The Importance of Tacit Knowledge Integration within Traditional Project Environment: A Critical Review

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Abstract

Project knowledge mostly remains in minds of involved individuals of project team and is not captured and transferred across the project in order to be used in future projects, mainly in construction industry. The successful completion of a project requires a rigorous understanding of each stage that can be enhanced through integrating knowledge between all individuals involved in project, specifically between detailed design phase and execution (construction) phase. This is where there are issues about performances in terms of traditional procurement. The construction industry suffers from lack of knowledge integration between its phases especially in traditional procurement system, because many professional designers at design phase are not skillful in construction means and methods, and have little experience and tacit knowledge in construction practices. The fact that the design and construction process are separated means common disputes exist between design and construction phase. The construction industry will lose its knowledgeable and skilled workforce and there is no efficient strategy by which knowledge can be integrated across project and between team members. This paper aims to highlight the importance of tacit knowledge integration within the project environment. A critical literature survey and review of existing published data will be carried out to explain challenges within the traditional project environment, existing practices in terms of knowledge management practices and the way in which knowledge integration can be adopted for better performance.

Keywords:

Construction Industry, Traditional Procurement, Knowledge Integration, Tacit Knowledge

1.0 Introduction

Knowledge is considered as the most valuable asset that should be effectively managed in order to create added wealth (Shokri-Ghasabeh and Chileshe, 2014). The availability of accurate and timely knowledge enables project members and organisations to respond rapidly to problems and facilitate processes. Therefore, the competitive advantage of organisation and successful completion of a project lie in the ability of effectively managing knowledge (Kivrak *et al.,* 2008). Knowledge Management (KM) plays a significant role in survival and performance of organisations, specifically in project-based industries like construction.

Researchers(Kazi and Koivuniemi, 2006; Shokri-Ghasabeh and Chileshe, 2014) believed that project knowledge mostly remains in minds of involved individuals of project team and is not captured and transferred across the project in order to be used in future projects, mainly in construction industry. This means that knowledge is not integrated between project team members. In other words, knowledge integration is the process of capturing, sharing, transferring and reusing knowledge within project environment in order to improve project performance. As the nature of construction project teams and projects are temporal, the continuity of using the same staff and professionals for the future projects will decrease, which leads to lose project knowledge (Shokri-Ghasabeh and Chileshe, 2014). Researchers also believed that the construction industry will lose its skilled and knowledgeable workforce and there is no efficient strategy by which knowledge can be integrated across project and between team members (Kanapeckiene *et al,* 2010; Shokri-Ghasabeh and Chileshe, 2014). Within this context, the failure to integrate the knowledge will result in increasing the possibility of "reinvent the wheel", which means spending more time and cost.

The successful completion of a project requires a rigorous understanding of each stage that can be enhanced through integrating knowledge between all individuals involved in project, specifically between detailed design phase and execution (construction) phase. This is where there are issues about performances in terms of traditional procurement (Love *et al.,* 2013). The construction industry suffers from lack of knowledge integration between its phases especially in traditional procurement system, because many professional designers at design phase are not skillful in construction means and methods, and have little experience and tacit knowledge in construction practices (Cheng, 2009; Love *et al.,* 2013; Aziz *et al.,* 2014). The fact that the design and construction process are separated means common disputes exist between design and construction phase. The construction industry will lose its knowledgeable and skilled workforce and there is no efficient strategy by which knowledge can be integrated across project and between team members. This paper aims to highlight the importance of tacit knowledge integration within the traditional project environment. A critical literature survey and review of existing published data carried out to explain challenges within the traditional project environment, existing practices in terms of knowledge management practices and the way in which knowledge integration can be adopted for better performance. The paper is organised as follows. Initially, the concept of KM and its components are discussed. Then, KM in construction is briefly discussed followed by the concept of knowledge integration and challenges of its component in construction project. Further, the relationship between these challenges and the impact of knowledge integration on traditional-based project performance is discussed.

2.0 Knowledge Management

The concept of explicit and tacit knowledge was introduced by Polanyi (1966). The explicit knowledge could be articulated, codified, stored and distributed in certain media, whilst the tacit knowledge is hard to be captured and distributed because it is associated with experiences and skills of individuals (Easterby-Smith and Prieto, 2008). As knowledge is a critical resource, KM is a fundamental and mandatory issue that brings success to organisation (Binney, 2001). According to Wilson (2002, 2003), KM is not only about managing knowledge but it also covers a wide variety of

practices. KM is defined as "any process or practice of creating, acquiring, capturing, sharing, and using knowledge, wherever it resides, to enhance learning and performance in organisations" (Armstrong, 2009). The aim of KM is to capture and distribute knowledge within projects and organisations environment before it is forgotten or lost in order to improve effectiveness of all primary activities. In other words, effective KM will be a main source of competitive advantage of organisation by reducing time and cost of project, improving project's quality and performance (Kivrak *et al.,* 2008). KM is a wide concept that consists of various processes such as creating, securing, capturing, coordinating, combining, retrieving, and distributing knowledge (Kivrak *et al.,* 2008). The term knowledge integration is the process of capturing, sharing, transferring and reusing knowledge within project environment in order to improve project performance.

2.1 Knowledge Capture

Hari *et al*. (2005) state that capturing knowledge is the process of turning personal knowledge into corporate knowledge in order to be shared among involved individuals in projects. Therefore, identifying the critical knowledge sources in project is prerequisite for capturing knowledge. Egbu *et al*., (2003) considered involved individuals in projects are the most important knowledge source. However, Kivrak *et al.* (2008) state some knowledge sources of companies that could facilitate the knowledge capture process. They are listed according to their importance; *Colleagues, Company's experience, Personal experience, Company documentation, Current project documentation, Project team meetings, Intranet, Personal library, Clients, Internet, Knowledge brokers external to the firm, External events* (conferences, seminars).

Considering these sources will facilitate the knowledge capturer to use a proper approach. According to Shokri-Ghasabeh and Chileshe (2014), different approaches for capturing knowledge from projects have been proposed by researchers among which the following studies have been investigated: Von Zedtwitz (2003), Carillo (2005), Williams (2007), Kululanga and Kuotcha (2008), Fuller *et al.,* (2011) and Henderson *et al.,* (2013). However, all the mentioned studies highlighted the benefits and impacts of capturing knowledge on performance of organisations, but it has not being prioritised in organisational culture.

2.2 Knowledge Sharing

Knowledge sharing is one of the important aspects of knowledge management (Riege, 2005). There has been various definition of knowledge sharing by researchers. Hickins (2000) describes knowledge sharing as the process of capturing tacit knowledge of individuals and transform it into shareable form. It is also defined as "activities of transferring or disseminating knowledge from one person, group or organisation to another" (Lee, 2001, p.324). According to Berggren *et al.* (2011), knowledge sharing is "the process of developing trans-specialist understanding through creation of overlapping knowledge fields". The important factor that was ignored by researchers is the difference of knowledge sharing and knowledge transfer which is the unidirectional flow of knowledge from one group, department or a project to another.

2.3 Knowledge Transfer

Knowledge transfer is a critical process in KM that enables knowledge to transfer (Cranefield and Yoong, 2007). It is the process of moving, skills and experience from one knowledge entity like individual, group or organisation to another in order to assimilate and accumulate new knowledge, develop new ideas, processes and practices in the receiving unit (Szulanski, 2000; Carlile and Rebentisch, 2003). Studies on practitioners and project learning have pointed out that there is a need to transfer knowledge within and between projects (Schindler and Eppler, 2003; Walker, 2004; Bower and Walker, 2007). As project knowledge and experiences can be used in other projects, it would be necessary to share the captured knowledge across projects in order to avoid unnecessary rework (Carrillo, 2005). Knowledge transfer plays a significant role in project-based organisations. Most project-based organisations tend to embark on rework thereby repeating the same mistakes again (Desouza and Evaristo, 2006; Landaeta, 2008). In fact, lack of effective knowledge transfer will lead captured knowledge from previous project, not being efficiently reused in other relevant projects and will cause time loss, errors, unnecessary rework that will affect project performance.

3.0 Knowledge Management in Construction

The UK construction industry has in excess of 1.5 million employees and constitutes approximately 20 per cent of total enterprises in UK. This industry plays a significant role in gross domestic product (GDP) of the UK that contributes around 8 per cent (Construction 2025, 2013). Furthermore, 99 per cent of organisations are SMEs in this industry and construction activities are highly knowledge-intensive which require an effective management (Hari *et al.,* 2005).

According to Latham (1994) and Egan (1998) report, UK construction industry has suffered from performance problems and has been in transition to overcome this issue. In order to improve overall performance of construction industry, two core factors, knowledge and learning, should be more considered (CRISP, 1995; OST, 1995). The term ‘knowledge management’ and the way in which to achieve it are a new category and essential in knowledge-based industries like construction (Carrillo *et al.,* 2000; Hari *et al.,* 2005). KM has a vital role in improving efficiency of project delivery and competitiveness of organisation (Egbu, 2005; Sheehan *et al.,* 2005; Fong, 2005).

Many researchers (Hari *et al.,* 2005; Bessick and Naicker, 2013; Ekambaram *et al,* 2014) have investigated the major drivers and challenges of KM in the construction industry. Kamara *et al.,* (2002) and Carrillo *et al.,* (2004) state the need to improve performance and the need to share valuable tacit knowledge are main drivers in the UK construction industry. Therefore, implementing KM in construction organisations confront with challenges such as capturing, sharing, transferring and reusing information and knowledge across projects, due to the nature of construction projects which are unique, short-term, project-based or task-oriented. However, people who worked on these projects, both in design and construction team, tend to disperse after the project ends. This means their experiences and the knowledge they have acquired through the project will be wasted and not be used in future projects (Kasvi *et al.,* 2003). This issue is more sensible in traditional-based construction projects as their nature is based on the separation of design and construction process. The traditional construction process approach has been criticised for several issues such as: *failure to*

form effective teams, separated approach to project delivery, time delay, lack of communication and coordination, rising costs, rework and wastages (Aziz *et al.*, 2014). However, it is necessary to put in place the structure that facilitates participation and interaction of involved people in design and construction process to integrate knowledge, in terms of capturing, sharing, transferring and reusing, across the traditional-based construction project environment in order to improve project performance. Therefore, project manager needs to consider challenges that confronts with these processes.

4.0 Knowledge Integration in Construction

The knowledge integration procedure is critical to project performance (Nonaka and Takeuchi, 1995), especially in project-based industry like construction. Several studies have been conducted on knowledge management in construction projects, but only few of them focused on knowledge integration between different construction projects (Adenfelt and Maaninen-Olsson, 2007; El-Gohary and El-Diraby, 2010). From working perspective, knowledge integration is defined as the process that leads to a practical solution by contributing expertise and knowledge of all involved parties. According to Mitchell (2006), knowledge integration is the ability to integrate internal and external knowledge to respond to environmental change. In other words, the knowledge integration process should enhance the dynamic capacity of organisations in a way to pretend environmental changes affect the project performance. Knowledge integration in this study is the process of capturing, sharing, transferring and reusing knowledge within project environment.

The construction industry has been suffered from low efficiency of project delivery due to its failure to form effective teams and to implement united approach to deliver a project (Evbuomwan *et al,* 1998). Adenfelt and Maaninen-Olsson (2007), investigated the way in which project performance is positively influenced by integrating knowledge between projects. According to their studies, three main factors were identified which are;

- Knowledge integration depends on interaction between the projects and the organisational context of the projects
- Knowledge integration depends on concerned actors' "time for reflection", "the nature of the activities in the project", and "interest and motivation of the involved actors"
- The role of knowledge management for integrating knowledge

Despite the positive influence of these factors on project performance, they should be investigated in terms of challenges that exist in knowledge integration sub-processes.

4.1 Knowledge Capture Challenges in Construction

Knowledge capture process, like other sub-processes of KM, confronts with challenges. After thorough review of literature, these challenges are mainly categorised from three perspectives; *Social issues, Technical issues* and *Process issues* (Hari *et al*., 2005).

Social issues include challenges like; people, communication and networks, culture, motivation and structure.

- *People issues*: most of tacit knowledge usually captured through informal network in project team. Unfortunately, involved individuals in project usually depend on professional's help to find appropriate document. This gives professional the feeling of overwhelming by receiving too many calls which will waste their time. This means tacit knowledge of experts has not been captured in order to help team members to find key documents.
- *Communication and networks issues*: It is one of the main social challenges in capturing knowledge, specifically in construction projects that are based on traditional procurement route. Separation of project phases (design and construction phase) and separation of sites would have affect the process of capturing knowledge. Therefore, establishing a network between people involved in project and across project's phases will develop a knowledge base for project team members.
- *Culture* is the main barrier to capture knowledge in construction industry. Individuals and experts are reluctant to share their knowledge, because they consider knowledge as power. Furthermore, they also do not tend to learn from others' experiences, because they fear of negative impact of admitting mistakes among their team members. However, there is a need for project manager to review both successful and failed projects after their completion with involved experts in order to uncover what they can teach.
- *Motivation issue*: It is the responsibility of project manager to improve the awareness of the team members about the importance of capturing knowledge and its impact on project performance and implementation of work tasks. The project manager should understand the expectations and needs of project members in order to motivate them about their jobs and cooperate in knowledge capture process
- *Organisational structure issues*: The flexible and decentralised organisational structure will prepare and enable the project environment for project members to easily and freely exchange their knowledge and share good/best practices. However, the certain use of techniques and technology for capturing knowledge depends on size and structure of the organisation.

Technical issues: highly focus on explicit knowledge and is all about IT perspective. In other words, technology is used to capture, transfer, share and reuse knowledge. Hari *et al*., (2005) identified some technological issues;

- Lack of IT software's and technical support
- Practical difficulties in accessing the intranet and website from site offices
- Lack of standardisation of the system
- The technologies have had to compromise one way or another between simplicity and specificity in capturing and publishing knowledge

Process issues: The knowledge capture process should be controlled and customised. The knowledge manager should determine the time of capturing tacit and explicit knowledge, when to make tacit to explicit knowledge, when to leave knowledge in its native form, make sure that all involved individuals in project have access to explicit knowledge about procedures and processes.

Furthermore, codification and dissemination of knowledge are also important. Capturing and maintenance of knowledge can be costly and time-consuming; therefore, the knowledge manger should keep track of decisions, rationale and discussions of professionals and team members in short-term projects.

4.2 Knowledge Sharing Challenges in Construction

Knowledge sharing process in construction industry depends on personal and informal communication (Styhre *et al.*, 2004). Researchers and practitioners have neglected studying the process, barriers and actual practice of knowledge sharing in construction projects (Styhre, 2009; Johansson, 2012). However, researchers investigate other processes of KM in construction industry like; capturing, codifying and transmitting knowledge (Johansson, 2012).

Researchers have identified three main challenges that affect knowledge sharing process in organisation and project which are; culture, trust and motivation (Smith, 2001; Stenmark, 2001; Bartol and Srivastava, 2002; Ipe, 2003; Riege, 2005; Fong and Chu, 2006; Wang and Noe, 2010; Bessick and Naicker, 2013). Organisational culture is highlighted as the most important factor in knowledge sharing process that creates link between knowledge sharing and business problem (McDermott and O'Dell, 2001). However, collaboration among involved individuals in projects and mutual trust along with having culture of support are other initiatives and success factors that will facilitate knowledge sharing process.

Generally, researchers categorised knowledge sharing barriers into three types; lack of supporting culture, lack of mutual trust and lack of motivation and time for sharing knowledge (Kivrak *et al*., 2008; Bessick and Naicker, 2013). Existence of supporting culture is highly important in sharing knowledge among individuals in organisation and project. This is mainly dependent on attitudes of knowledge manager to encourage and motivate knowledge holders; and build reward and recognition systems by using different techniques and technologies. However, knowledge manager should consider this issue that knowledge holders are reluctant to share their knowledge when they feel their job is insecure. Therefore, mutual trust and the awareness of knowledge holders about the importance of knowledge sharing on project performance should be improved. In addition, McDermott and O'Dell (2001) determined that lack of time will prevent knowledge holders from sharing their knowledge in temporal-based project, like construction project, even when the available technology is efficient.

4.3 Knowledge Transfer Challenges in Construction

Construction organisations are reluctant to invest in knowledge transfer and required infrastructure support, due to their low profit margins and conservative nature (Cheng, 2009). In fact, organisations are not aware of the importance and benefits of knowledge transfer on project performance. In construction projects, the main

challenge of transferring knowledge is to transfer knowledge of design intent and rationale to individuals in construction team. The involvement of multiple organisations in a project means that the transfer of knowledge from one phase to another depends on the kind of contract type or procurement strategy adopted for the project (Kamara *et al.,* 2002). The awareness of construction organisation members has been seen to be relatively low as regards the importance of tacit knowledge and knowledge transfer. It is necessary to improve this awareness and encourage them to implement knowledge transfer activities through incentives such as; increasing salaries, promotions, personal growth and acknowledgements. However, it is highly dependent on the organisational culture and should also be based on trust (Cheng, 2009).

Cheng (2009) identified three main barriers in implementing knowledge transfer in construction projects which are; *Insufficient Time of Members, Organisational Culture Challenge* and *Lack of Standard Processes*. There are several challenges for knowledge transfer between projects. Ekambaram *et al.,* (2014) highlighted five main challenges:

- *Lack of incentives to share information and knowledge*: it is necessary for project's members to be motivated to share their knowledge, otherwise no/inadequate knowledge will probably be shared
- *Attitudes* – lack of awareness/willingness to share knowledge: organisations need to consider and prioritise knowledge transfer in their culture and project process
- *Low stability or continuity in relations between collaborating organisations*: this stability can develop trust between individuals which is mainly important for effective knowledge transfer
- *Time pressure*: usually project members have no time for sharing and transferring their knowledge because they will be recruited in another project once it is complete or they are involved in several projects at the same time or within a certain time-period.
- *Inadequate information systems*: lack of having effective and efficient information systems like knowledge database, documentations and reports will have negative impact on knowledge transfer process

These challenges are interconnected. Comparing these with the previous mentioned challenges will reveal that the culture of organisation is the main challenge for transferring knowledge which is mainly affected by trust. Organisational culture should prioritise and increase the awareness level of its members on the importance of knowledge transfer. This is highly dependent on having a standard working process and existence of trust between project members. However, organisational culture besides effective standard process will moderate the time pressure challenge.

In order to have a better understanding of the proposed terminology of knowledge integration, its process and challenges of each sub-process are illustrated in Figure 1.

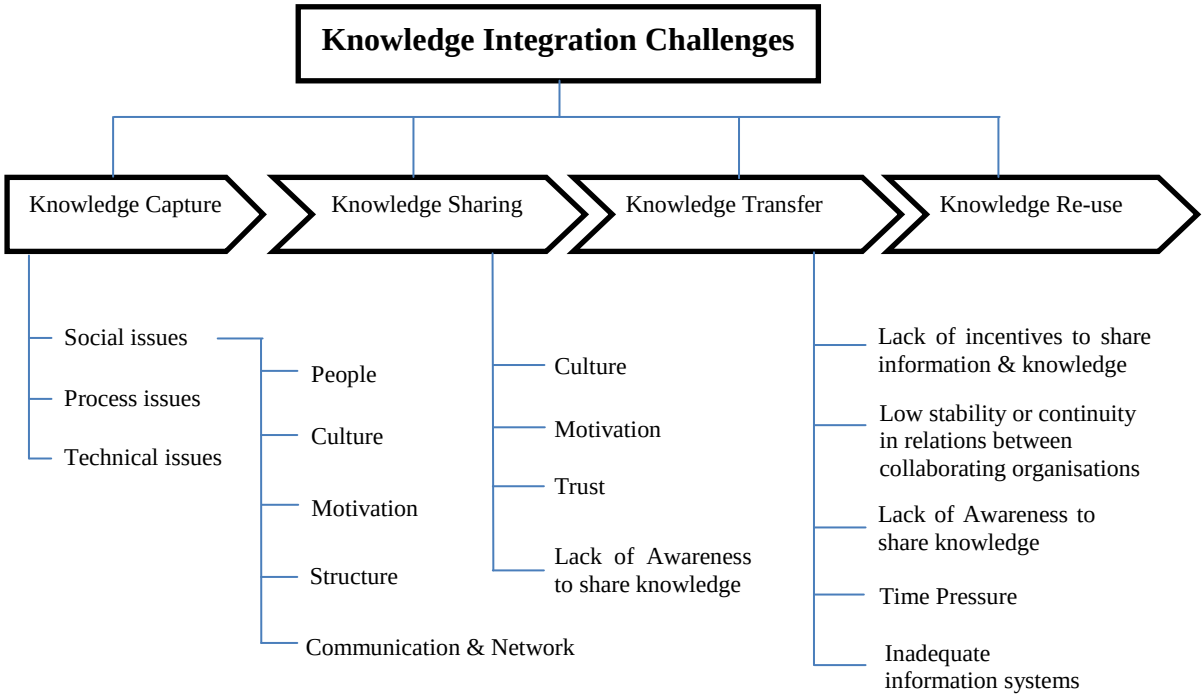

Figure 1. Knowledge Integration Process and Challenges

5.0 Discussion

The unique characteristic of traditional procurement system, separated method, in construction industry is the separation of responsibility of the design phase and the construction phase in the implementation process of the project. Generally, construction projects undertaken through this system confronts with challenges. Designers are not motivated and well experienced to effectively manage cost and time of project. Furthermore, they have no direct experience of managing construction work and construction team is unable to involve in design process until too late. However, it should be said that good communication and motivation to share knowledge usually do not exist between project members across and among project phases. Considering these challenges deduce that there is a lack of management expertise to effectively manage knowledge in projects undertaken by traditional procurement system.

Due to the lack of KM in traditional procurement system, construction projects undertaken through this system confront with number of issues; failure to form effective teams, separated approach and time delay to project delivery, lack of communication and coordination, rework, wastage and rising cost (Nasrun *et al.*, 2014). In other words, these issues will affect project performance. Comparing these problems with challenges of knowledge integration in construction project that were mentioned before, will infer that traditional procurement system suffers from poor project performance. However, these challenges are similar to challenges of knowledge integration sub-processes.

Most of the studies on KM in construction industry only considered one or two components of KM (Fong and Chu, 2006; Cheng, 2009; Ding and Ng, 2010;

Johansson, 2012). However, for improving the performance of construction projects undertaken on traditional procurement system, it would be better to have a holistic view rather than a very narrow set of views on very particular process. In other words, focusing and doing research purely on each component would not lead to improvement. However, it is critical to capture tacit knowledge of individuals and professionals involved in projects and reuse it in future projects, because most of knowledge and experience exist in the mind of involved participants in projects. In essence, for being competitive and improve project performance it is necessary to capture, share and transfer knowledge and experiences that are achieved from previous projects in order to reuse in future projects (Hari *et al.*, 2005; Lee and Egbu, 2005). Researchers state that the construction industry is poor in capturing, sharing and reusing tacit knowledge (Woo *et al.*, 2004). Therefore, there is a need to have a holistic view and establish a process to improve the performance of construction projects undertaken by traditional procurement system. Thus, the terminology of knowledge integration is proposed as the process of capturing, sharing, transferring and reusing knowledge within project environment in order to improve the project performance.

However, this critical review research not only extends previous research on knowledge integration, but also enables stakeholders to be aware of key challenges and barriers that exist in construction projects with respect to tacit knowledge integration.

6.0 Conclusion

Despite the fact that most of the studies investigate the positive impact of each sub-process of KM on performance of construction project, it has not been prioritised in organisational culture and project process to capture, share and transfer tacit knowledge of project's members. Finally, comparing challenges of knowledge integration process will reveal that they are in common and barriers such as organisational culture, insufficient time, and lack of standard processes, mutual trust and lack of collaboration among employees impact the knowledge integration process in terms of capturing, sharing and transferring tacit knowledge and make it difficult to fully benefit from this asset. It should mention that the term 'knowledge integration' is an attempt to provide a better demarcation to an existing terminology.

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