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CONCEPTUAL FRAMEWORK FOR KNOWLEDGE MANAGEMENT IN CONSTRUCTION INDUSTRY – A CASE STUDY

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Abstract
The importance of knowledge management is increasingly recognized in almost every industry. Every industry or organization is composed of department like Execution, Technical, Quality control Commercial / Procurement and each department has its own significance. Out of this technical department playing a significant role since the project progress completely depend on the availability of resources. Considering the fact managing technical knowledge effectively is critical to the survival and advance of a company especially in project based industries such as construction. Knowledge comes in two different types as explicit and tacit knowledge. Tacit knowledge is based on the experience of individuals and is not easily visible or expressible. It is stored in people's heads, so it is difficult to pass on to others. Much Technical Knowledge (TK) in construction industry is experienced – based too and tacit. However, this type of knowledge usually is not captured during the construction phase. This paper proposes and emphasis a conceptual frame work for capturing tacit technical knowledge in construction industry. The main components of this proposed framework are the TK source, the TK leader, the department team and the technical knowledge management system by which knowledge could be stored, shared and reused in future projects.

Keywords: Technical Knowledge, Knowledge Management, Construction Industry .

1. Introduction

Technical Knowledge management (TKM) is considered to a major part of the construction industry which enables the business activities of the organizations. Managing technical knowledge effectively is critical to the completion successful project in the estimated time, cost and to the satisfaction of the client expectation. Proper TKM can reduce project time and cost, improve quality and provide a vital competitive advantage for the construction organizations in today's knowledge-based economy (Shelbourn et al 2006).

The success of an organization in today's competitive business environment is strongly related with its market, product and technology knowledge. Managing its knowledge resource effectively is therefore highly critical for organizations to be competitive and sustainable in this changing business environment (Henley 2004)

While many given their own definition for knowledge like the Knowledge is not just information and there is no single definition for it. It is a broader, deeper and richer concept than information. For (Davenport & Prusak 1998), knowledge is a fluid mix of framed experience, values, contextual information and expert insight. According to (Nonaka & Takeuchi 1995), Knowledge is a vital organizational resource that gives market leverage. The distinction of knowledge as explicitly and tacit was first introduced by (Polanyi 1967). According to his definition, tacit knowledge is highly personal and context-specific, therefore it is hard to formalize and communicate. It is stored in human's minds, and is difficult to see, share, copy and manage. At this point of time it vital to understand the Tacit technical knowledge has been recognized as the most critical knowledge since it can give an organization a strong advantage over its competitors in terms of the providing the highly technical, workable, widely acceptable, differentiated, easily executable by the construction team.

On the other hand, explicit knowledge can readily be codified in words and numbers, easily shared from the project specification, drawing, schedule concept/function of the element, data from the manual of different material and is easy to distribute (Henley 2004) but level of understanding of the same is not definite because most of the time the design developer and client are different and it difficult to understand by the execution or supervision team. While it can be stored as written documents or procedures and made available to others. Also Technical knowledge is not some think straight forward since it is interpreted by every individual will deal differently and from their point of view it will be correct but coming to the ideal solution is important so that it shall be universally accepted by all which is vital part of construction providing this kind of solution solely lying with efficient technical team.

Knowledge Management (KM) is not a new concept. There have been many organization that already manage their knowledge through several methods, either formally or informally. Recently, it became a critical source of competitive advantage. Improving business performance, saving time and cost, being able to find innovative solutions are some of the

vital advantages effectively would face with serious problems in the future such as repeating the same mistakes again and losing money, time and cost, being able to find innovative solutions are some of the vital advantages of effective KM for organizations (M/R.Kamran 2012).in contrast, companies that do not manage knowledge effectively would face with serious problem in the future such as repeating the same mistake again and losing money and time in their businesses.

Much knowledge in the construction industry is experience based and tacit. However, this type of knowledge usually is not captured during the construction phase Construction companies have been successful at collecting and storing explicit knowledge, but they are generally always not good at capturing and reusing tacit knowledge of any kind and reusing in future projects can give construction companies a strong competitive advantage. This is mainly happening most of the company does not in a position to maintain the resource like human and knowledge in consistent often changing even within the project will lose the effectiveness of the project success & some time many not moving in one direction due to the nature and geographical arrangement. This paper proposes a conceptual frame work for capturing tacit technical knowledge in construction projects. The components of this proposed framework are the knowledge source, the knowledge manager, the project team and the knowledge management system parties involved and their inter-relation, by which knowledge could be stored, shared and reused in future projects.

2. Technical Knowledge Management in construction Industry

TKM in construction industry (CI) is essential for improving the project success and lead to business performance of organization. The CI is a knowledge based industry (Explicitly + Tacit). The production and management of knowledge Is therefore highly essential for businesses operating within this industry and for projects on which they work (Jelena Rasula vol 14 no 2 2012).The importanceof this issue is increasingly being recognized in this industry and have addressed by many researchers and academicians (F.L Ribeiro Portugal 2008).

There have been many factors to clarify the level of importance of TKM in the CI. (Margaret spring Schmaker 2014 15-72 Sciendirect) stated the main driver for KM in this industry as the need for innovation, improved business performance and client satisfaction and similar concept the TKM is vital part of the CI since all the forwards depends on the Technical department detail and approval. (Aini Jaapar December 2011 science direct), in a survey of construction firms, found the main drivers for TKM in construction as: the need to encourage continuous improvement, to share valuable tacit knowledge, to disseminate best practices, to respond to customers quickly, to reduce rework, and to develop new products and service, respectively.

The dynamic and changing business force construction organizations to learn faster, improve their business processes, find more innovative solution to their client's products of high quality with fewer expenses. Increase in the competition, globalization and the rapid developments in information technology led he organizations to focus more on innovation and learning in order to succeed in this environment.

TKM is strongly related with innovation as it makes tacit knowledge available as explicitly knowledge. Since tacit knowledge in technical department is the key component in reusing knowledge even it is available in the project specification, drawing and document as per the requirement of the project specific and client requirements and can give a distinct advantage over the firm's competitors, effective TKM becomes therefore crucial for the successful completion of the project.

Many stated that construction activities could be highly knowledge –intensive and knowledge-intensive sectors are characterized by a high degree of tacit knowledge. They explained the main difference of knowledge-intensive sectors from others as the type of product they supply and the role they play in the regional and national innovation systems. Thus, managing knowledge plays an important role is sectors such as the CI that currently demands a high level of knowledge, skills and learning.

Due to their nature, construction projects are unique and temporary. Construction companies work with different partners and supply chains. Construction projects teams are also temporary and consist of multi-disciplinary teams. After the completion of a project, parties involved move on to a new project. People involved in these projects disband at the end of the project. They move to another project, resign or retire. Generally, much knowledge gained is lost and the lessons learned are dispersed at the end of the projects (Alfredo Federico serpella 2014). This results in much re-inventing the wheel' and repetition of the mistake again and again which will cost more time and money which lead to non-satisfaction level to the client.

2.1.Barriers to implement Technical knowledge management

Construction organizations face with some barriers to implement KM. These barriers have been addressed and highlighted by several researches (Carrillo UK Egbu UK), the major barriers to implement KM in construction firms was found as lack of standard processes, not enough time, organizational culture, insufficient funding, employee resistance, and poor information technology infrastructure, respectively.

1. An organizational culture that discourages the sharing of knowledge will obviously be a great obstacle for a successful KM. In order to encourage knowledge sharing, organizations need to create a supportive culture. Moreover, (Alex Ramirez, Carleton university, Ottwawa 2006) identified three distinct cultural barriers to successful KM:
2. People don't like to share their best ideas, since they believe that knowledge is their power
3. People don't like to use other them appear less knowledgeable. People like to consider themselves as experts and prefer not to collaborate.

3. **Tacit Technical Knowledge in Construction**

Tacit technical knowledge resides in human's heads and is difficult to codify and share. As stated by many researchers that tacit technical knowledge is shared and exchanged through direct-face-to-face contact working in to the detail to detail and case by case. In construction, understanding the construction process and tendering skills acquired by experiences of preparing bids are some of the examples of tacit knowledge (Egbu & Robinson 2005).

It is commonly accepted that construction companies have been successful at collecting and storing explicit knowledge. However, it has also been recognized that they are poor at knowledge retrieval and sharing or utilizing at the right place. When considered that much knowledge during the preparation of construction document for the construction phase of projects resides in individual's heads, managing this type if knowledge becomes more crucial for the construction organizations in order to be competitive and sustainable in the long run. However, problems such as insufficient time for knowledge sharing and the difficulty in converting tacit knowledge into explicit knowledge makes it difficult to fully benefit from this valuable asset.

Based on practice of construction industry, it was found that most of thefirms do not manage knowledge, especially tacit technical knowledge, effectively in their projects. A conceptual framework for capturing tacit knowledge is therefore proposed and presented in this paper.

4 **Conceptual Framework**

Figure I presents the proposed conceptual frameworks for capturing tacit technical knowledge in construction projects. The main objective of the framework is to develop as effective way for capturing tacit technical knowledge of experts, engineers and experienced people involved in technical team for long run and involved in major and minor construction projects. The main components within the proposed framework are the Owner and design team &projects technical team, the technical knowledge management sources (in-house and external), the technical knowledge leader, and the knowledge management system.

1. The owner/Stakeholder and Design team denotes the technical staff involved in the project of the design organization. The vital point is that all team members should be encouraged to share their knowledge during the design phase and even from the past experience –Tacit knowledge in addition to the criteria available given by the owner as requirement. Therefore, the organizational culture that supports knowledge sharing is the key factor to encourage the team members.

2. Technical Knowledge sources include external and internal sources, and the construction industry based organizational knowledge, External sources mainly consist of the stakeholders (Sub-consultant for specialized elements of the project like lift or conveying system, façade, IT MEP Industrial Kitchen if applicable etc. related material suppliers, etc.) involved in the design team of the project.

3. External events, seminars, academic reports and researches, universities, knowledge brokers and the internet are the supporting elements of external sources.

4. Upon deciding the successful contractor to execute the designed dream project the following department form the contractor will involve to make a successful project which will called as internal source to the project.

Internal sources involve current project documentation like specification, drawing, regulation set by the organizational technical team in consultation with the design and supervision consultant, project team meeting, intranet / extranet and personal library of technical personnel, More of commercial/procurement team in finalizing the subcontractor and supplier in

order to provide the required technical data for the preparation of the necessary detail and drawing for the approval of the client and consultant prior to issue to the construction team for execution. Finally, the organizational knowledge is the intellectual capital of the organization which also comprises knowledge about the personal skills, project experiences of the employees and cross-organizational knowledge (Wetherill et al. 2002).

1. Tacit technical knowledge can only be captured from the experience individuals of the similar position worked in many project and experts of different trades involved in the project. The central point of the model is the Technical knowledge leader/Manager. The technical department should establish a technical knowledge management team in which knowledge expert will be hired in each project and knowledge manager will be given the responsibility for TKM. In construction, the technical knowledge manager is generally a senior member with a string construction background. Additionally, he/she should have the required competencies, skills and personal attributes. Leadership, management and communication are some of the skills that are very important to be a successful knowledge manager. The knowledge manager has also a direct connection with knowledge sources.

2. In order to prevent knowledge overload, only valuable tacit knowledge will be stored by the knowledge manager into the KM system. It will also include recording of photos and videos regarding the problem solution, innovation, etc.

3. The TKM system include tacit knowledge such as know-how, expert suggestions, and innovations as well as explicit knowledge such as reports and documents. Construction companies have not been successful at capturing tacit Technical knowledge during the design and construction phase. The system mostly focuses on accumulating and reusing tacit technical knowledge to overcome this problem.

4. The main page of the system contains the projects option where and how the technical information are handled during the execution of the project of current and finished projects of the company is available; the Technical knowledge type option where users can access to tacit and explicitly technical knowledge such as know-how, innovations, problems/solutions and explicit knowledge such as specifications, design drawings, Design parameters, design concept, contracts and reports; and the add new knowledge option which is used only by the technical knowledge manager to add new knowledge into the system.

5. The system will be updated by the knowledge leader/manager. The users can find the relevant knowledge in this system by using the following search option; knowledge type search, subcontractor type and contact detail, supplier detail, category of the element and purpose origin of product search and knowledge used in project search. On each web page the submitted date and approved date of the knowledge are given and the description of the knowledge is presented.

6. Immediate access to the relevant knowledge can be provided by this system. Therefore, it can reduce the time consumption and cost of finding knowledge which enable the department or company while proposing to the client and consultant and during the preparation of the schedule for the shop drawing, Material schedule, subcontractor schedule etc. which will ultimately enable to hand to finalizing the progress of the work and resource required etc.

7. All technical staff can access into this system by having a password authorized by the company. The company users can facilitate the updating process of knowledge by adding something extra if they have experience in the relevant field.

5. Conclusions

Construction companies have to manage their Technical knowledge better if they want to survive in the competitive business world. Recently, implementing TKM within their firms has become almost a necessity for all construction organizations who dealt with the mega projects. Obviously, implementing these processes requires a coordinated strategy to achieve the benefits of TKM.

1. In construction projects, much technical knowledge is wasted during the construction phase. Capturing tacit technical knowledge and reusing in
2. future projects is very important and can give a company a strong competitive advantage.
3. This paper proposed a conceptual framework to capture tacit technical knowledge in projects. The main components of the proposed framework are the Owner and design team & projects technical team, the technical knowledge management sources (in-house and external), the technical knowledge leader, and the knowledge management system.
4. The proposed TKM system is briefly described. Future research will be conducted in order to test the suitability of this system for capturing, storing and reusing tacit technical knowledge in construction projects.

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