

Wiki-based Construction Knowledge Sharing

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This is a concept paper that presents the use of Internet-based social networking, e.g., weblogs and wikis, as a knowledge sharing (KS) component of an organization friendly, user centered contemporary knowledge management system (KMS). This system is directed towards improving an organization's internal tacit knowledge capture, collaboration, and retention. Knowledge management (KM) and information technology (IT) literature is reviewed and presented in the context of its contribution to improved construction knowledge management. The transformation of web-based technology into a diffuse and easily managed communication exchange is explored with particular emphasis on the more recent KS techniques of weblogs and wikis. From these particular extracts, blogging and wikis, a simple user friendly but powerful construction KM interface system for in-house sharing of construction knowledge is explored and proposed.

Keywords: construction knowledge management sharing, wiki, organizational intelligence, blog

Introduction

It goes without saying that construction is an information and knowledge intensive activity. The requirement for receiving accurate and timely information is ever so critical as projects become more complex and subcontracting more diffuse. Additionally, many organizations are working in multiple jurisdictions with varying conditions, requirements, practices, participants, and code interpretations. As a result the ability to get the right knowledge to the right individuals at the right time is paramount. One low cost user friendly mechanism with which to accomplish the exchange of knowledge across an organization is through the use of real-time democratic knowledge sharing (KS) tools such as 'blogs' and 'wikis.'

Blogs and wikis are a contemporary, 5th generation Internet-based social network that has its origin in Bulletin Board System or BBS, further grown by the advent and usage of e-mail, project specific web sites, and instant messaging/chat. Blogs and wikis are further refinements in transforming the Internet through Internet-based social networks. 'Blogs' are user-generated websites that displayed journal style entries in a reverse chronological order. They are easily set-up, maintained and contributed to by a broad network of loosely connect individuals. 'Wikis' are websites that allow visitors to easily add, remove, edit, and change available content, in a collaborative manner typically without the need for registration or webmaster involvement. The ultimate manifestation is Wikipedia, a multilingual, web-based, free content encyclopedia that is collaboratively written and edited by interested users. Due to their democratic and freeform nature Wikis can allow and promote the proliferation of misinformation. This can be particularly devastating when deliberate efforts to undermine the integrity of information are undertaken. This is an inherent danger in any democratic form of communication and information creation. It should be noted that Wikipedia entry parameters and conditions have been refined since its inception in 2002 and now shows a remarkably reasonable level of accuracy (Giles 2006).

All organizations, including construction organizations, generate vast amounts of data, information, and subsequent knowledge. Construction is unique in that it is project based and temporal in nature. Different designs in different locations, with different actors in a different supply chain all gathered together for a short term production. As a result, the knowledge generated by the participants is fragmented among the various 'members' and becomes difficult to capture. With the advent of the information communication technology (ICT) revolution there have been continual developments in information processing, transferring, and archiving. Among these developments are the prevalence of project specific websites that typically become centrally controlled document management, retrieval, and archival systems. They do little in the way of capturing project and organizational lessons learned. The desire to utilize ICT for knowledge capture has generated a demand to engage knowledge management systems (KMS) to codify, capture, transform, transfer, maintain, and archive data, information, and knowledge. Many of the KMS components require skilled 'knowledge workers' and extensive technology centered solutions e.g., project-specific websites.

Knowledge is Power

Knowledge management (KM) has been defined by many authors in generally similar terms and "refers to a range of practices used by organizations to identify, create, represent, and distribute knowledge for reuse, awareness and learning across the organization" (Knowledge Management 2007). The strategic objective is to create shared intelligence throughout the network or organization, to improved organization and individual performance resulting in competitive advantage for the organization. Egbu and Botterill (2002) refer to KM as the processes by which knowledge is "created, acquired, communicated, shared, applied and effectively utilized and managed, in order to meet existing and emerging needs, to identify and exploit existing and acquired knowledge assets."

Not all knowledge is codified and placed within an organization's operational context. Much of the knowledge is tacit (gathered from experience) and subsequently resides within individuals, not the organization. An understanding of the interrelation between data, information, and knowledge is necessary to ascertain how tacit knowledge can be acquired, transferred and archived in order to minimize 'reinventing the wheel' on each project and within the organization. Data becomes information once it has become organized and structured into a format for further usefulness. The transformation of information into knowledge occurs when that information is reflected upon, given meaning and understanding, and then put into a decision making context. Blogs and more appropriately wikis offer a simple and inclusive mechanism to transform an organizations tacit knowledge into explicit knowledge.

The old saying that 'knowledge is power' has taken on renewed interest as it clearly becomes the last bastion of competitiveness in a global economy. Companies understand this and are investing increasingly greater levels of resources to maximize the benefits of KM (Cleveland 1999). In this context the authors propose that blogs (user generated 'journal' websites), and wikis (collaboratively edited real-time websites) can be used to provide organizations with live, people-centric, demand driven, user friendly knowledge sharing tools that will contribute to an organization's overall KMS in a yet unknown but powerful manner.

Construction Knowledge Management and Sharing

Knowledge is what provides an organization a competitive advantage and as globalization takes hold, knowledge becomes the one last export available in a competitive world. Therefore it is essential that organizations recognize their resources in human capital and develop systems that focus on developing the internal knowledge that resides within the workforce. It is ever so important in construction due to the inherent diversity in projects and project participants. Schaefer (1993) states very explicitly that knowledge is a production resource with economic value that needs management in a professional manner. According to Tan, et al., and sourced from literature 40% of UK construction organizations already have KMS in place, another 40% expect to implement KMS within a year, and 80% believe that KMS have a potential benefit to their organizations (Tan, Carrillo et al. 2006).

Construction's current knowledge sharing strategies are focused on both formal and informal transfer approaches. The most common techniques in knowledge sharing is to reassign people from one project to another, to assign junior personnel with more seasoned veterans for mentoring or knowledge 'ruboff,' share extractions from superintendent's daily journals, to conduct post-project reviews on lessons learned, and formally gather and exchange ideas. This is supported by Kamara, et al., (2002) who also include best practices guides, intranets, and by inference project specific web-sites. The knowledge gathered and dispersed in each of these mechanisms can be developed, captured, and shared through Internet-based social networking, i.e., blogs and wikis.

Williamson and Woo (2001) note that the use of project-specific web sites are calculated to result in project engineers saving approximately 29% of time over a paper based project management environment. This is only one example of the time intensive demands that project information processing tasks required to create, transmit, archive, search information. Although Williamson and Woo (2001) work is focused on document management it does suggest how the Internet has provided an opportunity over the last decade to redefine the way information is acquired, transmitted, and archived for organization wide usefulness; in effect the work demonstrates how effective the Internet can be in offering additional tools to assist in managing information as part of an overall knowledge management system. Unfortunately in the author's opinion many organizations appear to be relying erroneously upon project-specific web-sites as a product based KM solution (Carrillo and Chinowsky 2006). The author contends that Internet-based social networks offer a simpler and more democratic mode to advance organizational knowledge sharing.

The question becomes how best to provide tools that aid an organization in its efforts to implement a knowledge management/sharing system (KMSS). Kamara, Augenbroe, et al. (2002) identify organizational knowledge as contextual knowledge that is people-centered. They also allude to distinctions between tacit and explicit knowledge through their references to organizational contexts, i.e., informal communications networks versus formal organizational structures. Construction is essentially a people-focused enterprise that engages formal and informal networks that must share knowledge in order to succeed. Cleveland and Chinowsky both allude to the people-focused aspects of knowledge sharing as paramount to AEC

organizations achieving successful knowledge transfer (Cleveland 1999; Chinowsky and Molenaar 2005).

What does a construction KMSS look like?

There has been considerable literature to support KM in all organizations including construction. Classically KMS has focused on 'hard' or explicit knowledge that can be codified and is a direct outgrowth of research into artificial intelligence (Hildreth and Kimble 2002). Rezgui (2001) points out that during the construction process much data is captured, yet little is managed. He also categorizes construction knowledge into domain, organizational, and project knowledge, with organizational and project knowledge as the repositories with poorly captured tacit knowledge (Rezgui 2001). Much of the early KM literature within the construction domain has focused on this codifying explicit domain, organizational, and project knowledge while alluding to a potential to capture tacit knowledge or lessons learned (Rezgui 2001; Egbu and Botterill 2002; Kamara, Anumba et al. 2002; Lee, Lee et al. 2005).

Recently there has been a concerted effort to propose strategies for capturing an organization's tacit knowledge. Communities of Practice (CoP) a term first coined in 1991 and expanded in 1998 to organizations and more recently linked to KM (Community of Practice 2007). This term is an excellent descriptor of the contemporary strategy of coalescing an organization's tacit knowledge as a people-centric 'learning community' into the more explicit knowledge aspects of an organization's overall KMS (Chinowsky and Molenaar 2005). Therefore it becomes beneficial to dialogue on what 'free' form codification of tacit knowledge will materialize in the future and how organizations will manage or control this information.

It becomes easy to recognize that organizational and project domains offering the greatest opportunity for CoP focused knowledge capture and subsequent KS. Unfortunately, the term management, even that of knowledge brings into being the omnipotent project management concepts of control. Much of the contemporary world view of project management is specifically focused upon control. As such, an organizational strategy of free form KS through blogs and wikis may be foreign to construction management executives and thus resisted. Possibly through concepts such as CoP and 'learning communities' organizational resistance to free flowing, demand-driven KS will be overcome.

Freeflow KS Approaches

To address freeflow KS requires an understanding of what constitutes 'knowledge' and the subsequent functional management of this knowledge, or even if functional management of this knowledge is possible. The authors believe that it is neither possible nor desirable to manage KS but solely to embrace and enable it as an operational strategy. It is necessary to be cognizant of both the content and context of KS to understanding how an organization can and may use it as part of a larger KMS. One only needs to observe the multi-tasking activity of today's generation to gain a perspective on how information is processed and shared amongst peers or informal 'learning communities.'

The proliferation of instant messaging (IM), chat rooms, and knowledge threads, blogs, vlogs, wikis, peer-based websites such as '[Facebook](#),' '[MySpace](#),' '[YouTube](#),' and the freely democratic [Wikipedia](#) are all aspects of people-centric real or near-real time KS paradigms. Although Tan, et al., (2006) do not mention the opportunities that the above KS portals offer they point out the opportunity and need for 'live' data capture within the construction domain. What constitutes the transformation of the information presented into knowledge is unique to the individual and is combined and contextualized by that individual and results in new knowledge creation. This may be one reason that many construction initiatives consider a superintendent's war story to contain vast amounts of knowledge. And without question these stories frequently contain that elusive bit of learning that is contextualized and can't be formally imparted. Lessons learned can be captured and democratically sought out through a bottom-up approach for truly a people-centric KMSS. Internal to construction organizations many of these lessons can be captured by guided or freeform collaborative authoring by seasoned construction personnel within a case-based method approach.

Each of these information sharing vehicles has been adopted by large communities of participants and all the community participants are self-taught in the operational and functional aspects of interfacing amongst their peers. These KS vehicles cannot be controlled; they are what they are and will continue to remain uncontrolled. That is not to say they are without etiquette, quite the contrary, they are self-policed in addition to being organizationally policed within loose boundaries. It is time for organizations to embrace the best of these vehicles as it enables, endorses, and encourages these less structured models for organizational KS within the context of an overall KMS. The author believes the Nintendo generation is ready for the inclusion of these paradigms within their business organizational cultures. The author also believes that this new bottom up paradigm if given the opportunity and support will flourish as a wellspring of internal organizational knowledge and will be self-policed to the point of being beneficial to its users in ways that are currently unfathomable. This new paradigm will materialize much like the proliferation of digital photography coupled with mass storage and email has become a commonplace project management activity without top down organizational implementation.

Construction KS

Blogging construction knowledge

Blogs and wikis are two of the more democratic, i.e., user controlled KS mechanisms. These two approaches to KS are the focus of a new paradigm for KS within construction organizations. Weblogs are an Internet phenomena originating in the mid-90 as personal maintained websites, a major distinction between weblogs is that 'blogs' are added or posted to in a chronologically based manner by a network or like minded users or knowledge sharers, while wikis are collaboratively focused and generally more robust. Among the wiki world there are task specific structured wikis. Notable among these are a workflow based project management focused [Twiki](#), see <http://twiki.org>.

Blogs gained officialdom in the late 90's when the term 'weblog' was referred to as 'we blog,' since shortened to blog with blog producers often referred to as 'bloggers.' Blogging gained

substantial credibility, or at least societal recognition, as an alternative media source in 1998 when Matt Drudge in his [Drudge Report](#) was the first 'journalist' to break the Clinton/Lewinsky story (Blog 2007). A review of the Drudge Report website notes over 12 million website hits per day over the past month (Drudge Report 2007). Blogs are a powerful medium for knowledge acquisition and should not be overlooked as a KS component of a larger KMS. Little reported is the power that unofficial blogs has exerted in war zones by allowing troops upon returning from a 'recon' mission to go online and post live or near real-time battle tactics of opposing forces. This allows soldiers about to go out on 'recon' an opportunity to gather up to the minute potentially life saving information. This is a natural manifestation of a bottom-up KSS. Construction knowledge sharing can take the same format, particularly in fast and flash track construction projects.

A blog is a user produced, and updated conversational focused collection of text, graphics, photos, music, videos, and links to external websites or other forms of digital media. The blogger is the content manager. These blogs are typically focused on particular themes or content specific topics, including construction organization, project, marketing, and law blogs. The content is typically posted in reverse chronological order much like a personal dairy with newest content listed first. As of January 2007, Technorati posts on their website that they currently track over 63 million blogs including over 1.6 million posts per day (Technorati 2007).

As knowledge sharers Blogs are historically more focused on a particular maintainer, i.e, the blogger. Establishing a public blog is as easy as linking to [Blogger](#) at google.com and opening a free account. The blog is created and maintained by the original blog creator. Within an organization this could take the form of linked blogs that focus on a particular subset of construction knowledge domains, e.g., project management issues, procurement techniques, common design problems, workflow improvements, new techniques, new equipment, labor issues, etc. A downside to a public blog is that information can be accessed by those outside the organization and thus internal KS is not retained as proprietary knowledge of the organization. This can be solved by using a private blog. These are readily available for a small monthly fee from a blog hosting site. A web search revealed over seventy-five publicly accessible construction related blogs with one site indexing over fifty (see <http://dir.blogflux.com/cat/construction.html>).

The Wiki Way to Construction KS

A wiki is a website that allows participants to easily add, remove, and edit or change some of the available online available content. What makes wiki so powerful is that is a simple user friendly interface that requires little web management and site maintenance. Wikis are quickly becoming an effective tool for mass collaborative authoring. Private and public wikis exist and are quite simple in that they can simultaneously be both a structured database and a freeform discussion forum (Wiki 2007). Wiki's authoring, open-editing, and search capabilities places extensive KS power into the hands of end users and has the opportunity to become a bottom-up demand-driven knowledge store. Its user friendliness allows people without any computer background to immediately become contributors. The bottlenecking webmaster of old is eliminated. Wiki represents elegance in online democracy with participants being able to collaboratively contribute to advancing particular knowledge domains, the epitome of KS.

Wiki supports KS in a simple user friendly people-centric manner, consistent with the opportunity to capture, share, reuse, and maintain knowledge as proposed by Tan, et al., in their focus on 'live' construction KM and with Chinowsky and Molenaar in their work on 'learning communities' (Chinowsky and Molenaar 2005; Tan, Carrillo et al. 2006). In the writing of this paper the author's 'googled' the Internet for construction focused wikis and returned only three hits that remotely addressed construction wikis, one was similar to a builder's website, the other appears to be a named site without any significant content and the third was an interactive community Lego building game. One additional hit resulted in 'community' authored copyright free wiki textbook on straw bale construction. This book is the primary contribution by one author over a course of approximately 10 months. More recently, additional contributors have offered additional insights and authorship creating KS within a specific learning community (Straw Bale 2007).

Needless to say wiki hasn't found its way into the toolkit of construction KMS. The author believes this will change in due time as the simplicity and power of a decentralized people-centric KMSS becomes evident. Creation of a wiki is as simple as creating a blog. You go online, download, and setup. There are free 'wikiengines' that can be downloaded from the Internet as well as sophisticated yet inexpensive hosted wikis offered for as little as \$5 per month. All offer private and public access, collaborative authoring, and global searching. Many offer much more in support of a people-centric KMSS. Wikimatrix offers a comparison of 77 'wikiengines' that are available for download or purchase, including Twiki. Twiki is a free community supported multi-platform wiki focused on project management and used by many Fortune 500 companies (Wikimatrix 2007).

Conclusions

This paper is intended to stimulate discussions on people-centric user driven Internet-based social networks as a component in an organizational KMSS. The author has proposed that blogs and more specifically wikis offer tools in support of this strategy. The author wishes to begin a dialog within the academic community on how this democratic form of KS will manifest itself; on how organizations can capitalize on a new breed of workforce that is intimately involved in varying online collaborative communities; on advancing technologies that reduce knowledge control by eliminating the classic bottlenecks to placing instantaneous live knowledge regarding projects; and on how like minded learning communities that can alter the classical KS techniques and capture that elusive tacit knowledge that an aging workforce will takes with it unless it is captured, shared, and reused; on how private/public employee/employer privacy issues will eventuate; on how the absence of control will contribute to the proliferation of knowledge, on what content strategies can contribute to real-time construction management. KM is becoming an attractive tool for construction industries with many believing that KM offers the main benefit of providing a way to share tacit knowledge from individual people, individual projects, group cultures, and as a mechanism to disseminate best practices.

The question before all organizations is how best to implement a KMSS. Some will argue that the inherent chaotic nature of the Internet and particularly collaborative wikis are detrimental to empowering tacit knowledge. Others will argue that the knowledge created is inaccurate, subject

to falseness, lacks credibility without control. In response, the author offers 'lets turn the asylum over to the inmates;' that the control of knowledge only breeds resistance and results in apathetic participant involvement and subsequent failure. Let the system self-create and self-manage itself and it will flourish. A collective and collaborative organization is organic and will devise a better, more stable system than a top down approach will ever be capable of sustaining. Then and only then will the organization and each individual within share ownership of the knowledge.

A UK construction industry survey (Carrillo, Robinson et al. 2004) ranked the main challenges faced in implementing a construction focused KMS as:

1. Organizational culture,
2. Lack of standard work processes,
3. Insufficient funding,
4. Not enough time,
5. Employee resistance, and
6. Poor IT structure.

In the context of democratically shared learning communities and the freeform or structured format of wikis these challenges are only fears and evaporate within a new knowledge democracy. The incoming workforce brings a culture of do it yourself (DIY); a community of self-taught collaborative networkers able to multi-task and grasp diffuse work processes within a demand-driven knowledge system. Blogs and wikis offer themselves as user friendly, collaborative tools requiring minimal expense in cost, time, and infrastructure to setup and ultimately become a productive KMSS. Knowledge is power; the withholding of knowledge only fosters someone else's power. An organization cannot hope to control the growth of knowledge; it can only hope to capture, share, and reuse knowledge to better the organization competitive strength.

References

Blog (2007). Blog. (2007, January 5). In Wikipedia, The Free Encyclopedia. Retrieved 22:13, January 5, 2007, from <http://en.wikipedia.org/w/index.php?title=Blog&oldid=98685821>

Carrillo, P. and P. Chinowsky (2006). "Exploiting knowledge management: The engineering and construction perspective." Journal of Management in Engineering **22**(1): 2-10.

Carrillo, P., H. Robinson, et al. (2004). "Knowledge management in UK construction: Strategies, resources and barriers." Project Management Journal **35**(1): 46-56.

Chinowsky, P. and K. Molenaar (2005). Learning Organizations in Construction. Construction Research Congress 2005, San Diego, California, ASCE.

Cleveland, J. A. B. (1999). "Knowledge Management: Why It's Not an Information Technology Issue." Journal of Management in Engineering **15**(6): 28-28.

Community of Practice (2007). Community of practice. (2007, January 2). In Wikipedia, The Free Encyclopedia. Retrieved 19:09, January 5, 2007, from http://en.wikipedia.org/w/index.php?title=Community_of_practice&oldid=97983317

Drudge Report (2007). Drudge Report, (2007, January 4). Website Hits, Retrieved, January 4, 2007, from <http://www.drudgereport.com/>.

Egbu, C. O. and C. Botterill (2002). "Information technologies for knowledge management: their usage and effectiveness, Vol. 7, , pg. 125-137, <http://www.itcon.org/2002/8>." ITcon 7(Special Issue ICT for Knowledge Management in Construction): 125-137.

Giles, J. (2006). "Wikipedia rival calls in the experts." Nature **443**(7111): 493-493.

Hildreth, P. J. and C. Kimble (2002). "The duality of knowledge." Information Research, [Available at <http://InformationR.net/ir/8-1/paper142.html>] **8**(1).

Kamara, J. M., C. J. Anumba, et al. (2002). "A CLEVER approach to selecting a knowledge management strategy." International Journal of Project Management **20**(3): 205-211.

Knowledge Management (2007). Knowledge management. (2007, January 1). In Wikipedia, The Free Encyclopedia. Retrieved 18:00, January 3, 2007, from http://en.wikipedia.org/w/index.php?title=Knowledge_management&oldid=97696478

Lee, T. S., D. W. Lee, et al. (2005). Development of Knowledge Document Management System (KDMS) for sharing construction technical documents, San Diego, CA, United States, American Society of Civil Engineers, Reston, VA 20191-4400, United States.

Rezgui, Y. (2001). "Review of information and the state of the art of knowledge management practices in the construction industry." Knowledge Engineering Review **16**(3): 241-54.

Straw Bale (2007). Straw Bale Construction, Wiki Books, the open-content textbook collection, Reviewed on January 5, 2007 at http://en.wikibooks.org/wiki/Straw_Bale_Construction.

Tan, H. C., P. Carrillo, et al. (2006). "Live capture and reuse of project knowledge in construction organizations." Knowledge Management Research & Practice **4**(2): 149-61.

Technorati (2007). About Technorati, (2007, January). Retrieved, January 4, 2007, from <http://technorati.com/about/>.

Wiki (2007). Wiki. (2007, January 4). In Wikipedia, The Free Encyclopedia. Retrieved, January 6, 2007, from <http://en.wikipedia.org/w/index.php?title=Wiki&oldid=98514863>

Wikimatrix (2007). Wikimatrix, Reviewed on January 5, 2007, <http://www.wikimatrix.org/index.php>.