Barriers and Enablers of Effective Knowledge Management: A Case in the Construction Sector

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Abstract: Knowledge management is not new to construction companies, as they have been implementing and managing knowledge for as long as they have existed. However, there is the business need for organizations to continuously evaluate the effectiveness of their knowledge management enabling initiatives. With growing competition, companies must remain competitive through the deployment and use of various knowledge management enabling technologies. Equally important is the need to be aware of the factors that are related to the effectiveness of knowledge management enabling initiatives. As such, there is the need to know what those factors are, and the main purpose of this study is to identify the barriers and enablers of effective knowledge management enabling initiative in a construction organization. The research approach was a case study research design, and it captured in-depth experiences of a specific construction organization before and after the implementation of their knowledge management enabling initiative, and the major drivers of improvement. In general, the research found three key barriers and enablers to the knowledge management enabling initiative at the case study organization: awareness centered on the need and value of knowledge or lack of it, a knowledge sharing environment or lack of it, and web-enabled and integrated knowledge management systems or lack of it. It is hoped that from this study other construction organizations and other companies within other sectors would learn from the experience of the case study organization on barriers and enablers of effective knowledge management, as well as how to evaluate the effectiveness of their knowledge management initiatives.

Keywords: Knowledge Management, Information and Communication Technology, Construction Industry, Competitiveness

1. Introduction

Projects involve people, and people rely on knowledge to make decisions and take actions. Santos-Rodrigues, Pereira-Rodrigues, and Cranfield (2013) posit that in order to be successful and remain competitive, organizations must consider knowledge assets as an important resource. Jeon (2009) states that it is now a widely accepted fact that knowledge management is a component of an organization's competitiveness. A construction organization is typically involved in activities which require the use and management of knowledge resources. According to Robinson et al. (2005), knowledge management aims to reduce rework, provide a platform to share tacit knowledge, and help in the process of knowledge transfer.

Organizations are continuously evaluating the effectiveness of their knowledge management enabling initiatives so as to improve on them. Such evaluation would identify barriers and enablers of effective knowledge management.

At industry level, much has been written regarding factors that enable and hinder knowledge management. Minonne and Turner (2009) conclude that the effectiveness and efficiency of knowledge management initiatives can be evaluated based on four indicators: cultural integration, organizational integration, procedural integration, and methodical integration. Other research by Omotayo (2015) broadly highlights the factors that enable and hinder knowledge management, and the research identified the three main factors as people, processes, and technology. At a construction industry level, research by Yang, Chen, and Wang (2012) found that information technology enables knowledge management, which has an impact on project performance. As such the effectiveness of a knowledge management enabling initiative can be evaluated by looking at several project performance indicators.

Within the construction sector, little research has been conducted on factors that are related to effective knowledge management enabling initiatives. For instance, Dave and Koskela (2009) conducted a case study of a construction organization, and their work provides an in-depth view of how knowledge management enabling initiatives facilitated collaboration and knowledge sharing in the case study organization. Thomas and Keithley (2002) conducted similar research on the effectiveness of knowledge management initiatives, focusing on the impact of knowledge management on company performance at a specific construction

organization. They detailed specifically the experience of the organization before and after a knowledge management enabling initiative. Similar to these two studies, both of which focused on a specific construction organization's experience, this research is significant in the sense that it provides an in-depth view and contributes to previous work on factors related to effective knowledge management enabling initiative by way of looking at before and after experience of the case study organization.

The main objective of this research is to identify barriers and enablers of effective knowledge management enabling initiative in a construction organization.

Identifying the barriers and enablers of effective knowledge management requires an understanding of key drivers, which could be identified by looking at the needs, issues, and techniques of effective knowledge management practices in a construction organization.

This research sought to identify what factors relate to effective knowledge management enabling initiatives in a construction organization. The answer to this question provides specific insight into the factors that enable and hinder effective knowledge management enabling initiatives at the case study organization, and as such, provides the basis for the organization to continuously evaluate the effectiveness of their knowledge management enabling initiatives. In the review of literature, the paper looks at those factors related to effective knowledge management enabling initiative from a more general perspective of all industries and sectors. This is then followed by a look at those factors from a more specific perspective of the construction sector.

A single-case study research method was chosen to help answer the research question. The case study method was chosen because it permits an in-depth understanding on barriers and enablers of effective knowledge management enabling initiatives. This method involved a collection of the company's knowledge management related experiences before and after the implementation of a major knowledge management enabling initiative. The case study company was chosen because the company recently went through an enterprise resource planning/enterprise content management (ERP/ECM) implementation. It is important to note that ERP/ECM is not the same as knowledge management, but its implementation enables effective knowledge management practices because it supports knowledge resource capture, storage, retrieval, sharing, and transfer.

2. Literature Review

This section explores the literature on knowledge management barriers and enablers. In general, the literature looks at the challenges related to effective knowledge management and the techniques used for effective implementation of knowledge management within the context of an organization. To be specific, the literature touches on the values of knowledge management, the need for knowledge management, and the techniques for effective knowledge management within the construction industry.

2.1 The Unique Nature of the Construction Industry

Construction business is project-centered, where companies exist for the sole purpose of doing projects and each is unique and dynamic. Each project goes through a lifecycle and brings together different groups and stakeholders working together in order to bring the project to fruition. From the viewpoint of the wide range of different groups that participate in the construction process, the construction industry is viewed as a conglomerate of industries (Fernández-Solís, 2009). In addition, construction projects are temporal, only lasting for a given period of time. The lack of continuity and the complex array of players involved in construction may contribute to the fragmented nature of the industry. The industry is said to be data rich but information poor, due to its inability to easily tap into the wealth of knowledge that it generates from projects. Ineffective knowledge management may relate to situations where practitioners lack access to basic and relevant knowledge resources needed to solve everyday project related problems. Such situations affect performance, hinder growth, and put a company at risk of failure. However, the industry has been under pressure to embrace and implement appropriate information and communication technology (ICT) systems which could help improve production, quality of product, and speed of delivery. Knowledge management initiatives are about effective organizational knowledge management through systematic practices used for creating, capturing, storing, and making knowledge resources available (Kumar and Gupta, 2012). In comparison to other sectors, the debate over the years has been that the construction industry is slow in

adopting innovative technologies and all they have to offer (Dave and Koskela, 2009). This may result from the skeptical view on the benefits of using new technologies and inadequate data on the return on investment within the construction industry. Construction is a risky business, and the industry is full of stories of project failures and companies that are struggling to remain in business or have gone out of business. In the construction sector, the profit margins are very small, and there is no room for error or experimentation, meaning that construction companies will only invest in something they know will provide a good return on investment. Construction projects are unique and dynamic, and they have been viewed as wasteful, highly inefficient in the areas of both basic resources used in the construction process and knowledge resources (Kazi, 2005). Considering that construction projects are temporal and lack continuity, capturing lessons learned becomes critical to knowledge management. Ghasabeh and Chileshe (2014) found that fewer construction companies have systematic methods to effectively capture lessons learned from the projects that they undertake. There is also the rising cost of completing a project, the need to be more competitive, and to find ways to be efficient and reduce cost of production. As such, there is a need for effective knowledge management enabling system to help construction companies to effectively capture and reuse project related knowledge during and after the completion of projects.

Ineffective knowledge management in construction organizations is an especially important problem because it affects the performance of those companies and puts them at risk of failing. The construction industry will be better served with an understanding of the enablers of and barriers to effective knowledge management enabling systems.

2.2   Knowledge Management Definition

Looking back at the work of Davenport and Prusak (1998), knowledge from the point of view of the knower is defined as coming from one's experiences, values, contextual information, and expert insight which then provides the basis for evaluating and incorporating new experiences and information. Knowledge management can be seen as the way that people create, transfer, and adopt knowledge resources at different levels of interrelationships or networks. The work by Phelps, Heidi, and Wadhwa (2012) identified those network levels to be interpersonal, intra-organizational and intra-organizational. Within a construction organization, knowledge management is a set of tools and practices developed and implemented to gather, store, share, protect, and make project-related experience and training available for use. Knowledge management has many meanings within a variety of areas. Girard and Girard (2015) found that knowledge management has been defined differently by various authors in different disciplines. This also highlights the fact that within each context, people perceive and use the term differently, and it is appropriate to define knowledge management within the context of a construction organization. One of those definitions was captured by Levinson (2007). Levinson defines knowledge management as the process through which organizations generate value from their intellectual and knowledge-based asset. Regarding knowledge as an asset, Frost (2010) defines knowledge management as a systematic management of an organization's knowledge assets for the purpose of creating value to meet organizational objectives at the operational, tactical and strategic levels.

2.3   General Perspectives on the Challenges Related to Effective Knowledge Management

Knowledge management is driven by the need to share and transfer knowledge, but the process of knowledge management also faces several barriers.

Major issues in knowledge management identified by Kim and Park (2003) include administration, integration, indexing (tagging), and non-computerized knowledge. Sharing knowledge resources requires collaboration, which would require integrated systems and tools so that knowledge can be created, accessed, and shared with those who need them. Lack of web-based access could limit a project participant's access to information from anywhere internet access is available. A web-based content management system should allow users to capture, store, modify, share, reuse, archive, and work with information from anywhere, anytime.

Management support has been known as a crucial factor in successful transformation of organizational initiatives, and knowledge management is no different. Most projects will fail if they have poor management oversight and support. The study by Chi, Lan, and Dorjgotov (2012) showed that effectiveness of knowledge management as it relates to improving organizational performance indirectly depends on transformational leadership efforts. Another study by Shokri-Ghasabeh and Chileshe (2014) also found the effect of management support on the ability to capture lessons learned—a core aspect of knowledge management. The

research by Shokri-Ghasabeh and Chileshe (2014) also found that lack of the right technologies, such as an easy to search data repository, was a barrier to effective capture of lessons learned.

National and multinational organizations with offices located in various areas do have the need to communicate and share knowledge resources. Having dispersed offices could become a barrier if not properly bridged. The relevance of knowledge management system in organizations with dispersed locations was detailed by Kumar and Gupta (2012). Another way to look at the barriers of knowledge management is to look at some of the symptoms or evidence of ineffective knowledge management. Thomas and Keithley (2002) discussed some of the symptoms of an organization in need of knowledge management, and a few of those issues which the authors discussed include:

- Discipline groups working in silos, unable to share knowledge or lessons learned
- Globally dispersed groups reinventing the wheel
- Inability to leverage the power of collaborations
- Captured knowledge existing in disjointed, non-integrated systems
- Implicit knowledge held by experienced lead engineers, which leaves with them when they leave the company

As a result, with no single version of the truth, the latest and greatest version of captured knowledge is not known throughout the organization, making it difficult to leverage relevant knowledge

Knowledge management systems are technologies put in place to manage knowledge resources, and this is the core of ICT. Kumar and Gupta (2012) defined knowledge management system as a set of IT systems designed to manage organizational knowledge resources, through creating, organizing, storing, retrieving, transferring, accessing, sharing, collaborating, and performing similar activities aimed to enhance how organizations interact with their knowledge resources. With so many IT systems, it might become difficult to differentiate one system from another in terms of their fit and use as a knowledge management system or enabling system. As such, it would be helpful to have a set of guidelines to evaluate a good knowledge management system. Woodman and Zade, (2011) came up with five principles for such evaluation: complexity principle, non-reductionist principle, just-in-time principle, sociotechnical principle, and multi-view principle. From the performance objectives point of view, and according to Adjei (2015), the four primary objectives of knowledge management systems should be:

- To create repositories
- To improve knowledge access and transfer
- To enhance knowledge environment
- To manage knowledge as an asset

The need for knowledge management is driven by knowledge sharing and transfer, and the road to effective knowledge management is met with barriers resulting from lack of integrated and standardized system to capture, share and transfer knowledge resources. An understanding of the techniques that could enable effective knowledge management practice is needed in order to overcome the barriers and meet the need for effective knowledge management

2.4 General Perspectives on the Techniques for Effective Knowledge Management Practices

According to Kim and Park (2003), information technology is at the core of knowledge management. Information technology is the tool used to capture knowledge and make it available for reuse. Knowledge management involves three techniques: making knowledge available for use, sharing and making use of knowledge, and protecting available knowledge (Kim and Park, 2003).

Wang and Wang (2009) developed a tool to measure knowledge management as it relates to how well information technology enabled knowledge management. The authors found that information technology supports knowledge management when there is an alignment of business strategies, organizational strategies, information technology strategies, and knowledge management strategies. As such, just having knowledge management tools and systems does not automatically represent effective knowledge management, but instead, the tools and practices should be developed to achieve knowledge management objectives. In

addition, the work of Bosua and Venkitachalam (2013) expands on the need for knowledge management strategies to be aligned with the knowledge management processes. Alvarenga (2007) states that some of the key enablers of knowledge management include intellectual capital, organizational learning, management of innovation, information technology tools applied to knowledge management, intangible asset measures, competitive intelligence and environment scanning, strategic information management, organization development and competency management, and a community of practice. Tupenaite et al. (2008) evaluated knowledge management models and proposed a model which includes four major stages: project information and knowledge gathering, acquisition of knowledge, maintaining a best practices knowledge database, and making knowledge available through a knowledge-based decision and support system.

ICT is an umbrella of technologies for creating, storing, retrieving, manipulating, transmitting, sharing, and receiving information in a collaborative environment within a specific setting or context. Kim and Park (2003) outlined that typical knowledge management tools would involve tools to capture, transform, store, query, update, report, discover, share and learn, protect, and transmit knowledge. However, the work of Wang and Wang, (2009) showed that knowledge management does not just depend on available information technology but on the alignment of business strategy and knowledge management strategy. Knowledge is an asset which sustains an organization. This understanding is evident in the work of Shelbourn et al. (2006). A primary focus of Shelbourn et al. (2006) was the development of a framework that facilitates the process of knowledge creation and re-use at the project and organizational levels. The research developed an integrated platform of tools to facilitate project members' ability to capture and re-use project knowledge.

In addition, the study by Kamhawi (2012) found that effective knowledge management adds to organizational performance and that effective knowledge management is enabled by factors such as management support, IT, organizational design, and organizational culture. Rai (2011) explains that organizational culture is a critical driver in knowledge management, and his work produced a theoretical framework on the effect of organizational culture on organizational knowledge management.

Internet technology is seen as an enabler of knowledge management because it offers the opportunity of a network environment for better knowledge exchange (Jeon, 2009). Ajam et al. (2008) explored and presented how ICT enables organizations to develop integration and collaboration systems, which make it possible for organizations to save cost, save time and create value. The work by Ajam et al. (2008) shows how a web-based system could be developed to support collaboration within and outside an organization at various stages of a project lifecycle.

2.5   The Values of Knowledge Management in the Construction Sector

Construction organizations create knowledge resources every day as a result of the process of doing business. Ironically, some construction organizations still suffer from lack of access to the knowledge resources they create (Lee and Fink, 2013). Part of the problem is that construction companies have been known to lag behind other industries in adopting new and emerging technologies. Dave and Koskela (2009) acknowledged the ongoing debate that the construction industry has been very slow in adopting information and communication technology and all the things that it has to offer, such as the use for implementing knowledge management. In the construction sector, it is understood that people are an organization's biggest asset (Kamara et al. (2002). The acceptance that people are an organization's biggest asset is related to the fact that without knowledge resources, people's ability to perform diminishes and so does their worth. Knowledge management is an essential resource for continuous business improvement and for maintaining a competitive advantage (Robinson et al., 2005). This statement is in line with that presented by Dave and Koskela (2009), that knowledge management enables knowledge transfer, enables capture and reuse of knowledge, and enables better communication amongst stakeholders. To further support the understanding that knowledge has value, Liyanage et al. (2008) argue that knowledge and competency are the most critical resources in an organization, and Egbu and Robinson (2005) make a strong case for knowledge management. They also state that knowledge management is the most valuable asset required for an organization to create wealth, be successful, and be competitive. At Fluor Corporation (a typical construction company), knowledge management enables the organization to attract, train, develop and retain their employees, and it has also enabled the new employees to quickly acquire technical and business competencies much earlier in their career (Thomas and Keithley, 2002).

According to Thomas and Keithley (2002), implementation of knowledge management strategies at Fluor Corporation provides value and enables the organization to:

- Increase collaboration and improve access to lesson learned
- Improve ability to design-to-market
- Enable access and reuse of design principles and best practices
- Increase technology and innovation competency
- Have a "one stop shop" for all things related to project control and estimating, accessible to all employees, anytime, anywhere.

Alvarenga (2007) looked at knowledge management practices within the context of three large Brazilian organizations. The research found that some of the values of implementing knowledge management include: innovation cycle time reduction and faster time-to-market solutions, facilitation of expertise and people locations, creation of an organizational repository and memory, increase in learning capacity, and ability to anticipate competitors' actions and movement.

2.6   The Need for Knowledge Management in the Construction Sector

According to Hislop (2013), organizations need to effectively manage their knowledge in order to be successful, maintain a competitive advantage, and sustain their existence. People are an organization's most valuable asset, and the need for knowledge management is driven by several factors. Robinson et al. (2005) explored how large UK construction companies manage their knowledge assets. The authors found that construction companies with international operations and dispersed locations were more advanced in their adoption and implementation of knowledge management when compared to those that operate only in the UK. This could be explained by the need to connect, share knowledge, and collaborate with team members working from different locations. Knowledge is power, as they say, and in a competitive market like the construction industry, being extremely knowledgeable could be the key to winning and successfully managing new projects. Betit (2014) states that knowledge management systems are being developed in companies due to the need to bridge the knowledge gap between different knowledge consumers found within an organization, which include the young and less experienced, the middle-aged and experienced, and the retirement-aged and very experienced. Effective knowledge management enabling initiatives should be informed by an understanding of the barriers and enablers. As such, knowledge transfer and management should be developed around some understanding of the environment under which knowledge will be used (Liyanage et al., 2008). There is also the need to enhance innovation and to learn through knowledge management. Maqsood (2006) looked at how knowledge management plays a role in enhancing innovation and learning in the construction organization. Maqsood (2006) found that knowledge management helps organizations locate and bring in new knowledge that is outside of their organization, helps organizations to become innovative, and also enables organizations to learn and continuously improve their practice.

2.7   Techniques for Effective Knowledge Management within the Construction Sector

Mohd and Eqbu (2010) state that the construction industry has been slow to adopt knowledge management techniques, and the authors detailed the benefits and strategies for effective implementation of knowledge management. Some of the recommendations offered by the authors include a method to manage implementation change, a culture for sharing knowledge, support from top management, incentives that encourage knowledge sharing, appropriate technology platforms, training, and enabling practices. Organizations have the need to share and transfer knowledge, and it is critical that techniques for effective knowledge management practices are explored.

The construction industry has frequently been described as fragmented and information intensive, and the use of technologies and practices which enable knowledge management are encouraged. Elmahdee et al. (2014) looked at knowledge management practice of construction companies in Malaysia and found that while most companies did well at acquiring knowledge assets, very few of them disseminated or applied the knowledge asset they acquired in the process of doing business. As such, the authors recommend that Malaysian construction companies pay more attention to knowledge management as a means for sustaining their business.

Dave and Koskela (2009) argue that the fragmented nature of the construction industry creates issues to knowledge management, and the authors suggest that collaborative knowledge management might be the

most effective means to capture project based knowledge. Some of the collaborative knowledge management success factors suggested by the authors include top management support, a knowledge management system that is easy to use and implement, efficient information retrieval system, treating the knowledge management system as a core and indispensable tool, and creating the right environment for knowledge sharing.

Lin and Tserng (2003) explored the relationship between knowledge management and lean construction. They found that knowledge management is the key to lean construction, and the use of web-based technology was found to enhance knowledge management. Considering that lean construction is about reducing waste, reducing mistakes, improving performance, and increasing output, the authors made the case for how having the right knowledge at the right time would work in favor of lean construction.

Tarek (2014) highlighted that much previous research has been completed on tools and techniques for effective knowledge management in the construction industry. However, the author found that the three main factors which affect adoption of knowledge management are access to large databases, interoperability of tools used, and organizational culture.

Ahmad (2010) developed a knowledge management model which was found to facilitate the implementation and application of knowledge management in construction projects. The knowledge management model developed by the Ahmad (2010) involves the integration of collaboration tools, knowledge capturing tools, knowledge retrieval tools, knowledge repository tools, and general purpose tools.

Practices that enable effective knowledge management are driven by awareness of the barriers and enablers of effective knowledge management enabling initiative.

In general, this literature review looked at effective knowledge management enabling initiatives from a general perspective as related to all industries and sectors and then looked at those factors from a more specific level as related to the construction sector. To answer the research question and close the gap in knowledge on factors related to effective knowledge management enabling initiative, a single-case study research method was chosen.

In the following sections, the paper discusses the research design and method, the background of the case study organization, and the specific experiences of the case study organization before and after the implementation of a knowledge management enabling initiative.

3. Research Design and Method - The Single-Case Study Approach.

There is the business need for organizations to continuously evaluate the effectiveness of their knowledge management enabling initiatives. With that in mind, the research problem is the lack of in-depth understanding on barriers and enablers of effective knowledge management enabling initiative in a construction organization. The approach for this study was a single-case study research method, which is specific to understanding the experience and practice in a specific organization before and after the implementation of a knowledge management enabling initiative. It is important to note that for confidentially reasons, the name of the case study organization has been withheld.

Case study research is widely used to examine and capture specific experiences, with the main purpose of learning from those experiences. Some level of generalization could be made from a case study, depending on the case, the design, and the rigor. According to Yin (2003) this form of generalization is referred to as analytic generalization as contrasted with statistical generalization. However, even without the need for generalization, researchers could gain practical insight from case study research (Flyvbjerg, 2006). As such, case study research serves to explore events and reality of human behavior under certain circumstances. Despite the fact that case study research is viewed by some scholars as a weak research method, case study research has continued to contribute to new knowledge (Yin, 2003). Case studies may involve a single case or multiple case, and Yin (2003) provides rationales for single case study design, which may include critical cases, unique cases, typical cases, revelatory cases, and longitudinal cases.

In order to understand the barriers and enablers of effective knowledge management enabling initiative in a construction organization, the research focused on the experiences before and after a major IT initiative at the case study organization. Conducting a multi-case study and finding case study organizations is a challenge, and typically, it is difficult to find a construction company willing to grant a researcher access to their company data while the company is implementing a major IT initiative—which in fact does not happen quite often. The reason for selecting this specific case study organization was because they recently implemented an ERP/ECM

system, and relevant data was available for the research. The case study organization was a very good fit for this research and had the necessary data needed to understand the barriers and enablers of effective knowledge management enabling initiative.

An initial interview was conducted with one of the managers from the case study organization. The manager had good knowledge of the organization's ERP/ECM development and deployment. The interview lasted for an hour and was designed to gather and validate the experiences of the case study organization in areas that highlighted how the company created, accessed, stored, and transferred their knowledge resources before the new implementation. This information is captured under the section "Specific Knowledge Management Challenges at the Case Study Organization Prior to the Knowledge Management Enabling Initiative." Additional follow-up data were collected using a structured survey. Questionnaires were sent to several managers at the case study organization with the aim to understand if the ERP/ECM initiative was effective at enabling knowledge management and what the barriers and enablers were. The questionnaire was administered using Qualtrics, and the anonymous link feature in Qualtrics was used to avoid tracking any identifying information about the respondents. The questionnaire was sent to ten managers, and the response rate was 60%. The managers who were chosen to complete the questionnaire were those that have lived through the experiences of before and after the implementation of the ERP/ECM initiative. The study captured data on what the managers feel about the ERP/ECM initiative, as it relates to the effectiveness of the system at enabling knowledge management activities. Those observations are captured under the section "Specific Knowledge Management Experience at the Case Study Organization after the Implementation of Knowledge Management Enabling Initiative." The questionnaire was designed to find out if those knowledge management challenges experienced by the company before the implementation of the ERP/ECM initiative were resolved after the implementation and what factors were related to the effective implementation.

3.1   Background of the Case Study Construction Organization:

The case study company is a construction organization. The company has been in operation for over 125 years and has continuously adapted their knowledge management strategies to the changing times. The company has all the characteristics of a "living company" as described by De Geus, (1997). The company is one of North America's largest and most respected construction and engineering companies. The company operates with a decentralized system of districts which are located in the US, Canada, and other parts of the world. Each district covers one or more market areas which include: building; mining; oil, gas and chemical; power, transportation; and wastewater. The company has over 30,000 employees. The majority of their employees were employed right out of college, and most of them remain with the company until they retire. The company understands that people are their biggest asset, and they continuously provide necessary training and education to their employees. The company has continuously developed and maintained an environment, culture, and practices which foster and enhance knowledge transfer. The districts operate under different companies, and they would typically enter into internal joint ventures with other districts or external joint ventures with companies outside their organization. The employees are spread out in several countries and states, and there is always the need to centralize and share knowledge.

3.2   Specific Knowledge Management Challenges at the Case Study Organization Prior to the Knowledge Management Enabling Initiative:

Over the years, the case study organization has adapted to changing times, markets, and technologies, and they have faced various challenges along the way. Prior to their strategic IT implementation, the company faced several challenges in practices related to effective knowledge management, and this section aims to highlight a few of those challenges or barriers.

Knowledge management issues are typically evident with the ad-hoc nature of the construction projects, such as the inability to capture and reuse project generated knowledge, which may result in mistakes and situations where construction parties are "reinventing the wheel" (Dave and Koskela, 2009). For the case study organization, reinventing the wheel was in part due to several underlying problems, and some of those problems are identified below.

One area which was a challenge for the company was in standardizing file directories, file plans, document templates, as well standardizing tagging and indexing method. Lack of standardization made it difficult to effectively find or share knowledge within the organization or between collaborating organizations. This

challenge results in no "single version of the truth," which according to Thomas and Keithley (2002) is one of the symptoms of an organization in need of knowledge management.

Another area which was a challenge for the company was the lack of centralized and integrated computer network system or the use of client servers for business application software instead of enterprise web-based applications. There were stand-alone or network servers which were not web-enabled; and in other cases, there were several platforms and applications which were not integrated. These situations limited how their projects gathered, accessed, controlled, and collaborated with project generated contents such as contract documents, submittals, request for information (RFI), project correspondence, photos, videos, audio, web content, text messages, emails, raw data, etc. This challenge resulted from disjointed systems, and Thomas and Keithley (2002) found similar challenges at Fluor Corporation.

Other challenges included cases where project network servers were taken out of service as soon as the projects were completed. Because of this situation, project team members had to save copies of relevant files to their personal flash drives as personal backups before they leave the projects. Also, without access to previous projects, one of the few ways to gain access to knowledge resources from those project would be to "pick the brain" of someone that was on those projects, assuming they were still with the company. This situation depicts one symptom highlighted by Thomas and Keithley (2002) which is related to "reinventing the wheel."

Thomas and Keithley (2002) stated that inability to leverage the power of collaboration is a sign that an organization is in need of knowledge management. On joint ventures, the lead company is typically responsible for setting up and managing the ICT systems, and at the project closeout, the lead company usually takes those ICT systems away. The challenge that existed at the case study organization was that adequate provisions were not made on how to transfer knowledge resources when the joint ventures and projects come to an end. This is most critical when the joint ventures are with outside organizations. Liyanage et al. (2008) posit that the significance of knowledge transfer in a joint venture environment is not widely discussed as to the need for effective knowledge transfer. The model suggested by the authors include six major knowledge transfer steps: knowledge awareness, knowledge acquisition, knowledge transformation, knowledge association, knowledge application, and knowledge externalization/feedback.

Inability to do data analytics and gain insight was a challenge at the company due to the poor quality of data captured. One example was a situation where a project sought to gain insight into why the majority of their submittals went through several iterations or cases where several requests for information (RFI) were returned as inappropriate use of RFI. Such problems would require some basic data analytics to understand why, but in this case, the poor quality of the data captured made it difficult to do so. Valuable insight can change behavior and decisions, which could help a project and an organization achieve its objectives (Warren et al., 2013). Construction projects and construction organizations are never short of data. However, depending on how the data was captured and stored, much of the data may lack rich context and insight. Khalifa and Jamaluddin (2012) work aimed to identify the key success factors which affects knowledge management in the construction industry in Libya, and some of the factors which the authors found include organizational culture, IT infrastructure, top management support, ease of use of IT, and knowledge structure.

3.3 Specific Knowledge Management Experience at the Case Study Organization after the Implementation of Knowledge Management Enabling Initiative

In 2012, the company started deploying a major IT project (ERP/ECM) aimed at standardizing and integrating their technologies using web-based enterprise platforms which offered access to their systems anytime and anywhere . The IT project had the blessing, support, and oversight of top management. The new system provided for enterprise search across project sites, enterprise content management, business process management, business intelligence, records management, archiving, extranet collaboration sites, content sharing, and other functions. In addition, the new system offered advantages and opportunities which include centralized notifications, timely communications, and ability to collaborate with various dispersed parties. Also, the new system hosted a centralized area for the company to capture and share best practices and lesson learned.

As a follow-up, a directed survey was used to gain additional insight on the effectiveness of the knowledge management enabling ERP/ECM system that was deployed by the case study construction organization. The questionnaire was sent to ten managers, and the response rate was 60%. As compared to the specific knowledge management challenges at the case study organization prior to the knowledge management enabling initiative, the questionnaire captured data indicating that the new ERP/ECM system enabled effective knowledge management and provided:

1. A "one stop shop" for finding relevant information, lessons learned, and best practices.
2. Efficient business process execution and collaboration with dispersed parties.
3. Standardized indexing and tagging of contents across the organization, thereby making it easy to find and retrieve contents.
4. Standardized indexing and tagging of contents across the organization, thereby making quality data available for project and organizational related analytics and insights.
5. Versioning of content, thereby making it possible to have "one version of the truth."
6. An integrated system, thereby reducing the chances of "reinventing the wheel."
7. Access to information anytime and anywhere.
8. Transfer and leveraging of knowledge when the organization enters into a joint venture with an outside organization.
9. Project related contents to be available and accessible for many years, long after the projects are completed.
10. Evaluation of the impact of knowledge management system and the need to improve adoption and usage through training and feature enhancements.

A review of the case study organization's experience before and after the ERP/ECM system points to some key drivers that are relate to the effectiveness of knowledge management enabling initiative, and the next section presents those findings and discussion.

4. Findings and Discussion

These findings and discussion reflect the challenges and practices before and after the implementation of the knowledge management enabling initiative and the key drivers of the improvements found. The improvements were found by looking at the experience of the case study organization before and after the implementation of the knowledge management enabling initiatives.

The study identified specific challenges and experiences before the implementation of the knowledge management enabling initiative, as well as the specific experiences after the implementation, at which point the related drivers could be identified. In addition, the general and specific focus of the literature and the case study provided a broader and interesting reflection on factors related to effective knowledge management enabling initiatives.

This study revealed that the case study organization became more effective after the implementation of the knowledge management enabling initiative. The implementation would not have happened without the strong support of top management. The research revealed that management support is a crucial factor in successful implementation of knowledge management enabling initiatives. This finding is in line with what was found by Khalifa and Jamaluddin (2012).

An in-depth evaluation of the before and after experiences and practices of the case study organization revealed that knowledge management could be enabled or hindered by the tools and technologies that organizations use, and the environment under which they are used. Another key finding from this research is that it is important to align IT initiative with knowledge management strategies. According to Wang and Wang (2009), knowledge management does not just depend on available information technology, but on the alignment of business strategy and knowledge management strategy.

There is an inherent business need for organizations to continuously evaluate the effectiveness of their systems. This study revealed the need to continuously measure the impact and adoption of the knowledge management enabling initiatives.

The findings from this study indicate that the experiences of the case study company before and after the implementation of the knowledge management enabling initiative were in line with similar case study research by Thomas and Keithley (2002) and Dave and Koskela (2009), both of which focused on the construction sector and found that the use of an integrated system enhances knowledge sharing and collaboration. Also, in general, the findings from this study support the research by Shokri-Ghasabeh and Chileshe (2014), which found that the right technologies enable effective knowledge management enabling initiative.

The findings gained in this research revealed that, specifically, effectiveness of knowledge management enabling initiative could be identified by the presence or absence of the need for knowledge management, an enabling environment, and appropriate technology. As such effective knowledge management enabling initiatives happen when users understand the need and value of knowledge management, when appropriate technology such as web-enabled and integrated ICT systems are in use, and when management creates the right environment and policies to continuously enable knowledge management.

5.   Conclusion and Recommendation

Performance evaluation is an inherent part of doing business, and organizations have a need to continuously evaluate the effectiveness of their efforts. Knowledge management is seen as a core and indispensable part of doing business. The literature shows that construction organizations are aware of the fact that knowledge is a resource; it has value, and it provides the much needed competitive edge. However, effectively capturing and using knowledge require a conscious effort informed by an understanding of the barriers and enablers of effective knowledge management. In line with the research question, the purpose of this study was to identify the barriers and enablers of effective knowledge management enabling initiative in a construction organization. The study explored the challenges related to effective knowledge management and the techniques used for effective implementation of knowledge management within the context of all industries and sectors. In addition, the study highlighted the values of knowledge management, the need for knowledge management, and the techniques used for effective knowledge management within the construction sector. The research approach was a case study research design, and it captured in-depth experiences of the construction organization before and after the implementation of the knowledge management enabling initiative, and the major drivers of improvement. Findings from existing literature aligned with what emerged from the experiences of the case study organization as they relate to barriers and enablers of effective knowledge management.

In addition, this study is significant because the case study approach identified the specific drivers from a more focused viewpoint, which extends to the more general viewpoints. In other words, using a single construction company as the focus, the three main findings regarding the need for knowledge management, the environment, and enabling technology, are drivers that are not only specific to the construction sector, but they apply to other sectors. In general, the research identified three key barriers and enablers of effective knowledge management as captured in the case study: first, the lack of or presence of awareness centered on the need and value of knowledge as the most valuable resource; second, the lack of or presence of an environment, culture, and practices that foster and enhance knowledge transfer; and, third, the lack of or presence of efficient ICT systems and methods that integrate, and standardize the way organizations capture, store, access, share, organize, reuse, control, discover, secure, and improve knowledge.

This research has shown that the experience of the case study organization is similar to what was captured in previous case study research which focused on before and after implementation of an IT initiatives within a construction organization. This study recommends that construction organizations and organizations from other sectors use this research as a guide towards implementing an effective knowledge management enabling initiative.

References

Adjei, K. O. K., 2015. Assessing implementation of knowledge management systems in banks, a case of Ghana. Journal of Information and Knowledge Management, 5(1), pp. 133-139

Ahmad, H. S., 2010. Development of KM model for knowledge management implementation and application in construction projects. (Ph.D. Thesis). University of Birmingham, Edgbaston, Birmingham, United Kingdom.

Alvarenga, N. R. C. D., 2007. Knowledge management in the Brazilian organizational context: A shift towards the concept of "Ba". The Electronic Journal of Knowledge Management, 5(2), 143-152

Ajam, M., Alshawi, M., and Mezher. T., 2008. Improving the tender stage through integrating collaborative extranet with project integration databases. AACE International Transactions, IT.04. 1-25

Betit, J., 2014. Heavy construction transformation – knowledge management. Retrieved from http://www.sparpointgroup.com/joseph-betit/vol12no31-knowledge-management

Bosua, R., and Venkitachalam, K,. 2013. Aligning strategies and processes in knowledge management: A framework. Journal of Knowledge Management, 17(3), 331-346

Chi, H. K., Lan, C. H., and Dorjgotov, B., 2012. The moderating effect of transformational leadership on knowledge management and organizational effectiveness. Journal of Social Behavior and Personality, 40(6), 1015-1024

Dave, B., and Koskela, L., 2009. Collaborative Knowledge Management - A Construction Case Study. Journal of Automation in Construction, 18(7), pp. 894-902.

Davenport, T. H., and Prusak L. (1998). Working knowledge: How organizations manage what they know. Boston, MA: Harvard Business School Press.

De Geus, A., 1997. The living company. Boston, Mass: Harvard Business School Press.

Elmahdee, M. A. B. A. H., Noraini, A. T., and Khawla, M. A., 2014. Knowledge management practice in Malaysian construction companies. Middle-East Journal of Science Research, 21(11), 1952-1957

Egbu, C. O., and Robinson, H. S,. 2005. Construction as a knowledge-Based industry. In Anumba, C. J., Egbu, C. O., and Carrillo, P. M. (eds.) Knowledge Management in Construction. Malden, MA: Blackwell Publishing.

Fernández-Solís, J., 2009. How the construction industry does differ from manufacturing. 2009 Associated School of Construction (ASC) Conference Proceedings at University of Florida.

Flyvebjerg. B., 2006. Five misunderstandings about case-study research. Qualitative Inquiry, 12(2) 219-245

Frost, A., 2010. Knowledge Management Definition. Retrieved from http://www.knowledge-management-tools.net/knowledge-management-definition.html

Girard, J., and Girard, J., 2015. Defining knowledge management: Toward and applied compendium. Online Journal of Applied Knowledge Management, 3(1), 1-20

Hislop, D., 2013. Knowledge management in organizations: A critical introduction. 3rd Ed. Oxford: Oxford University Press.

Jeon, J., 2009. Success factors for a lessons-learned system in a construction organization. Cost Engineering Journal, 51(5), 13-20

Kamara, J. M., Augenbroe, G., Anumba, C. J. and Carrillo, P. M., 2002. Knowledge management in the architecture, engineering and construction industry. Journal of Construction Innovation, 2(1), 53-67

Kamhawi, E. M., 2012. Knowledge management fishbone: A standard framework of organizational enablers, Journal of Knowledge Management, 16(5), 808-828

Kazi, A., 2005. Knowledge management in the construction industry: a socio-technical perspective. Hershey, PA: Idea Group Pub

Khalifa, Z. M., and Jamaluddin, M. Y., 2012. Key success factors affecting knowledge management implementation in construction industry in Libya. Australian Journal of Basic and Applied Science, 6(5), 161-164

Kim, W., and Park, S. S., 2003. Knowledge management: A careful look. Journal of Object Technology, 2(1), 29-38

Kumar, S., and Gupta. S., 2012. Role of knowledge management systems (KMS) in multinational organization: An overview. International Journal of Advanced Research in Computer Science and Software Engineering, 2(10), 8-16

Lee, J., and Fink, D., 2013. Knowledge mapping: Encouragements and impediments to adoption. Journal of Knowledge Management, 17(1), 16-28

Levinson, M., 2007. Knowledge management Definition and Solutions. Retrieved from http://www.cio.com/article/2439279/enterprise-software/knowledge-management-definition-and-solutions.html

Lin, Y., and Tserng, H. P., 2003. Knowledge management and its application to lean construction. Retrieved from www.iglc.net/Papers/Details/254/pdf

Liyanage, C., Li, Q., Elhag, T., and Ballal, T., 2008. The process of knowledge transfer and its significance in integrated environments. AACE International Transactions, TCM.06. 1-8.

Maqsood, T., (2006. The role of knowledge management in supporting innovation and learning in construction. (Ph.D. Thesis) RMIT University, Melbourne, Victoria, Australia.

Minonne, C., and Turner, G., 2009. Evaluating knowledge management performance. Electronic Journal of Knowledge Management, 7(5), 583 - 592

Mohd Zin, I. N., and Egbu, C. O., 2010. A review of knowledge management strategies — issues, contexts, and benefits for the construction industry. Proceeding of the CIB World Congress 2010, Salford Quays, UK

Omotayo, F. O., 2015. Knowledge management as an important tool in organizational management: A Review of Literature. Library Philosophy and Practice (e-journal).

Phelps, C., Heidi, R., and Wadhwa, A., 2012. Knowledge, networks, and knowledge networks: A review and research agenda. Journal of Management, 38(4), 1115-1166

Rai, K., 2011. Knowledge management and organizational culture: A theoretical integrative framework. Journal of Knowledge Management, 15(2), 779-801.

Robinson, H. S., Carrillo, P. M., Anumba, C. J., and Al-Ghassani, A. M., 2005. Knowledge management practices in large construction organizations. Journal of Engineering, Construction, and Architectural Management, 12(5), 431-445

Santos-Rodrigues, H., Pereira-Rodrigues, G., and Cranfield, D., 2013. Human capital and financial results: A case study. The Electronic Journal of Knowledge Management, 11(4), 387-392

Shelbourn, M. A., Bouchlaghem, D. M., Anumba, C. J., Carrillo, P. M., Khalfan, M. M. K., and Glass, J., 2006. Managing knowledge in the context of sustainable construction. The Journal of Information Technology in Construction (ITcon), 11, 57-71

Shokri-Ghasabeh, M., and Chileshe, N., 2014. Knowledge management: Barriers to capturing lessons learned from Australian construction constructors perspective. Journal of Construction Innovation, 14(1), pp. 108-134

Tarek, M., 2014. Knowledge management in the construction industry: Integration between research and practice. International Journal of Engineering and Innovative Technology, 4(4), 30-41

Thomas, D., and Keithley, T., 2002. Knowledge management improves performance. AACE International Transaction, PM.17. 1-4.

Tupenaite, L., Kanapeckiene, L., and Naimaviciene, J., 2008 Knowledge management model for construction projects. Proceedings of the 8th International Conference "Reliability and Statistics in Transportation and Communication. 15-18 October 2008. Riga Technical University Kalku str. 1, Riga, Latvia

Wang, S., and Wang, H., 2009. An induction model of information technology enabled knowledge management: A case study. Journal of Information Technology Management, 20(1), 1-14

Warren, P. N., Neto, T. M., Misner, S., Sanders, I., and Helmers, S. A., 2013. Business intelligence in Microsoft SharePoint 2013. Redmond, Wash: Microsoft Press

Woodman, M., and Zade, A., 2011. Five grounded Principles for Developing Knowledge Management Systems The Electronic Journal of Knowledge Management, 10(2), 183-194

Yang, L. R., Chen, J. H., and Wang, H. W., 2012. Assessing the impacts of information technology on project success through knowledge management practice. Journal of Automation in Construction, 22, 182-191

Yin, R., 2003. Case study research: design and methods. Thousand Oaks, Calif: Sage Publications.