Knowledge Management Practice on Construction Project Performance in Nigeria

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Abstract:

The study which was exploratory in nature evaluated the benefits of KM practice on construction project performance. A field survey was conducted with the use of structured questionnaires, self-administered to a sample of stakeholders in the built environment. Descriptive statistics was employed for the analysis. Results of the study have identified eight (8) value-adding KM factors as essential for obtaining KM benefits. Likewise, the results further indicated 19 benefits of KM practice for improving construction project performance and include: improve project quality, cost and time; practice and process improvement; encourage effective teamwork and innovation; improve the client satisfaction; boost productivity of employees and processes; enhanced organisational competence; higher levels of expertise and knowledge; enhanced employee capability and organization learning; risk minimisation; and improved decision-making, among others. The survey has systematically reviewed the scientific contributions of knowledge management practice that guide stakeholders on construction project performance. Moreover, the findings will assist government and other agencies in the adoption of KM practice in the Nigerian construction industry. It recommends that government and professional bodies should mandate the use of KM practice on construction project delivery for better performance.

Keywords: Benefits, Construction project performance, Knowledge Management, Nigeria.

Introduction

The construction industry is very crucial in any nation's social and economic development especially with respect to its contribution to GDP, though improving but still below the potential contribution of the sector (Adeagbo, 2014). The sector is exposed to challenges of low productivity, inefficiencies in project delivery and clients' dissatisfaction from the built facilities. This result of poor quality performance, in addition to the persistent problems of time and cost overruns. However, KM is a key vehicle that improves the creation, sharing, and use of different types of knowledge (human, social, structural) that are critical in addressing the construction industry's challenges (Dahiru & Mohammed, 2013; Kasimu, 2015).

Knowledge is fact, talent, skill, best practice, know-how and know-what that are acquired through learning and experiences gained through apprenticeship (Garvin, 1993; Lee, 1997). KM is a process of creating, capturing storing, sharing, re-using and updating the knowledge and professionals experiences in order to improve the construction industry performance (Garvin, 1993). KM practice has been categorized as an asset for the built environment (Kasimu, 2015). In order to remain competitive, construction industry must efficiently and effectively create, locate, capture, and share knowledge and expertise.

In an effort to investigate and sustain the application of KM practices, Dahiru and Mohammed (2013) had conducted a survey on the challenges associated with the KM practices in the Nigerian construction industry and discovered barriers impeding its implementation in the country. The study further provides a comprehensive list of the barriers hindering the application of KM practice and include: lack of transparency and accountability; poor value management system; lack of supportive policies, procedures and guidelines; reluctance to embrace new ideas; unwillingness to share knowledge; lack of staff motivation to share knowledge; lack of trust between the parties; external influence (political, economic, legal and social); lack of supportive I.T. infrastructures; and reluctance to change the industry routines; among others. At the end of the survey, the researchers suggested further study on the benefits associated with the wider adoption of KM practices. The study explored ways of addressing these barriers by identifying the value-added KM factors and benefits that will facilitate wider adoption of KM practice in the Nigerian construction industry.

Knowledge Management Conceptual Framework

A key problem facing the construction industry is that all work is done by transient project teams, and in the past there has been no structured approach to learning from projects once they are completed. Now, though, the industry is adapting concepts of knowledge management to improve the situation (Figure 1). Lee (1997) emphasized that a learning organization is not only one with the capacity to create, capture and transfer knowledge but it is one which modifies its behaviour in order to reflect new knowledge and experiences.

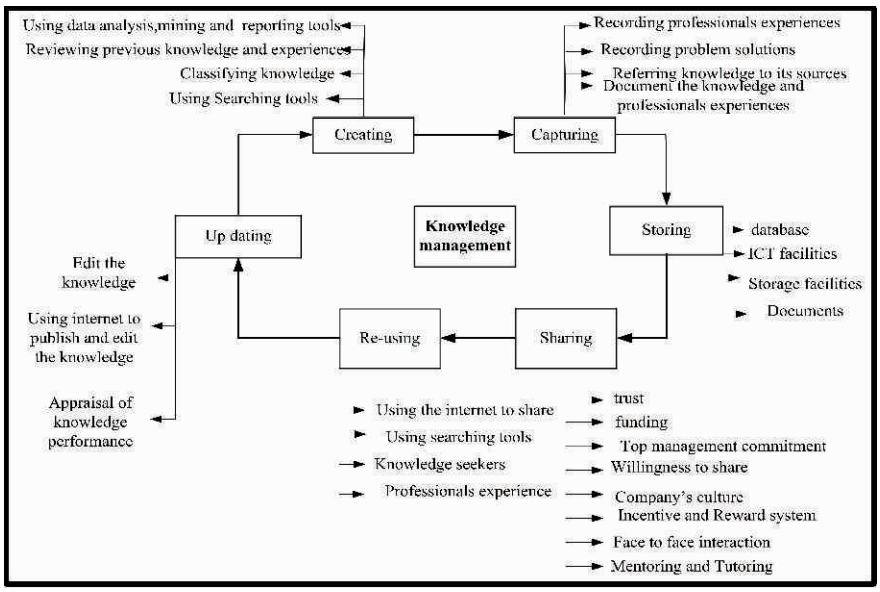

Figure 1: Knowledge Management Conceptual framework (Lee, 1997)

This applies to knowledge creation at all levels and in all areas of the business; and, explicit policies should be integrated into the construction project development so as to transform information and experience into knowledge which will be shared and reused by all employees and their collaborators as indicated in Figure 2.

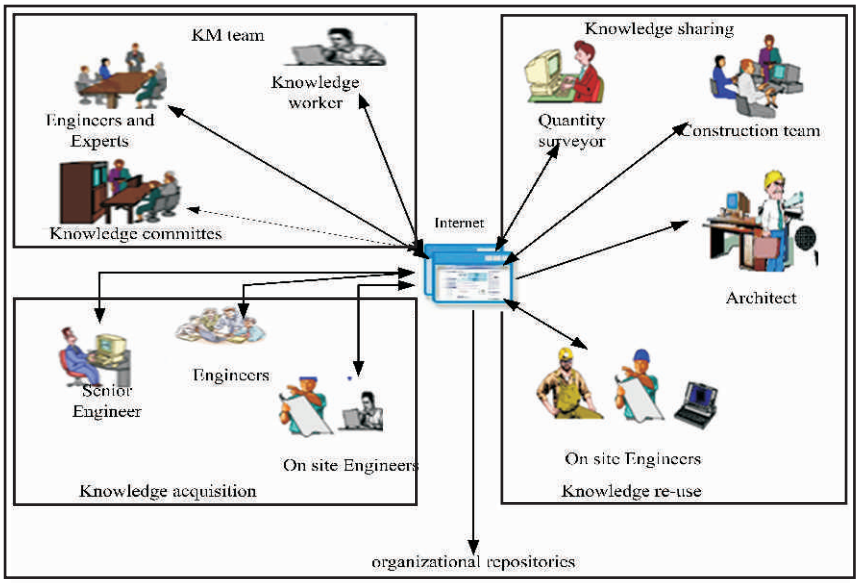

Figure 2: Knowledge sharing in the construction projects (Robeiro, 2009)

Pellicer *et al.* (2008) conceives knowledge management as fundamental for feedback processes of quality and innovation management in firms as indicated in Figure 3. Unlike quality and innovation, knowledge management is still not open to standardization, and this prevents improvement in competitiveness, especially in firms that manage and produce developers. In addition, knowledge management is fundamentally the responsibility of the individuals dully participated in the project development (Robeiro, 2009).

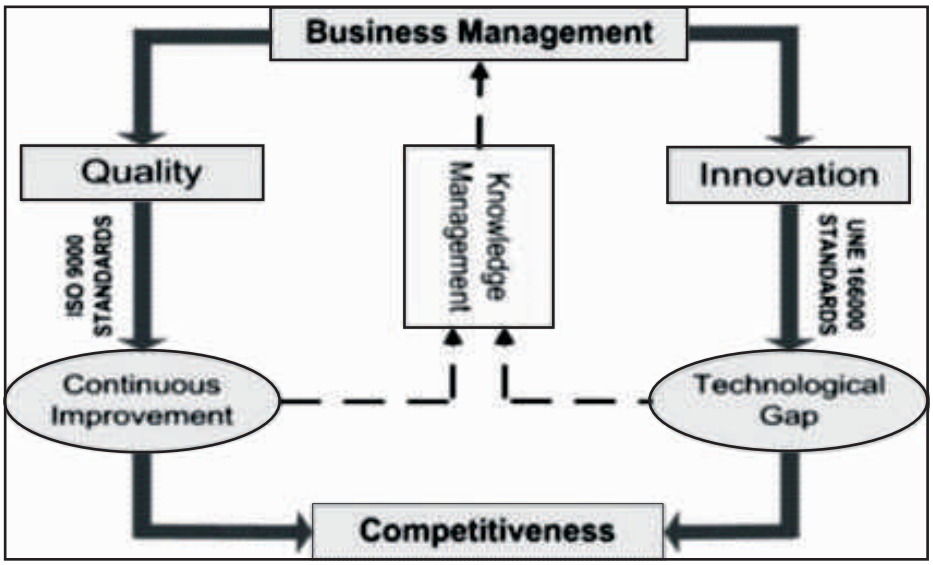

Figure 3: Quality, innovation, and knowledge relationships in firms (Pellicer et al., 2008)

However, for the project to perform correctly, a basic level of information and communication technology must be adapted to the needs of the client (Lee, 1997). Although this factor is crucial, it is the human factor that prevails as the principal protagonist (Cheung *et al.*, 2001). Furthermore, construction project developers must find out the best ways to learn and the advantages that these bring to them, on the basis of knowledge created by the project team. Once eliminated the barriers to the creation of knowledge, its transfer and storage must be secured (Ngai et al., 2002).

Construction project developers must also ensure that the correct information is provided to the right person at the right moment in order for him or her to make the best decision. Thus, developers manage knowledge efficiently when they are not only able to apply or use knowledge, exploit and explore its resources, adapt to or change its environment, but also ascertain and develop what has been learned so as to transform it into new knowledge (Yu-Cheng *et al.*, 2006; Tserng & Yu-Cheng, 2004). In the same vein, it is necessary to capture external knowledge (technological watch) and generate new knowledge by solving problems on-site and implement solutions to increase the

competitiveness of the company (Pellicer *et al.*, 2012).

The knowledge management cycle in the Construction Industry

According to Lee (1997), knowledge management consists of a set of eight factors: knowledge culture, human factors, quality of information, generation of knowledge, knowledge transfer, use and exploitation of knowledge, innovation and, finally, information and communication technologies. All these factors must work in harmony for construction project developers to efficiently manage knowledge. Figure 4 shows the inter-relationships among the eight factors of knowledge management. A solid line indicates a direct relationship between two factors, so that one factor has a straight influence on the target factor. In contrast, a dotted line indicates an indirect relationship between two factors. In this case, however, the link is not direct; i.e., the source factor influences other factors which, in turn, have an impact on the target factor.

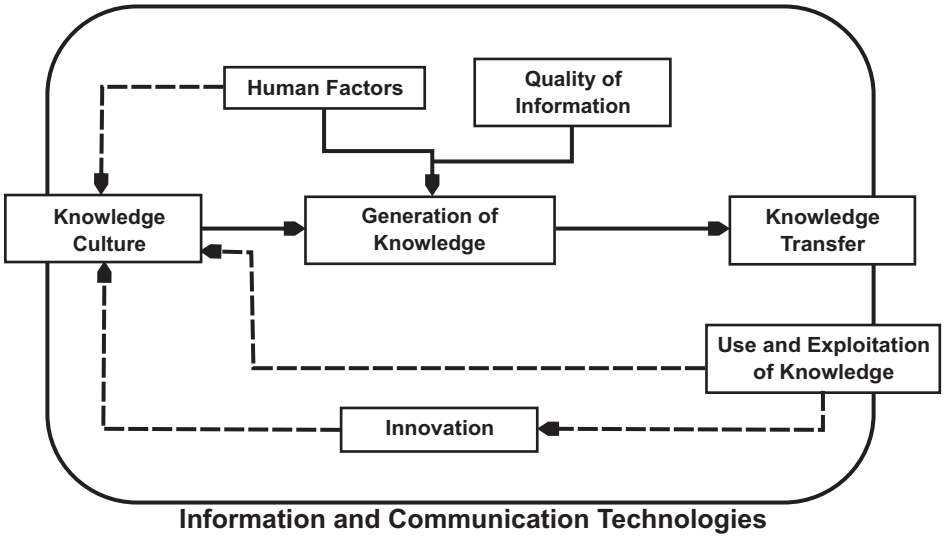

Figure 4: The knowledge management cycle in construction project delivery (Lee, 1997)

Culture – Lee (1997) observed that culture influences the commercial activities of project developers and so knowledge management practices may be affected by cultural differences (Figure 4). There is an increasing recognition of culture as a source of innovation and competitive advantage. Sandhawalia and Dalcher (2011) have also pointed out the growing interest in research into the culture of the construction industry and its projects, as well as the effects of culture and cultural differences on construction. Good knowledge management is hindered by the lack of an appropriate organizational culture that encourages members of a project team to create and share knowledge as well as of a suitable definition of what knowledge is valuable for the firm. Previous studies and experience in the sector show that cultural differences have a daily

impact on construction firms, either negatively or positively (Fong & Choi, 2009; Sandhawalia & Dalcher, 2011). Furthermore, trust is one of the fundamental values for knowledge management along with open communication and conducting work properly (Fong & Choi, 2009).

Human factors – Construction industry businesses depend on the knowledge of their workers (Yasin & Egbu, 2011). Carrillo *et al.* (2004) noted that individuals are a firm's biggest asset, as they play a crucial role in the transfer of knowledge (Dahiru & Mohammed, 2013). One of the problems experienced by most businesses that manage and produce projects is that the workers are more loyal to the project than to the firm, and are more inclined to change jobs at the end of the project. As projects are temporary in nature, the knowledge and lessons learned are dispersed when the project ends, fragmenting and deleting the organization's knowledge (Gann & Salter, 2000; Esmi & Ennals, 2009). Additionally, one of the most difficult challenges regarding human factors is the employees' resistance to change (Dahiru & Mohammed, 2013). Staff participation and motivation in projects can be evaluated to establish the effectiveness of knowledge management. Knowledge transfer depends directly on the participation of staff and the capacity to consolidate what has been learned once the project is finished. The problem becomes evident when employees have no time to share and evaluate experiences before moving on to the next project. In fact the pressure on employees as they work on a project prevents them from making the necessary effort to meet, share and reflect on the knowledge produced by previous projects, which would produce a greater exchange of experiences (Lee, 1997).

Quality of information – It is well known that construction projects are largely based on quality (Cheung *et al*., 2001), and quality monitoring is one of the great challenges for knowledge management systems (Robeiro, 2009). Love *et al.* (2000) indicate that total quality management has not been well received by the construction industry as it is perceived as the equivalent of a guarantee of quality. In consequence, construction firms have not made sufficient progress in this area; thus, their potential for learning is limited.

Information and communication technologies – Technology plays a fundamental role in facilitating the processes of knowledge management in a multicultural environment (Lee, 1997). Although technology cannot by itself solve the problems related to the exchange of knowledge, it can significantly improve its managerial processes (Robeiro, 2009). The use of information technology allows for the capture, accessibility, and re-utilization of information and knowledge. Many knowledge management systems focus on the use of a strategy of codification of information, with a heavy emphasis on the use of information technologies (Bayliss, Cheung, Suen, & Wong, 2004), which allows for knowledge to be worked on explicitly. It is important to clarify that knowledge management does not only depend on the use

of information technologies (Carrillo & Chinowsky, 2006); these are simply tools which allow the firm to monitor information efficiently. In fact, information and communication technologies favour the creation, search for, and diffusion of knowledge because they allow for high speed transmission and response, as well as the easy storage and sharing of information.

Generation of knowledge – The generation of knowledge begins when an employee has an idea and transmits it to other members of the organization through a cycle which feeds back on itself and allows for learning. Software systems such as wikis, forums, bulletin boards, or blogs, support themselves on the basis of this factor. Fong & Choi (2009) highlight the fact that this exchange of knowledge is the first step towards its management. The exchange of informal knowledge is thus defined as all the forms of exchange that exist, along with all the institutionalized forms of exchange of knowledge that exist (Fong and Choi, 2009). Furthermore, Lu & Tsai (2004) hold that organizations ought to focus on the creation of knowledge in order to prevent their existing knowledge from becoming rapidly obsolete. Tserng & Lin (2004) affirm that the exchange of experiences and re-utilization of knowledge brings other benefits with it, such as a reduced need to consult previous projects, an improvement in the quality of solutions and a minimization of the time and costs involved in finding solutions to problems, as there is no need to constantly find answers the same questions.

Knowledge transfer – Businesses in the construction sector tend to repeat all too often the same errors because they fail to effectively transfer the knowledge obtained through other projects (Dahiru & Mohammed, 2013). The exchange of knowledge between projects is equally important because transference from a current to a future project allows staff to use existing, already tested, knowledge to solve problems, instead of having to generate new knowledge which generally requires more time. This exchange improves overall performance and reduces the costs of the project (Love *et al.*, 2005). In spite of this, businesses in the construction sector have not managed to effectively achieve the transfer of knowledge between projects, nor have they developed a system of learning management which would take both technology and people into account. Knowledge transfer in the construction industry has been shown to be difficult to achieve in practice (Yu-Cheng *et al.*, 2006). This could be explained by the unique nature of each project. As the time for each project is limited, those involved focus on having the product or service ready on time, instead of devoting themselves to activities related to knowledge transfer. This lack of time is one of the most frequent barriers to knowledge transfer (Dahiru & Mohammed, 2013). Likewise, according to Fong and Kwok (2009), the lack of resources devoted to knowledge transfer by organizations is one of the main difficulties involved in the application of knowledge. Javernick-Will (2012) states that there are four main factors that affect knowledge sharing: resources, intrinsic motivation,

incentives, and overall social motivations. Among them, social motivations generate the greatest impact on knowledge sharing (Lu & Tsai, 2004). Thus, strategies to promote the motivation of employees and increase knowledge sharing are vital within organizations.

Use and exploitation of knowledge – Watkins and Marsick (1996) highlighted five key ideas regarding the efficient use of knowledge in organizations:

1. Knowledge is more than a collection of learning individuals.
2. The organization shows itself to have the capacity for change.
3. Not only does it accelerate the individual's capacity for learning, but it also redefines the organizational structure, culture, design of work and assumptions regarding how things are.
4. There exits broad participation on the part of the employees, and often by clients too, in the exchange of information and taking of decisions.
5. Systemic thinking and the growth of the organization's memory are promoted.

It can thus be said that knowledge gained from and lessons learned from different construction projects are not systematically integrated into the firm's memory, and this means that work that has already been done must be repeated, solutions to problems must be reinvented, and time is wasted (Tserng & Yu-Cheng, 2004).

Innovation – Innovation is a key issue in knowledge management practices (Dahiru & Mohammed, 2013). However, in the construction industry, little effort is made to implement new ideas or to innovate. Fong and Kwok (2009) clearly indicate that innovation is now considered to be a key factor in the success of organizations and creative ideas are seen as a secured parameter for competitiveness of a firm. The organizations that effectively leverage their knowledge assets are more competitive (Sheriff *et al.*, 2012). To ensure that innovation occurs, a positive climate must be created to encourage culture in which workers are competent and that they make use of the most up-to-date knowledge. They must also have the opportunity to develop new ideas. Management should make sure that organizational culture stimulates and encourages innovation and diversity in the work team (Kivrak *et al.*, 2009). Financial consulting firms have been pioneers in the development of innovative systems in knowledge management, in the vanguard of the application of a culture of knowledge management and have recognized the productive potential of knowledge workers.

Construction Performance Improvement through Knowledge Management practices

KM as being the context and conditions by which knowledge can be created, shared, and put to use towards the attainment of organizational goals. The deliberate concentration of a firms' effort on increasing awareness and efficiency / effectiveness of these areas will inevitably

raise the firms KM performance. Knowledge conversion has been outlined by Sandhawalia and Dalcher (2011) as being made possible through the processes and activities of synthesis, refinement, integration, combination, coordination, distribution, and restructuring of knowledge. Continual implementation of these activities creates a culture of knowledge sharing and helps grow the general intelligence level of the workforce. By sharing experiences from previous projects with peers, there may be an improvement in the construction management performance (Yu-Cheng *et al*., 2006). Complimenting this with reward systems related to knowledge and expertise creation will build learning organizations in the construction industry (Ribeiro, 2009).

Network knowledge maps give users an overview of available and missing knowledge in core project areas, enabling tacit and explicit knowledge to be managed appropriately. Yasin and Egbu (2011) discuss knowledge mapping as "the process of linking different forms of available knowledge in order to identify opportunities, improve efficiency, improve effectiveness and add value to the organisation." The improved control of the knowledge in the organisation will lead to an increased performance rating. The researchers continue to explain that knowledge mapping is a continuous assessment process as knowledge creation and improvement is on-going.

The Benefits of KM Practice in Construction Projects Performance

KM encompasses a broad range of tools, technologies, and managerial practices intended to produce bottom-line benefits by making better use of an organisation's intellectual capital. Vast literature on KM has described the ways to create, disseminate, reuse, embed and store knowledge (Ribeiro, 2009; Yasin & Egbu, 2011). KM does not only increase the profitability of the organisation but also reduces mistakes and waste of resources. Construction firms are realising that their competitive edge is mostly the brainpower or intellectual capital of their employees and management. Despite that KM is not yet tied to enterprise strategy and performance in practice (Yu-Cheng *et al.*, 2006). Establishing a KM system involves time, cost and changes in the original operating system which can be the reluctance of the investment. Ribeiro (2009) states that KM has been empirically recognised to improve the performance of the construction projects, especially in the area of quality, time, speed, steadfastness and reducing construction costs. In an effort to assess how improved KM would benefit construction projects, Tserng and Yu-Cheng (2004) had evaluated the perceived benefits of construction projects through KM in China (figure 5).

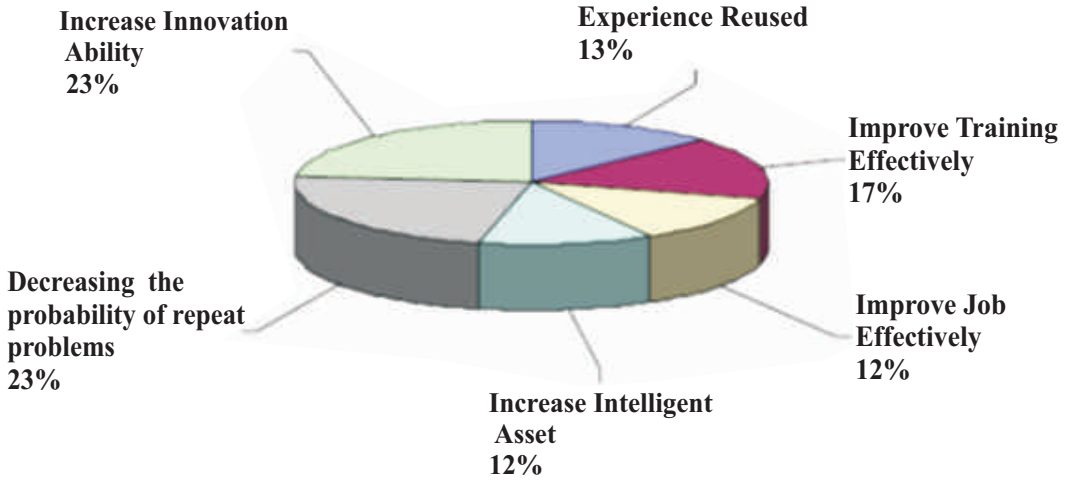

Figure 5: Knowledge Management Benefits (Tserng & Yu-Cheng, 2004)

Knowledge Sharing and Re-use - The construction projects engage large number of employees, which comprises of various professionals, skilled and unskilled workers to accomplish the project task. These employees have different background of knowledge, skills and areas of specialisation and thereby brought together to accomplish the clients goals. As a result of differences in the knowledge and areas of specialisation of these employees, the social interaction of the employees is significant to share knowledge and skills among each other to overcome the challenges of construction problems. The construction projects are well known with the problems of variations, disputes, political interference, poor planning and management, poor estimation, ineffective communication, poor financial control on site, cash flow problems during the construction, mistakes and errors during the construction stage, design problems etc, (Kasimu, 2015). These problems and their solutions are rarely documented, stored and share among the employees of construction projects for future re-use and thereby the lesson learnt is restricted in the minds of professionals who experienced them.

The use of information technology (IT) in construction projects facilitates the speed search, access and recovery of knowledge, and encourages teamwork and communication between construction personnel which in turn improves the construction project performance. According to Kasimu (2015), IT plays four major roles in KM practice in the construction projects to reduce the project's cost and improve the performance: acquiring knowledge; describe; store; classify; index; connecting knowledge-related digital products; seek and smooth the information flow. Furthermore, the use of IT has four various roles to facilitate project cost reduction through KM practice, these are: providing channels to acquire necessary information, precise flow methods, discovering the position of knowledge of the company, and knowledge seeker.

The construction organisations have characters of disengage the specialists after the completion of the projects. The problem and solutions that occurred during the course of construction projects are in the mind of specialist, and if there are no retention within the organisation they left with their domain knowledge and experiences to other organisation. In a situation where these specialists are retaining to share knowledge and experiences among other colleagues for future re-use, it would improve the efficiency of the construction organisation and thereby reduces project cost and time. The knowledge connected with previous construction project success or failure, services, customers and products are assets that can produce a long term and sustained competitive benefits for construction organisations (Ribeiro, 2009).

Seeking for knowledge from external source is another benefit of reducing the construction project cost through KM practice. Seeking for knowledge from external source is a method of employing a specialist from another construction organisation to share experiences, and knowledge among the employees in order to improve the construction performance and also organisational efficiency in terms of project cost reduction. Since construction industry builds up lots of intellectual knowledge that may later be used by the same firms to gain advantages, improve competition and subsequent project performance (Pellicer *et al.*, 2008). According to Lee (1997), seeking for knowledge from the external source reduces the followings in the construction projects: wastage of the materials; project cost and time; unforeseen problems; repetition of construction works as a result of mistakes and errors; poor financial control in construction site; disputes; claims; lapse in management and control; late deliveries of materials and equipment's etc.

Mentoring and coaching of the employees helps to reduce the construction cost through KM practice (Ngai, *et al.,* 2002 & Sheriff *et al.,* 2012). Construction projects involved people from various professionals, contractors and stakeholders who work together to accomplish its task. Majority of the construction project site have project manager, construction manager and other unit head, these are professionals that have experiences and knowledge in their areas of specialisation. The roles of these sectional heads and other specialist employees is to mentoring and coaching the other employees by sharing their tacit knowledge and experiences to avoid the reinventing of the wheel and also improve the organisational efficiency. The mentoring and coaching of employees during the course of construction projects reduce the project cost in the following areas: material management; labour cost; plant cost and utilization; site management and control.

Research Methodology

The appropriate choice of methodology is a key factor for a successful research. The approach is quantitative because of the nature of the research problem. The study seeks to answer, "what are the benefits of KM practice in construction project delivery". Secondary data for this

research were obtained from comprehensive literature review, to gain the general overview of KM practices and identify benefits for adoption in the construction industry. The primary data were obtained through field survey, using a structured questionnaire, which was distributed to architects, quantity surveyors, civil engineers, and contractors in the cities of Abuja, Kaduna, Kano and Lagos. These cities were chosen due to availability of professionals within the built environment. 360 questionnaires were administered and 148 (41%) were retrieved and used for analysis. This was adequate based on the assertion of Moser and Kalton (1971) that the result of a questionnaire survey can be considered significant if the response rate is not lower than 30-40%.

Mean Score was employed to analyze the level of significance of factors attributable to KM practice in construction projects performance. This method of analysis usually represents the average value of all factors associated to a cause. Egwunatum (2015) observed that arithmetic mean is employed, unless otherwise a condition for application is giving. Mean Score (MS) has been prevalent amongst construction management researchers (Egwunatum, 2015). This study applied the weighted mean score which involves assigning numerical value to respondents' ratings of factors with respect to their importance e.g. very high (5), high (4), moderate (3), low (2), and very low (1). In each case, assessment was carried out from the factors which have been weighted on a 5 point.

Likert scale to rank the level of importance attached to each factor. The weighted mean was use and computed from (Moser & Kalton, 1971);

$$\text{Weighted mean} = \frac{w_1y_1+w_2y_2+.....+w_ny_n}{w_1+w_2+.....+w_n}$$

$y_1, y_2, \ldots\ldots\ldots\ldots\ldots y_n$ represents the factors under evaluation

$w_1, w_2 \ldots\ldots\ldots\ldots w_n$ represents the weightings of the factors that translate to;

w_1 = number of respondents who answered very low

w_2 = number of respondents who answered low

w_3 = number of respondents who answered moderate

w_4 = number of respondents who answered high

w_5 = number of respondents who answered very high

Results and Discussion

This section is dedicated to the presentation of the field results and the analysis of the data obtained through the questionnaire administered. It also discusses and interprets the relationship of the results presented in order to assess the cross correlation with previous outcomes of other studies. This is with a view to show the significance of the results of the study and to draw up evaluations and conclusions. The data collected were analyzed to generate the mean of each factor and later ranked in order of importance. The response rate of the questionnaire survey reveals that out of the 360 questionnaires administered, 148 were returned (41% responded and 59% did not respond). The results of the survey could be

generalized and accepted as valid (Moser & Kalton, 1971).

Identification of value-adding KM factors for improving construction performance

Adoption of KM practices will result in re-engineering of the construction projects delivery. In order to identify the benefits of KM practices, value adding KM factors were generated from the literature review which form part of the questionnaire to ask respondents about the importance of these factors in the adoption of KM practices. Identification of these factors is a critical step where benefits are generated. Table 1 shows the mean score of the respondents for the 8 value-adding KM factors for improving construction projects performance. The Likert scale of 1-5 was used where 1 denotes least effective factors and 5 represents most effective respectively. The results show that all the 8 means for all the 8 factors were more than 3.00 and higher than 4.00. The least mean was 4.30 and the highest mean was 4.48, that is, $4.30 \leq \text{mean} \leq 4.48$.

It is important to identify value adding KM factors for construction projects delivery with a view to improve performance. It is notable to consider the rank of the eight (8) different factors, illustrating the importance of each factor as being the highest drivers in achieving KM benefits significantly. As the level of importance decreases, the importance of the factors decreases proportionately. For all eight (8) of the factors, more than half of the respondents indicated that the factors are very important. Culture was ranked the most significant driver in promoting construction project performance through KM practice. This is followed by human factors and quality of information as been the second and third value adding KM factor for improving construction project delivery. Others include: information & communication tech, generation of knowledge, transfer of knowledge, use and exploitation of knowledge, and innovation as been the least factor (table 1).

Table 1: Value-adding Knowledge Management factors for improving construction performance

Value-adding KM factors	Response %						**MS**	**Rank**
	Unsure	Not----------Very						
		1	2	3	4	5		
Culture	0.0	0.0	5.3	11.5	15.8	69.6	4.48	1
Human factors	0.0	0.0	0.0	20.1	15.4	68.4	4.44	2
Quality of information	0.0	0.0	5.3	10.5	24.4	57.9	4.40	3
Information & communication tech.	0.0	0.0	5.3	10.5	22.5	52.6	4.38	4
Generation of knowledge	0.0	0.0	5.2	10.2	14.4	52.2	4.35	5
Knowledge transfer	0.0	0.0	0.0	21.1	15.8	43.2	4.32	6
Use and exploitation of knowledge	0.0	0.0	5.3	14.5	15.8	48.4	4.31	7
Innovation	0.0	0.0	5.3	13.5	15.8	46.6	4.30	8

Source: survey, 2016

Identify factors	Architect	Q/Surveyor	C/Engineer	Contractor	Overall mean	Rank
Improve project quality, cost & time	3.81	3.79	3.82	3.83	3.8125	1
Practice and process improvement	3.79	3.74	3.80	3.76	3.7725	2
Encourage effective teamwork & innovation	3.78	3.82	3.75	3.69	3.7600	3
Improve the client satisfaction	3.80	3.75	3.73	3.71	3.7475	4
Boost productivity of employees & processes	3.68	3.79	3.69	3.80	3.7400	5
Enhance organisational competence	3.77	3.68	3.72	3.66	3.7075	6
Higher levels of expertise & knowledge	3.59	3.68	3.70	3.62	3.6475	7
Enhanced employee capability and organisation learning	3.73	3.63	3.58	3.60	3.6350	8
Risk minimisation capable of improving business growth	3.66	3.54	3.49	3.55	3.5600	9
Improved decision-making	3.61	3.46	3.52	3.62	3.5525	10
Distribution of best practices	3.53	3.60	3.44	3.48	3.5125	11
Reduce repeated mistakes & duplication of works	3.61	3.45	3.50	3.43	3.4975	12
Increased flexibility and adaptability	3.47	3.38	3.51	3.42	3.4450	13
Improve personnel quality, satisfaction and motivation	3.50	3.41	3.39	3.43	3.4325	14
Increased employee's morale, creativity and ingenuity	3.36	3.43	3.44	3.34	3.3925	15
Enhanced the rate of responses to client's needs and other external factors	3.34	3.33	3.48	3.26	3.3525	16
Employee stimulation and motivation	3.41	3.43	3.24	3.22	3.3250	17
Raise company professional image	3.35	3.28	3.31	3.34	3.3200	18
Rapid and effective in enterprise-wide problem solving	3.32	3.36	3.24	3.26	3.2950	19

Table 2: Ranks of the benefits of KM practice in construction projects in Nigeria

Ranks of the Perceived Benefits of KM practice in Construction Projects Performance

From the analysis shown in Table 3, the overall mean score for the 19 factors responsible for improving construction projects performance through KM practice is presented ranging from 3.8125 to 3.2950 mean score. It can be seen that factors such as: improve project quality, cost & time (3.8125); practice and process improvement (3.7725); encourage effective teamwork & innovation (3.7600); improve the client satisfaction (3.7475), boost productivity of employees & processes (3.7400); enhance organisational competence (3.7075); higher levels of expertise & knowledge (3.6475); enhanced employee capability and organisation learning (3.6350); risk minimisation capable of improving business growth (3.5600); and improved decision-making (3.5525) were found to be the top ten (10) important factors emanating from the use of KM practice in construction projects delivery.

The least important factors found to be responsible in improving construction projects delivery include: distribution of best practices(3.5125); reduce repeated mistakes & duplication of works (3.4975); increased flexibility and adaptability (3.4450); improve personnel quality, satisfaction and motivation (3.4325); increased employee's morale, creativity and ingenuity (3.3925); enhanced the rate of responses to client's needs and other external factors (3.3525); employee stimulation and motivation (3.3250); raise company professional image (3.3200); rapid and effective in enterprise-wide problem solving (3.2950).

Findings of the analysis shows that application of KM practice in construction projects delivery improves project quality, cost & time. Thus, sharing of knowledge and experiences among other colleague for future re-use would significantly improve the efficiency of the project thereby reduces cost and time. Additionally, the practice of KM has been empirically recognised as a method of improving the performance of the construction projects especially in the area of quality, time, speed, steadfastness and reducing construction costs (Dahiru and Mohammed, 2013). The results have also revealed that: practice and process improvement, encouragement of effective teamwork & innovation, and improvement of the client satisfaction were among the most significant factors obtain in construction project delivery through KM practice (Lee, 1997; Robeiro, 2009; Yasin & Egbu, 2011).

Another important factors that improve construction project performance through KM practice include: boost productivity of employees & processes, enhance organisational competence, higher levels of expertise & knowledge, enhanced employee capability and organisation learning, risk minimisation capable of improving business growth, and more importantly improved project decision-making process. This indicate that the sharing of knowledge and skills among the project team will significantly improve the decision making process faster thereby increasing awareness, efficiency and effectiveness of the project development process (Kasimu, 2015).

Table 2 shows that distribution of best

practices and reduction of repeated mistakes and duplication of works were found to be among the benefits of KM practice in construction projects delivery. Additionally, increased flexibility and adaptability couple with improve personnel quality, satisfaction and motivation also form part of the importance of KM application in project delivery. It is imperative to note that increased employee's morale, creativity and ingenuity capable of enhancing the rate of responses to client's needs and other external factors were derived from the adoption of KM practice.

Conclusion and Recommendation

Conclusion

Adoption of KM practices will result in re-engineering of the construction projects delivery. The study has systematically reviews the scientific contributions of knowledge management practice that guides stakeholders on construction project performance. Value adding KM factors were identified as a critical steps where benefits are generated for improving construction projects performance. These factors include: knowledge culture, human factors, quality of information, generation of knowledge, knowledge transfer, use and exploitation of knowledge, innovation and, finally, information and communication technologies. All these factors must work in harmony for construction project developers to efficiently manage knowledge.

Recommendation

The construction cost and time overrun limiting project performance in Nigeria will be minimized significantly if government support the use of KM practice in construction projects delivery. This will provides guides that will aid government and organisations in formulating policies towards improving construction projects performance. To the academia it will serve as a reference for increasing awareness, efficiency and effectiveness of the used of KM practice in construction project development process.

Based on the findings of this study, the following recommendations were made with a view to ensuring the appropriate adoption of KM practice in the Nigerian construction industry. The study recommends similar research to be carried out in other part of the country since the research covers only few states. The professional regulatory bodies should include KM practice as a policy for project management. Lastly, the research also recommends that government should mandate the use of KM practice in public projects that may attract high capital outlay.

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