2002). Knowledge creating communities in the context of work processes. *ACM SIGCSE Bulletin,* 23(3), 8–13.

Gupta, J. D., & Sharma, S. K. (2004). *Creating Knowledge Based Organizations*: IDEA Group Publishing.

Kille, A. (2006), Wikis in the Workplace: How Wikis Can Help Manage Knowledge in Library Reference Services. Last accessed April 24, 2006, from Archives publication at University of Texas Austin Web site: http://libres.curtin.edu.au/libres16n1/Kille_essayopinion.htm

Leuf, B., & Cunningham, W. (2001). *The WIKI WAY. Quick Collaboration on the Web:* Addison-Wesley.

Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, 5(1), 14–37.

Nonaka, I., & Takeuchi, H. (1995). *The Knowledge-Creating Company?* New York: Oxford University Press.

Raman, M., Ryan, T., & Olfman, L. (2005). Designing Knowledge Management Systems for Teaching and Learning with Wiki Technology. *Journal of Information Systems Education (JISE),* 16(3), 311–320.

Wagner, C. (2004). WIKI: A Technology for Conversational Knowledge Management and Group Collaboration. *Communications of the Association for Information Systems,* 13, 265–289.

Wagner, C., Cheung, K.S., & Rachael, K.F. (2006). Building Semantic Webs for e-government with Wiki technology. *Electronic Government,* 3(1), 36–55.

APPENDIX Basic Wiki Functions

Function	Purpose of Function	Using the Function
Editing in general	Enables users to quickly add, delete, and modify content in wiki pages.	Every page in a wiki has an "edit this page" link. A user can click on the "edit this page" link to add or delete content in a given page, using plain text. Once the edit has been completed, the user can hit the "save" or "update" function. The new content on the page will automatically be published in Web format. Notice that the editing is done in plaintext with no use of HTML tags.
Creating new wiki pages	Enables users to build new pages within the wiki to develop a logical flow of related ideas.	A user has to edit an existing page (e.g., the home page) and type the name of the new page using "WikiWords" or "CamelCases." WikiWords or CamelCases are words that are smashed together (Leuf & Cunningham, 2001). For example, to create a new page called "Information Management," a user can type "InformationManagement" while editing an existing wiki page. This InformationManagement syntax automatically creates a link from the existing (currently being edited) to a new page called InformationManagement.
Linking between wiki pages	Enables users to establish links between wiki pages within a wiki Web site.	Wiki pages cite each other. Assume we have a page called InformationManagement. While working on or editing another page, typing the words InformationManagement will automatically link this page to the InformationManagement page.
Linking to external Web sites from a wiki	Enables users to link a page or specific idea/content on a wiki page to an external URL.	By clicking on the external link icon (under quick links), the following will appear on the wiki page that is being edited: [http://example.com|desc]. To create an external link, simply type the URL needed, between the // and |desc.
Formatting (e.g., bold, underlining, creating tables, etc.)	Enables stylistic presentation of text and images created in a wiki page.	Every page has a standard set of formatting functions, such as bold, underline, and bullets, under the quick links navigation bar. Click on the particular formatting style you want and fill the text in the appropriate space indicated. Example: Assume you intend to underline the word "manager." Click on U icon and you will get the following: __text__. When you write the word manager between the two lines, the word (manager) becomes underlined.

See http://www.chat11.com/30_Second_Quick_Wiki_Tutorial for more details on using basic editing features within any wiki. Another useful resource is http://angelakille.pbwiki.com/WikiResources. To download a wiki engine, use www.tikiwiki.org as a reference.