ASSESSING THE POTENTIAL APPLICATION OF ONLINE SOCIAL NETWORKS FOR THE CONSTRUCTION INDUSTRY

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The construction industry is said to be slow in adopting new information technologies into their processes. It is also said to be fragmented due to the project based nature of the industry. There is a need therefore for an ICT solution that satisfies both of these constraints. The potential application of social networks to the construction industry has thus far been largely unexplored. The research focuses in on this area by questioning the current understanding of the technology within the sector, the current level of collaboration, the requirements of the industry to fostering greater efficiencies and concept areas beyond collaboration associated with online social networks. The research carried out establishes the level of understanding of social networks and their predecessor technologies. The research also establishes a number of existing concepts. Interviews were conducted both with industry professionals and an industry specialist online social network provider and builds upon these findings extending them into newer concepts beyond collaboration, thus highlighting areas where greater efficiencies can be made by the industry through their implementation. Through habitual and structured use it leads to the naturalisation of knowledge management, virtual teams through remote participation, and social intelligence. The research identifies a natural progression of the online social network to higher levels of conceptualised use leading to enterprise social networks and social knowledge networks. The construction online social network will allow the construction contractor to defragment the fragmented, to empower its employees, to become more efficient both in the field and off while simultaneously naturally building a knowledge base which becomes a source of revenue through its continued and structured use.

Keywords: communication, information technology, knowledge network, project collaboration, social network

INTRODUCTION

Online social networks (OSNs) all have common attributes that are highly transferable to the construction sector. On a daily basis contractors make and receive multiple calls, multiple emails and record and forward images as site work progresses via email and other methods. This is a very fragmented process of communication. The fragmented information shared between these sources can be broken and easily lost and lead to possible further issues for the contractor. There is a requirement for harmonisation between the information carrier sources and OSNs can potentially offer that harmonisation.

Many attempts have been previously been made by researchers to highlight ICT's recognisable values to the construction field of communications. Niche ICT tools have proven their worth in the past for certain contractors which have tended to meet the

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specialisations of their needs. Contractors have benefitted immensely by their use but the use of ICTs has still not broken in to the main stream industry. Coupled with the guarded nature of the industry with its information, there is an inherent lack of actual case use by which these construction organisations can make informed decisions to purchase OSN software or similar.

The aim of the research therefore is to provide the industry with up to date and relevant information as to the current demonstrable use of OSNs by those who are taking tentative first steps into OSNs and the means by which they are using the technology and for what purposes.

The central research question for this paper is; what is the current understanding of online social networks in the context of the construction industry, and what effect does it have on project collaboration and knowledge management in the field?

BACKGROUND TO ONLINE SOCIAL NETWORKS

Core function and context

OSNs (Facebook, Google+, LinkedIn etc.) have seen major gains in user numbers over the past ten years and the reason for this can be attributed to the core function of the software and the ease at which it carries out this function. This core function is the sharing of information between individuals. According to Cachia (2007) there is no commonly accepted definition of OSNs and this is perhaps because, the pace at which these platforms have grown beyond their core function in the recent past of simply sharing snippets of daily living. Cachia goes further to define OSNs as having two core functionalities which make them stand out from other related services.

Firstly Cachia describes OSNs as advanced tools for sharing digital objects (texts, pictures, music, videos, tags, bookmarks, etc.); and secondly as advanced tools for communication and socialisation between members. Cachia delivers the point that the combination of social networking and ICT has resulted in applications, referred to as social computing. Technologies that allow multiple participants to collaborate, discuss, edit, capture and disseminate knowledge etc. over the internet in real time are also known as virtual teams.

Building upon the area of social computing, Shih (2011) recognises the potential of OSNs as a collaborative tool as it: enables individuals to build better rapport and, therefore, can contribute to a more trusting and satisfying team environment. Attributing it to three main aspects of casual communication and interaction modes for establishing rapport, the capability to connect with individuals outside your network and the capability to find functional experts and view the expertise of collaboration team members.

ONLINE SOCIAL NETWORKS

OSN Progression

On reviewing the current literature surrounding the area of social networks and construction collaboration technologies there is a clear and definitive path of progression from basic ICT tools to high level use of OSNs. This identification is based largely upon the concepts that are derived from each categorisation of the use of an OSN.

Building Collaborative Technologies

The goal of OSNs is to do more than mere networking with peers - contributing collaboratively often leads to discussions that mature into a project which could lead to a new way of producing a product or solving a problem. In this respect networking is a prerequisite to collaboration, Awad (2011). With this in mind there is a definitive structure or systematic way with which to gain maximum potential from OSNs. In this manner therefore it is safe to assume that the use of any collaborative technology is the prerequisite to OSN use and application. Concepts typically found and associated at this level of use are Networking, Shared Environments, interconnectivity and RTC.

Online Social Networks

The next level of the OSN progression is the OSN and its main concept of knowledge management (KM). KM is often cited among academics and researchers as a major benefit to an organisation when construction IT and adoptions are discussed. Sun (2001) defines it as having two aspects. Firstly, it is managing knowledge itself, typically using some IT technology and secondly managing people who create knowledge and encourage a knowledge sharing culture.

The basis is to capture tacit and explicit knowledge that is stored or locked in the employee's mind. This can be captured in a number of ways either in a structured (formal), semi structured or informal manner. Sun likens it to a form of capital that is capable of exchange between people and be capable of growing. Sun also describes it as intellectual property that adds value to the organisation competitively.

In research carried out by Smyth *et al* (2008), it was identified that both email and project databases are the most common method of knowledge capture. This presents a fragmentation of the knowledge capture process adding to the complexity of knowledge seeking.

OSNs may offer the solution to the building contractor wishing to capitalise on their organisation's fragmented knowledge. In one instance it offers simplicity and a clean user friendly interface. Both of these points Williams (2007) argues are paramount to successful knowledge capture and use. While at the same time it offers a single and central hub from which all information is gathered and shared removing the processes as described by Smyth (2008). Concepts identified at this level are Project Collaboration, Behavioural Based Actions, Remote Participation, Sharing Culture, Knowledge Management and Social Recollection. OSNs adopted not just at the site level but at the organisational level seek to reconnect sites to other sites within the organisation promoting a shared environment.

Combined, this technology emphasises that knowledge is easily shared and retrieved among users but that this process can take time in getting it to that point.

The topic moves away from KM and moves towards project collaboration and the new dynamic that it creates within the organisation. Simply sharing knowledge or information on a particular topic on an OSN where there are multiple viewers almost naturally promotes a discussion. This discussion promotes further knowledge sharing through advice and previous experiences of the contributors and thus expands the knowledge base of the organisation. A layering effect of knowledge to the organisations knowledge base occurs further enhancing the captured knowledge.

Enterprise Social Networks

In a larger organisations or perhaps even a community of smaller organisations, Shih uses the term Enterprise Social Networks (ESNs) as opposed to OSNs and highlights

an important function of OSNs/ESNs is for discovering expertise within the organisation. ESNs are thus the next progression of the OSN. Concepts associated with the use of ESNs are Transparency, Knowledge Based organisation, Self-policing and Naturalisation of Knowledge Management.

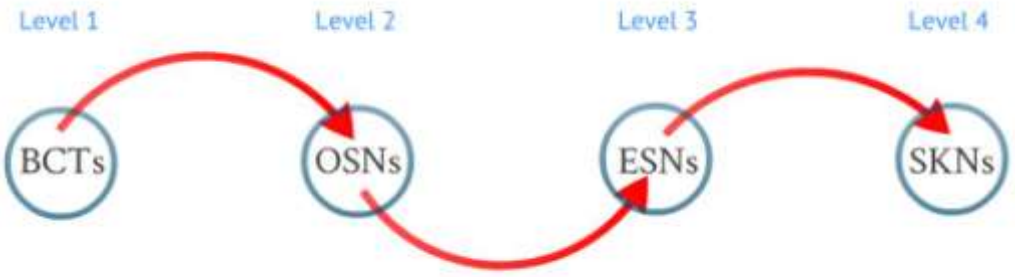
Business intelligence can be compared to a form of data mining or dataveillance. Dataveillance can be seen as a method of intrusion of privacy however here the method is used to the benefit of the end user by collating data and presenting it in a manner that is useful for the business. When used in the right manner dataveillance can demonstrate positive benefits to the user but there is also the addition that it can be used to gather data on the participating organisation without their express knowledge.

Remote participation is also highlighted as a benefit for the contractor. The need to be present on the physical site in order to determine what is going on in real time is no longer necessary. This reduces time travelling and other expenses associated with travelling from site to site.

Social Knowledge Networks

In order for an ESN to become a SKN it must be social, collaborative and ubiquitous on top of which all lower concepts must be previously demonstrated. Figure 1 completes the progression theory. Engagement is therefore critical for not only the successful implementation of an OSN it is also critical for its continued growth from one progression to the next.

Figure 1: Online social network progression



OSN concept hierarchy

By the identification of the functional concepts that are fundamental within the use and application of OSNs a vertical concept hierarchy becomes clearly defined. This hierarchy defines the manner by which a number of concepts need to be achieved/demonstrated prior to proceeding up the hierarchical structure to a more advanced level of OSN use and thus be rewarded by the benefits by the use of that level of OSN.

OSN knowledge spectrum

The OSN knowledge spectrum is a derivative model of the OSN concept hierarchy. It represents how each concept is related to the progression of the social network. Each progression of the OSN requires an organisation to have demonstrated the concepts associated with that progression and thus can be placed on the knowledge spectrum. Lower and easier concepts (from the left) lead to higher concepts and thus in turn are more complex and require a greater effort to attain. Figure 2 show the OSN knowledge spectrum.

This type of transparency opens a number of avenues for the organisation using an OSN. Depending on its level of use and associated rights, an individual can assess the work of another individual over a given duration and assess the true value that the individual is providing to the organisation over that duration. Combine any number of individuals on a site and the data that can be examined allows for any number of strategic business decisions to be made. This will allow contractors to be more responsive and flexible with their mobile workforce and will allow for a more streamlined approach to the sometimes adverse construction business environment.

In order to achieve that level of quality data analysis the contractor needs to have an existing culture of information sharing (sharing culture) throughout every level of the organisation. Which according to Sun (2001) is *the basis is to capturing tacit and explicit knowledge that is stored or locked in the employee's mind*. There must be frequent updates made to the OSN by every individual and these updates must contain some business activity information i.e. current activities, duration, number of personnel etc. This will depend on where the organisation wishes to take its interests along the OSN knowledge spectrum/benefits.

The transparency effect also empowers individuals to be more vigilant in what they do, and in some cases it may inspire a more productive workforce.

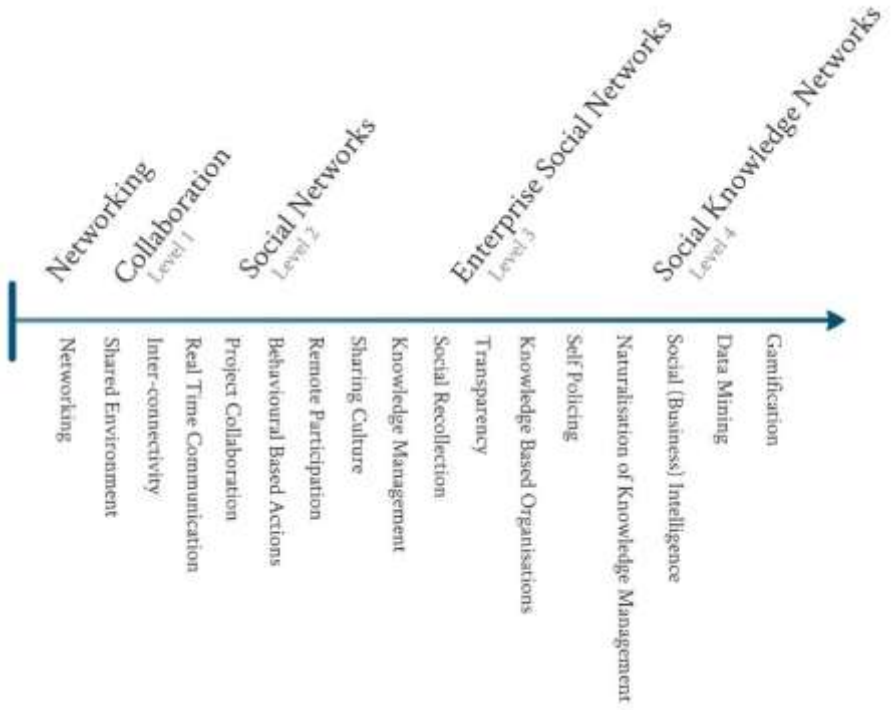


Figure 2: OSN knowledge spectrum ,relationship of conceptual use to OSN hierarchy.

CASE STUDIES

The case study methodology was chosen primarily as a means to justify the research aims by which to provide solid examples of use within the industry while simultaneously providing an opportunity to delve into the modes of conceptual use as demonstrated by the contractors.

Case study number 1:

Company A have had Senubo (a construction industry specialist OSN) within their organisation for approximately six months but it was not used extensively on any project or with any goal in mind. A decision was made to introduce Senubo with the view point of testing the software extensively during this project.

Prior to adopting Senubo on the project site, Company A relied solely on hardcopy site diaries for the recording of daily information. The site diary was not used as much until nearing the end of a job to return over previous entries and retrospect particular elements of work. The interviewee states that on using a hard copy diary that no one else would have picked it up to view entries for any particular purpose unless it was absolutely necessary. Thus the information contained within is never viewed by anyone but the owner.

The decision to use this technology was based on the rapidly evolving IT sector and the desire to keep apace, Company A considered Senubo as a tool that enhanced mobility within the construction environment. There was also the identification that Company A wanted to see if the tool would allow communication within the site in itself or be more broadly interlinked between sites.

Company A are currently using Senubo mainly as a substitute for their site diary, by recording daily tasks, number of operatives, plant and machinery, weather conditions etc. to the platform. That is all recorded via SMS text messaging as the participant walks the project site. Updates are then posted and those posts then appear on the web application for off-site viewing. Company A also use the OSN to report on any safety issues when they are encountered immediately on site during daily site inspections and also demonstrate how the transparency of the technology has enabled behavioural based safety on the project *"anyone can see that the [safety] checks have been carried out, it's up there, it's all there for everyone to see".*

Recollection at the end of a day's work was commonplace among company A and there is an admission that such recollection is not truly accurate of actual events. Procrastination is replaced by prioritisation by using the OSN. There is also recognition that the benefits of OSN real time updates and OSN transparency have had on the process of reporting in that there is no worrying associated about having not reported an issue to a particular individual. It appears to all on the main web application within seconds of sending the SMS update.

This eager adoption approach has allowed company A to clearly demonstrate a number of intermediate concepts that are associated with the use of OSNs. This would point immediately to a clear understanding of the technology and of what it can actually do. This demonstrates a championing approach to the technology.

A single site was used to begin the adoption of this technology. This targeted project site use implies a structured adoption approach by upper management and strategic decision making. There is awareness within the project team that technology is now more mobile and that this connectivity between people is making it easier to communicate. There is excellent understanding of the project team in terms of project collaboration and the sharing of update posts between team and organisation members and they even use terms such as interlinked which demonstrates further their understanding of the OSN.

Project collaboration is mainly carried out via sharing site diary updates using text and photographs. They also demonstrate the concept of remote participation by external

team members based in head office who can view the live feed and contribute remotely all of which adds naturally to the organisation's knowledge base.

Examples of using Senubo for safety updates and issues as and when they are spotted and this emphasises the technology as a live reporting tool that informs other team members of current issues who can then take appropriate action without delay.

There is also an awareness of the limitations associated with using hard copy diaries in that they have no social aspect unlike Senubo. This awareness further highlights Company A's understanding of the technology in terms of project collaboration. By highlighting the links between individuals on the site the team have become more aware of what is occurring on site at any given time.

Similarly the comparison between real time updating and retrospective writing into a site diary highlights time savings and more accurate knowledge management due to the ease of use of the OSN itself as there was an admission that having to retrospectively update a hard copy diary may lead to accidental knowledge loss.

Adding to the aforementioned point, the site team also demonstrate social recollection by the process of project collaboration and reading what other team members are doing. This also improves knowledge capture and management. Company A also show acute awareness of OSN security and privacy issues as the interviewee reassures that they were fully knowledgeable as to what the technology was capable of doing or not doing. This may have some links to previous use of other open OSNs (Facebook, Google+ etc.) by the interview and would thus skew the result.

Finally a link is highlighted that describes the relationship between a social network and proficiency of use and the age of the individual. The older an individual is the less proficient he or she is at using such technologies and vice versa. This is an expected result among the general population. The reaffirmation here highlights that more awareness of the OSN technology should be made to those who may not be as familiar with the technology and provide more care and attention. Without this care and attention the implementation process could run in to some issues reducing its capability to show increased performance or perhaps lead to its rejection. Perhaps Company A chose this project site due to its relatively young team members and as a result has proved implementation success over a relatively short period.

Figure 3: Position of company A on the OSN knowledge spectrum

By having this understanding and building the technology into a core function/process of the construction site has allowed company A to reap many of the benefits associated with an organisation. Figure 3 finds company B located to the middle section of the spectrum due to the manner by which they are using the technology.

Case study number 2:

Company B have had Senubo within their organisation for approximately one year specifically on a trial basis purpose only, thus there was no direct decision behind adopting the technology. Company B has no specific use for the technology thus far but has demonstrated minor collaborative use and data retrieval as the interviewee who is office based would notify some of the site team on a monthly basis to gather information for the monthly application process. It is also used by the interviewee to monitor progress out on the site and any other problems that may occur.

Previous to adopting Senubo all data retrieval processes were organised and collected by email. OSNs are seen by company B as *"more open and easier to use than email"* and that it is *"there in front of you… an open page and everybody can see it. So if someone has a comment to make they can make it."* With email the interviewee admits that there was always the possibility of missing someone's name during a circulation or not send the email to those who need to know.

Company B's approach to OSN use is extremely limited however there are clear and good examples of how it can be used both in project collaboration and disseminating information to the site team. There is however a distinct lack of strategy towards its implementation and notable absence of any attempt to embed the technology into any existing current process. There is nevertheless, comparative recognition of the benefit of the OSN over email in terms of disseminating information accurately to the correct individuals.

While it is not stated specifically by the interviewee, the concept of remote participation is clearly evident as he is office based and remote to the site relaying information back to the site team in real time.

On discussing the benefits of the technology to the organisation a number of OSN related concepts are also displayed by the organisation and particularly by the site team namely real time communication, shared environment, knowledge management and project collaboration. There was no recognition by the interviewee that they were active in these OSN areas. Even with the absence of strategic implementation of Senubo a number of low level concepts occur naturally as the OSN is being used at the basic level.

A point is made by the interviewee when he explains that the usefulness of the OSN reduces as the project nears completion. This is to be expected as the technology is being used mainly as a collaboration tool in this instance. As site activities decreases so do the number of personnel on site and thus the use of the OSN falls in correlation. In terms of disadvantages there is a level of awareness of the future potential of Senubo through data processing and data mining and that the lack of these tools with the OSN is seen as a disadvantage. This further highlights a poor level of strategy of implementing the technology into the organisation.

Having an OSN available to use for almost a year, company B do not show any high level use of the technology that would be expected after such a period in time. The interviewee does state that the adoption process was relatively quick and attributes

that to the young age of the site team. Again imposed limitations of use may be a reason for the natural under development of the technology.

There is a link made by the interviewee where due to the young age of the team and their previous familiarity with open OSNs the process of implementation was smoother. Inferring that OSNs are best used by younger as opposed to older individuals. Figure 4 finds company B located to the lower end of the spectrum due to the nature by which they are using the technology.

Figure 4: Position of company B on the OSN knowledge spectrum

Comparison

The benefits that OSNs provide as described by both organisations are unique to their respective circumstances. This proves that OSNs have multiple uses and benefits derived from those uses for each particular organisation. This demonstrates OSN flexibility within project collaborations while also demonstrating a number of concepts derived from OSN use that either occurs naturally or by design.

While discussing security and privacy both organisations believe that there were no real issues in relation to that area and that it was not an issue. Company A show that there is real trust in the OSN and thus prove that trust by exhibiting higher lever of OSN concepts while Company B show levels of mistrust impacting on their use of the technology. While there is little evidence to conclude that there is a correlation between organisational trust of the technology and benefits derived from the technology's use it does highlight its existence. Also the brief comparison shows that every organisation will have its own unique issues when implementing OSNs.

Adopting the OSN into the organisation for both organisations show further examples of the impact poor adoption strategies can have on the overall benefits of and OSN and its associated benefits. This is borne from the comparison between Company A and Company B wherein Company A show structured implementation and thus place higher on the OSN knowledge spectrum while Company B show little or no structure and thus place much lower along the OSN spectrum in relation to Company A.

Individually, both case studies highlight areas where OSNs have proven to be beneficial to the construction organisation. The grouping of legacy communication tools, while cumbersome to use, fail to reach the level of collaboration and knowledge

management that's associated with the OSN knowledge spectrum. The dynamism of the OSN coupled with the fragmentation of the industry put a clear case towards its use within the industry clearly demonstrated by the case studies and the manner by which it is used.

CONCLUSION

The nature of the online social network is one that allows the user to modify his or her use of the technology with great flexibility and thus see the OSN respond in a manner that is both elastic and malleable without the need for other modes of legacy communication tools. The identification of the concept hierarchy and associated level of social network use allows for the contractor to begin using and benefitting from the technology at any point along the spectrum regardless of their level of technological prowess.

The associated concepts of OSNs each have their own benefits that can have potential application to suit and meet the needs of the many facets of the construction industry and their specialisations. Providing accessibility akin to email

The case studies demonstrate that even by simplistic use of the technology have shown and gained benefits and have naturally begun to move along the OSN knowledge spectrum to higher level concepts without their explicit knowledge. This is the naturalisation of knowledge management in that it is occurring without prior awareness. There is however recognition that further research is required as the technology gains traction within the industry. The case study of company B highlights a possible side effects to the natural highs and lows of construction activity on the construction site in that activity also wanes on the social network and associated loss of interest in the technology (and its benefits) as a result making efforts to reignite use in the social network difficult on the next project.

This research finds that there is ample application of social networks into construction industry and that the benefits that are derived from its continuous use will effortlessly defragment the construction communication process while simultaneously providing the construction organisation with a natural knowledge base with which to analyse to further improve physical construction processes.

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