

Variations in the Civil Engineering Construction Projects: Knowledge Management as an Antidote

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ABSTRACT

The Civil Engineering (CE) construction sector in Nigeria has been facing the challenges of management of knowledge and professionals' experiences to reduce the variations and other claims problems during the course of construction project. Therefore, the aim of the paper is to establish the benefits of knowledge management (KM) practice in moderates the causes of variations in the CE construction projects in Nigeria. To accomplish this aim, the quantitative research approach through the uses of survey method was employed as a result of quality and type of data required, in line with complexity, fragmentation and diversification of CE construction firms. A total of 350 numbers of questionnaires were distributed to Engineers, Quantity surveyors, Project Managers, Construction Managers, Foremen and other professionals across the selected CE construction companies in Nigeria. The average index was used to analyse the data obtained from the responses of the respondents. The result obtained from the analysis shows that the practice of KM improves project delivery in term of cost, time and quality, reduce unnecessary costs; reduce construction rework problems and demolitions; reduce errors and omissions in design; improvement in problems solution; improves labour skills and integrate knowledge in the construction company etc. Therefore the management of the CE construction firms should develop proactive management strategies that would facilitate the KM practice by organizing workshops and seminars to create awareness of the benefits of KM practice.

Keywords: Variations, Knowledge, Knowledge management, Construction projects, and Construction cost

INTRODUCTION

Civil engineering (CE) construction projects are usually multifaceted, complicated and ambiguous in nature as results of its diversification and fragmentation. This is because each construction project has its own unique circumstances and situations. The multifaceted in the CE construction projects means that it is very scarce to execute a project successfully without any alteration and modification of the initial master plan. These changes in the CE

construction projects are due to some certain factors such as contractor factor, client factor, consultant factor, and weather condition factor. These factors usually occur in one way or the other depends on the nature and types of CE construction projects at hand. These changes in the master plan occurred during the construction stage of projects once the contract have been awarded is known as variations. [6] defined variation as a change that occurs in the master plan of the project different from the agreed or signed contract. However, [26] stated that, the causes that trigger alteration and modification in a construction project could be as modest as change of mind by the clients, the consultant and uncertainty during the course of construction. Therefore, these changes in a construction projects have a detrimental effect on the initial budget plan of the construction projects cost and time, which resulted in time and cost overruns and addition works. This affected the developmental plan and sometimes resulted in abandonment of the construction projects. Moreover, the cost is the major concern during the construction project administration life cycle and considered as one of the most significant instruments of a construction project and driving force of the successful project execution [4]. The CE construction firms in

Nigeria have faced the challenges of the variations problems during the course of construction projects especially in the road, bridges, railways, high rise buildings, flyover constructions, thereby affected the quality, time and cost of the construction projects. However, doing the construction job right from the first time, it reduces the cost of construction reworks, poor planning and designing, disputes, conflict, variation and improves innovation. This can be accomplished with adequate planning and good management strategy at the conceptualization of the design stage by sharing the knowledge and professional experiences of the past projects among other employees for re-use to make appropriate preparations and cautions about the previous mistakes/errors from reoccurring in the future projects. This is because managing the previous knowledge, best practices and professional experiences in the construction organization improve the organizational performance in term of project delivery and also prevent reinventing the wheel.

The aim of the paper is to establish the benefits of knowledge management (KM) practice in moderates the causes of variations in the CE construction projects in Nigeria. This will provide a platform that clarifies the importance of KM practices in the CE construction projects. The above aim is achieved through the accomplishment of the following objectives. Namely; to examine the benefits of KM practices in CE construction projects and to investigate the significant influence of KM practice in mitigating the causes of variations in CE construction projects.

LITERATURES REVIEW

In this paper the following areas of the literatures were examined to

establish the theoretical underpinning the research: Variations, the influence of variation order in construction project performance, knowledge management, KM as an antidote in construction firms. These are explained in Section 2.1 to 2.4 respectively.

Variation Orders

The variation orders comprise of the instruction that enable modification and alteration of the original master plan of the construction project. Usually this alteration and modification happen after the contract have been awarded to the contractor and have started work on the construction site. Sometime, this alteration and modification may be as a result of different reasons for example, the issues concerning the scope, materials and labour schedules, cost, as well as the method of construction. However, in the CE construction projects in Nigeria, the majority of the contractor does not meet up with stipulated time for completion of the project as a result of alteration and modification of the master design [2,18,21]. In addition, there are other factors that influence the alteration and modification of the design such as funding, design aesthetic, geographical location, weather condition of the environment, statutory law and client wishes [16]. Many past researchers have been commissioned to find out the major causes of variation orders in the construction projects, especially in Nigeria that experiences lot of variations during the CE construction project which have a detrimental effect for the initial budget and time stipulated in the articles of agreement. The researchers have conducted many studies in the different part of the world in relation to the variation problems in the construction projects. For example, [17] discovered that 10-17% ratio of the cost of alteration and modification in relation to the total cost of the projects. Similarly, [11] conducted a study and found out that 63% of the site order ended in additional works. They further stressed that 14% of the variations are accompanied by wastages particularly in the areas of those that involve in modification to the part already completed. Figure 1 summarized the causes of variations within the construction projects.

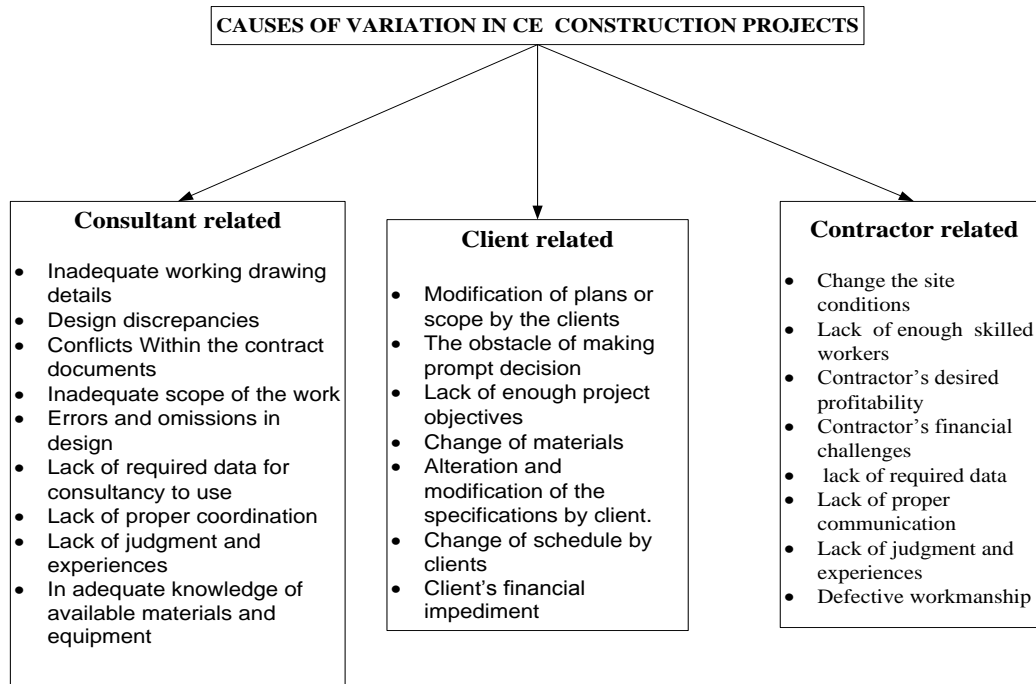


Figure 1: The causes of variation in the construction projects

The Influence of Variation Orders in Construction Project Performance

The significant influence of the variation orders in the construction project performance is mainly where the appropriate schedule of work is prepared for a certain project to adhere to and the schedule was altered as a result of change order, then the performance might be affected. However, [27] alleged that variability generally impedes project performance in terms of delivery within the stipulated time and cost with high quality. They further added that variation orders have a marvellous effect on the project performance because it affects the productivity and cost. [3] Stressed that variation orders are undesirable but predictable reality of any construction project. [16] Argued that that construction project wedged by means of variation orders cause the contractor to accomplish a lower output level than planned.

Knowledge Management

The researchers have established that KM incorporates the management efforts to enable the accomplishments of obtaining, generating, storing, distributing, diffusing, developing, and deploying knowledge and expertise by individual and groups [9,24,25,28,20]. [20] described KM as a strategy developed in an organization to ensure that knowledge reaches the right people at the right time for sharing and re-using in order to improve the organizational performance. However, [1] stated that KM is not about getting the required information to the people at the desire time; rather it is about allowing people to interpret what they

observed and authorizing them to use their judgment. And further maintained that the ability of an enterprise to influence soft knowledge and learn faster, its competitors may be the only source of sustainable advantage in the future. KM in CE construction firms is about capturing, storing and sharing, the knowledge, best practices and professional skills for the utilization in the future projects in order to circumvent the recurrence of past mistakes/errors and also to reduce the cost and time of construction re-works. Therefore, in this research paper KM is described as a process of creating, capturing, storing, sharing, re-using and updating knowledge in construction organization as shown below.

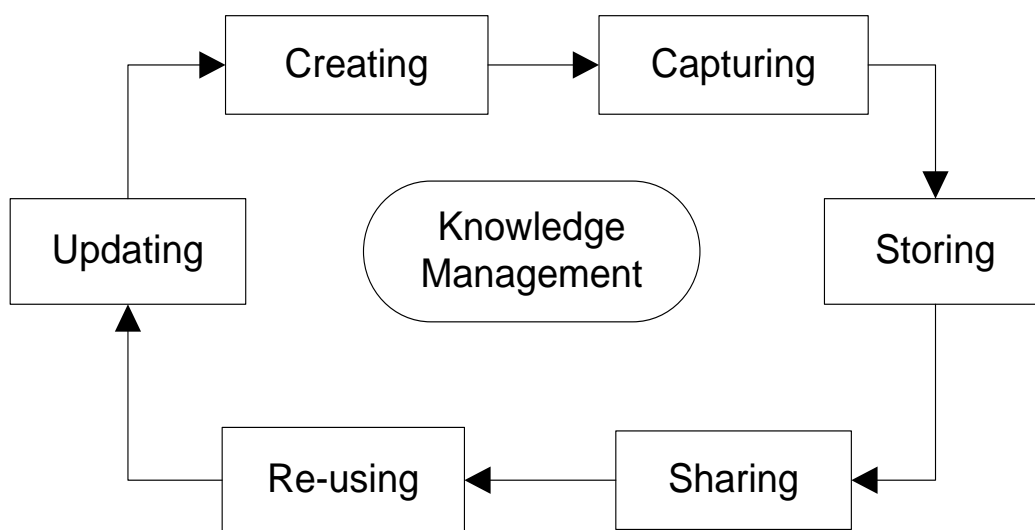


Figure 2.0: Concept of knowledge management.

Knowledge Management as an Antidote in CE Construction Firms

The CE construction firms is a workplace that is dominated by heuristic construction companies and their staffs are likely to carry out their project management task based on their past experiences, rather than following a textbook approach, or established logical approaches [19, 30]. Therefore, the construction project team has to work jointly to realize a successful construction project. Working jointly involves sharing ideas, lessons learnt, best practice and information which strengthen the successful execution of complex construction projects. Each construction employee contributes its knowledge in the form of people, processes and technologies at varying degree of strength to the construction process. The management of knowledge within the CE construction project setting is very essential since information and knowledge are dispersed over different processes, trades and people in different CE construction projects and in different organizations [13, 15, and 22]. [7] emphasized that KM has a role in improving more collaborative behaviour among organizations and individuals

involved in the construction processes. In addition, [30] conducted a research on Knowledge leadership to improve project and organizational performance and outlined the benefits of knowledge management practices as: Improve project delivery in term of time, quality and cost; improve labour skills and integrate knowledge in the construction company; improve bidding performance; reduce unnecessary costs and improve economic profitability.

However, there are different organizations working on a construction project and the documents shared between these organizations vary from technical drawings, contract documents, project reports, and schedule [8, 29]. Construction projects usually consist of temporary designed teams from different organizations to produce a unique product. The project team members may generally be new to each other and may possibly have not worked together before. Therefore, it is difficult to set up a channel to exchange information and knowledge within the construction project teams without establishing trust and common goal among the employees. [12] expressed that, lack of common goals makes project employees emphasis only on their part of the work and disregard the knowledge desires of the other project members.

METHODOLOGY

This research adopted a quantitative research approach through the uses of questionnaire survey method. This method is use in the field of research to sample the individuals from a population with the aim of making statistical inference about the population using the sample [14]. In addition, this method is also used to pull out about public view, such as beliefs, perception, ideas, views and thought about some things. The survey method is commonly used for scientific drives as it provides vital information for all kinds of research fields, for example, the current situation on the ground, psychological perception and views of the population. The construction industry has diverse professionals with different kind of know-how, and they have to work collectively to produce the product of the companies and sometimes these professionals were in different workplaces. Therefore, to obtain the data necessary for this research, the survey questionnaire was adopted as results of disintegration and diversification of the CE construction sector.

However, the stratified random sampling method was employed for the selection of the construction firms that part takes in this research based on the concept of [17]. 35 numbers of construction firms that fully participated in the construction projects both in public and private sector were carefully chosen for the questionnaire survey based on their annual turnover, experiences and past records. Thereafter, a total of 350 questionnaires were distributed to Engineers, Architecture, Quantity Surveying, Builders, Project manager, Construction managers, Information manager and others experts across the selected construction companies. Though, 72.29% of the questionnaires distributed were

filled correctly and returned; 12% were filled wrongly and returned, whereas 15.71% were not returned. Then, 72.29% of the questionnaire returned represented the 253 questionnaires that were used for the analysis.

Analysis of data

Average index analysis was used to analyse the data obtained from the CE construction firms. However, the mean value was obtained from AI by simplify the arithmetic average of the values in the set, which was acquired by summing the values and dividing by the number of values.

Average Index

Average Index (AI) was employed to measure the average value of the data gathered from the questionnaire. In addition, it is also use to measure and testifies a set of observation data into a single value. The range of the value was tabulated in Table 1. AI is applied in this research to determine the important of each variable from the opinion of respondents. The calculation for AI is based on the equation as started below:

$$\text{Average Index} = \frac{\sum a_i x_i}{\sum x_i}$$

Where:

a_i = constant expressing the weight given to i

x_i = number of response for $i = 1, 2, 3, 4, 5$

x_1 = number of respondents who answered none

x_2 = number of respondents who answered low

x_3 = number of respondents who answered moderate

x_4 = number of respondents who answered high

x_5 = number of respondents who answered very high

The method of averaging individual rating to a discrete value or index is easy, but extra care is required during its analysis and interpretation of these values so that they reflect the overall respondents rating.

FINDINGS AND DISCUSSION OF RESULTS

The results obtained from the descriptive analysis was summarised in tabular form for clear understanding. The decision on the results of the

descriptive analysis was based on the class range in Table 1. The class range was obtained from the five point Likert scale adopted in obtaining the data.

Table 1: Class range of Average Index

Mean Range	Likert Scale
$1 \leq \text{Average index} < 1.50$	None
$1.5 \leq \text{Average index} < 2.5$	Low
$2.5 \leq \text{Average index} < 3.5$	Moderate
$3.5 \leq \text{Average index} < 4.5$	High
$4.5 \leq \text{Average index} < 5.0$	Very high

Source: [18]

Table 2: The level of influence of the KM practice in terms of mitigating the causes of variations in CE construction firms

Items measured	Mean	Std. Deviation	Ranks
Reduce unnecessary costs	4.56	1.231	1
Reduce construction rework problems and demolitions	4.23	1.109	2
Reduce errors and omissions in design	4.12	0.907	3
Improve project delivery in term of cost	3.94	1.272	4
Improve labour skills and integrate knowledge in the construction company	3.88	1.031	5
Improve project delivery in term of time	3.85	0.942	6
Improve project delivery in term of quality	3.74	1.018	7
Ability to respond to market and clients' needs	3.56	1.190	8
Enhancement of company competitive advantages	3.52	1.167	9
Improve bidding performance	3.24	0.843	10
Improve economic profitability	3.05	0.829	11
Improve work efficiency	2.95	1.195	12
Improve problem solving and decision making	2.68	0.875	13
Enhance in personal capabilities	2.49	1.262	14
Rise the morals of the spirit of works	2.24	0.845	15
Reduce conflict between contract documents and conflict on construction site	2.09	1.084	16

The decision of the Table 2 was based on the class range in the Table 1. The results show that the followings: reduce unnecessary costs and reduce construction rework problems and demolitions were very high in terms of influence of KM practice in mitigating the causes of variations in CE construction project. However, reduce errors and omissions in design, improve project delivery in term of cost, improve labour skills and integrate knowledge in the construction company, improve project delivery in term of time, improve project delivery in term of quality, ability to respond to market and clients' needs and enhancement of company competitive advantages are high in terms of influence of KM practice in mitigating the causes of variations in CE construction projects. In addition, improve bidding performance, improve economic profitability, improve work efficiency and improve problem solving and decision making are moderate in terms of the influence of KM practices in mitigating the causes of the variations in CE construction projects. Similarly enhance in personal capabilities, rise the morals of the spirit of works and reduce conflict between contract documents and conflict on construction site are low in terms of influence of KM practice in mitigating the causes of variations in CE construction projects.

This result was in line with the [10] that the success of projects relies seriously on the right mixture of knowledge and experiences of the past projects acquired by the professionals and other experts in the construction organization. However, [23] emphasized that KM has been empirically established to improve the performance of the construction projects in terms of the quality, time, speed, reliability and reducing production costs. A number of reasons have been put to fault for the failure of the construction industry to entirely benefit from KM practice to improve organisational performance. In addition, [5] asserted that KM practice creates understanding of the possible methods of handling different situations and anticipate implications and judge their effects and approaches for the improvement.

CONCLUSION

The practice of KM in the CE construction sector is vital, based on the outcome of the result obtained from the analysis. The result shows that the practice of KM mitigates the causes of variations in CE construction projects in the areas of cost, time and quality, reduce unnecessary costs; reduce construction rework problems and demolitions; reduce errors and omissions in design; improvement in problems solution; improve labour skills and integrate knowledge in the construction company; ability to respond to market and clients' needs; enhancement of company competitive advantages etc. Therefore, comparing the causes of variations within the construction projects highlighted in the Figure 1 above with the benefits of KM practice in the construction firms. It is glaring that KM practice is the real answer to the causes of variations problems in the

construction projects especially the CE construction sector that is complex in nature with different professionals of different types of knowledge and skills. Therefore the study suggests that the senior management of the CE construction firms should develop proactive management strategies that facilitate the KM practice. The employees should be educated on the concept and theory of the KM practice and also the benefits derived in practice KM through workshop and seminars.

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