A social networking-based approach to information management in construction

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INTRODUCTION

Successful project completion in the construction industry requires careful and timely management of information exchange between a wide variety of disparate individuals and parties. Difficulties in exchanging project information may result in project delays and legal or financial repercussions. Effective information management is critical due to the unique nature of construction projects; every project consists of a unique specification and different actors. Furthermore, once a project is complete, the information developed over the course of that project needs to be organized and stored in such a way that others can utilize the experience and knowledge gained.

Research has been conducted to understand both how and why innovative information technology (IT) solutions are adopted. Mitropoulos and Tatum identified four factors for the adoption of new IT among contractors: institutional requirements, problem processes, competitive advantage, and technological opportunity. Chinowsky and Meredith found that construction firms improved strategic management by encouraging employees to exchange knowledge and identifying potential opportunities to expand their market. Interviews conducted by Toole supported the competitive advantage and technological opportunity drivers proposed by Mitropoulos and Tatum, but concluded that, while construction contractors are applying IT solutions for information and knowledge transfer, IT was not being utilized for market and service expansion.

Furthermore, Toole made two important findings when surveying ten large construction contractors. First, contractors expect Web-based technology for collaboration between actors in a project to significantly impact the construction industry, but that there will be resistance to such integrated IT solutions. Second, the usefulness of mobile computing devices for the capture, storage, and transfer of project information over wireless networks will increase immensely, but the ability of firms to utilize these technologies is uncertain.

The continuing development of the Internet and the World Wide Web (WWW) has led to research on the utilization of Web-based technologies for the construction industry. Communication and information management systems for improving collaboration; utilizing high-speed Web access; Internet tools like HTML, Java, scripting, FTP, and so forth; standardized data formats; and the increasing availability of wireless access and devices, have been proposed by researchers in the construction engineering and management fields.

Four previous research works were identified as utilizing a Web-based approach for the management of project information or for establishing a social network for increasing information exchange and collaboration in the construction industry. Rojas and Songer; Dawood, Akinsola, Hobbs; Lee et al.; and Ariöz et al. proposed similar, Web-based systems for standardizing and simplifying the means for exchanging project information. By using a central computer database, data processes could be automated for reducing errors and increasing quality, and project information and documents could be made available for access to all project actors at any time, thus reducing delays and increasing cost savings.

While these research works are technically sound, what they fail to address is that a Web-based system for the organization and exchange of information between people already exists. Web-based social network communities (SNC) have grown significantly in popularity over the last few years. MySpace (www.myspace.com), Facebook (www.facebook.com), Hi5 (www.hi5.com), Friendster (www.friendster.com), Orkut (www.orkut.com), and Bebo (www.bebo.com) are examples of popular SNC, with a world-wide distribution of users. These SNC function by providing a Web-based community for people who share interests and activities, and allow them to interact using common interfaces such as chat, messaging, email, and blogging; and the exchange of information by sharing files such as music.
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THE SNC PARADIGM

A social network is a structure composed of nodes, which re-
represent people or groups of people, connected to other nodes by ties,
which represent some relationship or relationships. Web-based
SNC have grown around allowing a user to upload their informa-
tion to a profile. Then, the user can establish ties to other users in
the network based upon whatever social connection exists between
them. In some cases, the two users may share a common
interest, thus creating a tie between the two nodes.

Social networks may take a large variety of forms, from the very
simple (personal address book) to the sophisticated (Web-based
SNC). They also be for casual (again, Web-based SNC) or busi-
ness (job hunting sites) use. In this paper, Web-based SNC were
chosen due to the rapid growth and popularity which they have
seen in recent years. Three categories of features will be present-
ed: Web-based technology, information organization and exchange, and user control.

Web-based technology

The growth of the Internet and the WWW has allowed for
instantaneous data access and contact by utilizing the perpetual
connectivity of the Web. Social networks have capitalized on this
accessibility by providing an interactive structure in which users
can provide up-to-the-minute information and distribute it
instantaneously to their friends and contacts. Furthermore, Web
accessibility is growing as wireless networks and devices
increase in number and sophistication. This in turn allows even
more up-to-date information exchange, as the number of locations
and means by which users can access the SNC increase.

Social network providers cannot control the end-user; therefore,
they have to ensure that the interface they provide is usable by any-
one. Web scripting and programming languages, such as HTML
and Java, are two ways which have been established as a common
means for accessing Web content. Ideally, Internet browsers are
programmed to understand these languages without requiring any
special software or download. Accessibility without complicated
requirements is important for providing access to a large number of
people with a wide diversity of abilities. Therefore, a simple, com-
mon interface, such as that provided by the Web, is important
when dealing with a user base of unknown capability.

The importance of Web-based technology for assuring accessi-
ability of information in the construction industry has already been
discussed in the surveyed research works. However, it’s important
to mention that using the standardized interface of the modern Web
browser decreases the difficulty of integrating other companies into
a social networking system.

Information organization & exchange

Users in SNC often share photos or videos between each
other. In order to identify the contents of these media, tags are
applied by the user. Tags are similar to keywords, in that they allow
for the classification and organization of media by surveying the
entire content of that media. These tags are, however, not lim-
ited just to categories or contents. People in photos or videos can
be tagged by their name and have that tag connected to their user
profile. This allows users who view the photos to make connec-
tions to other users. The information provided by users in their
profile can also be viewed as a type of tagging. Data given in cat-
ergories such as ‘education,’ ‘interests,’ ‘activities,’ and so forth
provide information which can be used to organize and classify the
users themselves.

Media can also be categorized or tagged by event. An event may
be similar to a user profile, and represents some gathering of users,
either in the real or digital world. In this case, the tie between the
users is the mutual attendance of the event. Event information,
such as time and location, as well as media can be uploaded and
tied to the event.

Applying tags to media allows for the organization or grouping of
different forms of media based on a given search topic or selec-
tion. In SNC, grouping is a basic way of finding other users who
share similar characteristics, or gathering disparate types of
media together based on a single common theme. As mentioned
previously, media can be organized by date or time as well.

For the construction industry, being able to quickly and effi-
ciently organize users, media, and so forth, based on temporal,
geographical, content, or other dimensional criteria would be ben-
eficial for managing information in a construction project. By
utilizing online computer databases for storing users, media, and
their attached metadata, the ability to organize and group would be
limited only by storage space and processing power. Furthermore, computer-managed databases can organize and dis-
seminate information faster, more efficiently, and with fewer
errors than a human-managed system.

User control

The ways in which SNC have given control to the network users
has been, in part, driven by the need to ensure privacy. SNC users
provide personal information, but may not want that information available to all users in the SNC. Hence the development of privacy controls, which allow users the power to approve who sees their information, as well as how much information is viewable. The control of information flow is an important aspect of efficient project management. This topic will be discussed further in the following section.

ADOPTING THE SNC PARADIGM

Features of SNC and the social networking paradigm are already being adopted for other applications and industries. Most notably, major email providers such as Google and Yahoo are attempting to develop their own social networks by integrating and expanding their standard email services. As emails represent the connections between people, the email providers already have the framework for establishing a SNC. Other features, such as organizing emails by relationship strength, displaying profiles of email correspondents, and a news feed with status updates from friends, are all inspired by the social networking paradigm.

The social networking paradigm itself is constantly changing as different networks compete to provide the best service and attract more users. Facebook garnered a lot of attention for allowing outside developers to build programs which can be integrated into the Facebook system and made available to users.

SNC for the construction industry

While the social networking paradigm and its features have already been covered, the question of how to adopt these for application to the construction industry has yet to be discussed. Consideration must be given to how the construction industry operates, and how SNC features can be applied to help solve information management problems.

Social networking could conceptually be applied in two ways. The first is project-focused. In this model, the social network is built around a construction project; the actors are the project participants, and the information to be exchanged belongs to the project. User interaction is purely within the bounds of the project scope. The second model is a professional social network for the construction industry. This model may be utilized for the sharing of experience, new ideas or techniques, and would act as a forum for establishing professional ties and increasing collaboration between different members of the construction community. In this case, the information exchanged may relate more to the users. The surveyed research works are of the former social network model. In the latter model, the social ties are established by the users themselves, which is more similar to existing Web-based SNC.

Information control requires consideration when proposing the adoption of social networking. In the Web-based SNC model, information is controlled by each individual user, who can choose how much to share and with whom. Assuming the construction project as a social network, the exchange of information may not be decided by each user, but restricted by legal or contractual guidelines. Previous research works have already shown that there is a flow to information in construction projects. Therefore, any information management system would need to follow the contract document’s legal structure.

Information security in a construction project is vital in order to protect the interests and investment of the parties involved. Other industries have already provided Web access to secure information for their customers, so they have discovered the vulnerabilities in adopting the Web paradigm and are continually readjusting their services to account for new security threats. As the Web paradigm is relatively new to the construction industry, problems relating to information security are not entirely clear. However, research into the problems experienced by other industries, combined with an investigation of the needs for the construction industry, would provide necessary background information for developing security in information management systems.

Conceptual project-centric social networking model

A simple, conceptual social network model for a construction project was built using the information organization and exchange concepts from the Web-based SNC paradigm. This model, shown in Figure 1, assumes the construction project as the core feature. Within the project, there are several sub-categories: project information, users, media, events, and updates.

Details about the project are given in the information sub-category. General information about the project, such as location, description, and scope, is stored here. Since information is a sub-category of project, any information stored here is directly related to the project.

The participating project members are given in the user sub-category. In this group, the different roles of the project can be filled by users, such as owner, architect, or inspector. Each of these users then has a user profile, which is used to provide information about that user. The activity sub-category is used to track any actions of the user; if a user is identified in another set of data, then that information will be related back to the user’s profile. The employment sub-category is like a digital business card stored in the social network.

The media sub-category is the storage space for all digital files related to the project. Media uploaded to the project is accompanied by identifying metadata, such as the uploading user, tags (or keywords), a brief description of the media contents, the event to which the media relates, and so forth. Once this information is stored in the database, the media can be related back to the user and/or event.

The event sub-category is a virtual calendar which stores
information about project events. The timeline is a master calendar which holds all the dates and their related events; each event has its own related information such as date, location, description, related media, and attending users. After an event has occurred, data can be uploaded into the database—media and user attendance, for example—and this information will be tied to the related media or user profile.

The final sub-category is updates. This sub-category is a database which records the most recent changes to the project system and provides that information to the users.

**Concerns with social networking**

Even though the popularity of social networking is growing rapidly and many companies are investing in the technology to increase their social networking strength, the SNC paradigm may not be appropriate for all businesses. While the construction industry appears to be an ideal application for social networking, its specific needs should be further studied in order to verify how to properly adopt this developing technology.

**CONCLUSIONS**

A survey of past research works found that using a Web-based database and interface reduced mistakes and increased accessibility, which resulted in reduced project costs. However, these works did not acknowledge the paradigm established by Web-based SNC. This paper proposed the study of Web-based SNC for the development of information management systems for the construction industry.

Web-based SNC allow users to interact through a common inter-
face anywhere they can access the Internet, at any time. In order to create a simple and intuitive means for these users to share data, tools were developed for the organization and exchange of information. Tags are a means of labeling the contents of any type of media, allowing users to generally know the contents of a file without having to survey the entire file. Tags can be more than just keywords, though; they can also be users or events. Organizing data by using tags allows for the quick grouping of any type of information which is identified by a given tag. A conceptual model of the construction project as a social network was developed using these tools for information management.

While these tools may be easily utilized by the construction industry, other features of the SNC paradigm cannot be easily transferred. Information control is an important part of effective construction management. In the normal SNC paradigm, information flow is generally free, restricted only by user controls on privacy. However, on a construction project, information flow may be dictated by contractual or legal requirements. Therefore, controls need to be established to respect the legal structure of the contract. To develop these controls, studies need to be performed to understand the relationship between information flow and control and contractual agreements. Such studies should also investigate the importance of information security in the construction industry. While other industries have already adopted the Internet as a means for exchanging information, the construction industry does not have that experience. Therefore, background information should be gathered to clarify the role of security when developing an information management system.

There are two ways in which social networking could be adopted by the construction industry. The first model uses the construction project as the tie between actors in a network; information exchange in this model is restricted to that relating to the project. In the second model, the social network encompasses the field of construction; the role of information exchange is for the enhancement of industry knowledge and increased collaboration.

As indicated by past studies, contractors are hesitant to adopt new IT technologies; therefore, the benefits and problems of this paradigm for managing information should be made clear before practical adoption of the model by the industry.

(Manuscript received, March 5, 2008)

REFERENCES