

The Significance Impacts of Knowledge Management on Cost Overruns in the Civil Engineering Construction Projects in Nigeria.

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Abstract: Construction firms in Nigeria had failed in terms of quality project delivery within the predetermine sum at the stipulated time frame. The aim of the study is to determine the solution to the cost overruns in the civil engineering(CE) construction projects in Nigeria through the application of knowledge management (KM).To accomplish this aim, the questionnaire survey approach was adopted, because of the nature ofCE construction firms and the nature of the data required for this research work. A total of three hundred and fifty (350) numbers of questionnaires was distributed to Architects; Quantity Surveyors; Engineers; Project managers; and foreman, across the selected CE construction firms in Nigeria. The method of analysis employed in this study is descriptive, reliability and factor analysis to analyse the data acquired from the participants. The results show that KM practices in the CE construction firms in Nigeria are now a necessity, because the practices of KM boost the construction organizational efficiency and effectiveness in term of the project delivery within the predetermine sum with good quality at the stipulated time frame. Therefore, the paper suggests that the professionals and engineers that participated in the CE construction projects should be educated about the significant impacts of KM practices on cost overrun in order to smooth the implementation of KM in the CE construction companies.

Key words: Knowledge management; cost overruns; construction projects; knowledge. Knowledge sharing.

INTRODUCTION

The civil engineering (CE) construction firm is a project-based organisation. People from different departments, professions or companies gather as a team to complete a project. The time of a project may be from several months to years. However, CE construction projects are usually capital intensive; therefore time and resources play a crucial role in deciding the cost of every project. Hence, by doing the job right, the very first time, total project cost can be reduced substantially by identifying mistakes, analysing the situation and solving any problems. The CE construction firm in Nigeria is one of the biggest organizations and any extra cost means huge losses to the contractors and higher expenses to the clients. Moreover, the successful execution of this construction project within the estimated cost and prescribed scheduled depends on the management of the resources, adequate communication within the construction workers and management of the lesson learnt both during and after the completion of the projects (Tserng and Lin, 2008). It is believed that if the estimated cost in the Bill of Quantities is insufficient to carry out the construction works, due to some changes as results of variation, fluctuation, mistakes/errors and construction reworks then the project is considered to be a cost overrun (Kwakye, 1997). Cost overrun is considered as problems that hinders project's progress, since it decrease the contractor's profit leading to huge losses, and leaving the project in a big trouble (Radujkovic, 1999). The main objectives and policies of construction organization is to execute successful quality project within schedule time and cost. Therefore, CE construction firms in Nigeria had failed in terms of delivering quality project within predetermine sum and the timeline and these problems were caused as a result of not capturing, storing, sharing knowledge, best practices and experiences of the past projects among the employees for re-use in future projects to prevent the mistakes/errors and problems that have already solved to resurface again, which will then sustain the construction cost within the predetermine sum(Kasimu, 2012). The aim of the study is to determine the solution to the cost overruns in the CE construction projects in Nigeria through the application of KM. This will provide a platform that clarifies the needs of KM practice within CE construction firms in Nigeria. The above aim is achieved through the accomplishing of the following objectives:

- ❖ To identify the significant impacts of KM practices on cost overruns in the CE construction projects.
- ❖ Two examines the level of of the significant impacts of KM practices on cost overruns in the CE construction projects.
- ❖ To suggest the way forwards.

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Knowledge:

Knowledge is a vital resource for construction oriented organization. Baofeng and Song (2009) stressed that knowledge may be the mixture of knowledge and experiences that are acquired by individual in his workplace over a period of time, and it is ideological matter, which may be produced, recognized and utilized by individual brain alone. Therefore, knowledge is crucial not only for implementing successful projects, but also for choosing the right projects and winning the bids. KM is essential in the construction organization, because knowledge sharing and re-using can reduce time/cost of construction reworks, improve quality, and provide opportunities for competitive advantage for the construction participants as well as organization (Khaksar, *et al.*, 2012). However, knowledge is scattered in the construction projects and the pool of knowledge is lost if there is no proper channel of transferring the knowledge created during the construction phase of projects to other projects for re-used. Knowledge sharing across a project is important since, knowledge transfer from a current to a concurrent or future project allow people to use existing proven knowledge to solve problems as a substitute of generating a new knowledge, which can guzzle time (Fernie *et al.*, 2003; Love *et al.*, 2005). Overall efficiency is thereby increased, and project expenditures can be lowered. Critical factors for the success or failure of a project can be shared as lessons learnt or post project reviews. This is particularly crucial for contractors, as they are now operating in a highly competitive environment.

Knowledge Management:

According to Wernerfelt, (2005) KM is a technique that makes things easier and get better process of sharing, distributing, creating, and capturing; understanding knowledge within a construction organization. Fong and Chu (2006) explained that KM is a method of making knowledge as a strategic asset to drive sustainable organizational benefit and also encourage an organisational approach to identify, capture, evaluate and share a firm's intellectual resource. Successful KM accept a knower to have the ability and means to internalize what is learned through listening, observing, reading and gaining of the experiences. KM has been considered as a tool to enhance the organisational performance with many academic and practitioners advocating the construction organization benefits of KM including delivery projects with quality, shorter design and production times, customer and staff satisfaction, market leadership (Carrillo and Chinowsky, 2006). Soon and Zainol, (2011) further expressed that KM must be integrated with organisational performance to improve the organisation efficiency and competitive advantage. However, Mclerney (2002) with different opinions that KM is an offer to develop useful knowledge within an organization by encouraging communication, offering opportunities to learn and promoting the sharing of suitable knowledge artefacts. Beckman, (1997) stressed that, KM is the formalization of the admittance in the direction of experience, knowledge, and expertise with the aim of creating new capacities, facilitate better-quality performance, promote innovation, as well as improve customer worth (Frappaolo, 2000 and Teerajetgul *et al.*, 2009). KM is a process of creating; collecting; storing and sharing knowledge among the Engineers, Experts and skilled workers within an organization for the betterment of the construction projects and minimizing the time of solving and resolving problems (Montana, 2000; Bergman, 2002; Egbu 2003; and Lin and Lin, 2006). It is believed that when experiences; knowledge and skilled were properly shared at the right time then the same problems in the construction project do not necessarily to be solved constantly. Kasimu *et al.*, (2012) expressed that KM is a discipline that focused on systematic and innovative practices, methods, and gearing towards managing the generation, acquisition, exchange, protection, distribution, and utilization of knowledge, intellectual assets and indefinable assets.

Cost Overruns in the Construction Projects:

Cost overrun is regarded as an excess of actual cost over budget. Cost overrun is also sometimes called "cost escalation, cost increases, or budget overrun" (Arditi *et al.*, 1985). Semple *et al.*, (1994) asserted that cost overruns is the difference between the original cost estimates of the project and the actual construction cost of the completed project. Jackson (1990) further explained that cost overruns is the change in contract amount divided by the original contract award amount. Flyvbjerg *et al.*, (2002) stressed that big construction projects like CE construction projects have been overwhelmed by cost and time overruns. The previous research works have shown that, such types of projects usually have their final project costs higher than the cost estimates prepared at the following stages of initial planning, preliminary and at the inception of construction work. Shen *et al.*, (2009) stated that construction organizations are facing major challenges in controlling project budgets over the time span between commencement of the project and the completion of construction projects. However, the improvement of cost estimates that accurately reflect project scope, economic conditions, community interest and the macroeconomic conditions provide a baseline cost that management can use to instruct discipline into the design process. It is very possible that projects can be delivered within the estimated budget but the preliminary estimate must be accurate and error free for good starting. In addition adequate measure must be put in place to overcome the factors that can cause cost escalation, and project mismanagement. In an organization that discipline is lacking, there will be a significant cost escalation that can

pose problems to the ongoing projects, because funds will not be available for future projects that are programmed for construction.

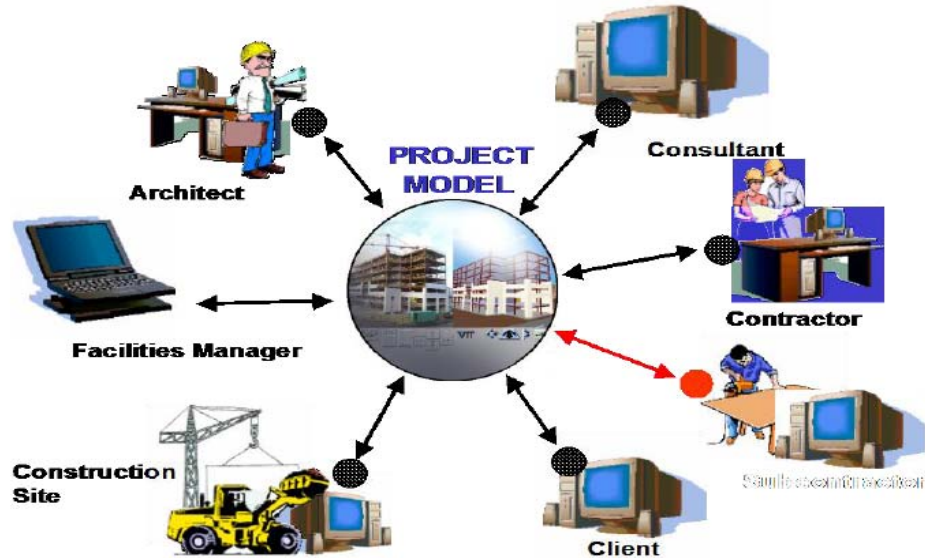


Fig. 2: Sharing of information and knowledge in the construction projects (Sarshar *et al.*, 2004).

The Factors That Influence Cost Overruns:

Many researchers have discovered the reasons for the disparity between the tender sum and the final cost of the construction project. The following were identified as the factors that influence cost overruns. Such as design change, inadequate planning, unpredictable weather condition, and fluctuation in construction materials (Morris, *et al.*, 1990; Kaming *et al.*, 1997; and Mansfield *et al.*, 1994).

❖ ***A List of Critical Factors That Cause Cost Overruns:***

1. Incomplete design at the time of tender.
2. Additional work at owner's request.
3. Changes in owner's brief.
4. Lack of cost planning/monitoring during pre-and-post contract stages.
5. Site/poor soil conditions.
6. Adjustment of prime cost and provisional sums.
7. Re measurement of provisional works.
8. Logistics due to site location.
9. Lack of cost reports during construction stage.

❖ ***List of other Factors, which are Usually Ignored:***

1. Delays in issuing information to the contractor during construction delay.
2. Technical omissions at design stage.
3. Contractual claims, such as, extension of time with costly claims.
4. Improvements to standard drawings during construction stage.
5. Indecision by the supervising team in dealing with the contractor's queries in delays.
6. Delays in costing variations and additional works.
7. Omissions and errors in the bills of quantities.
8. Ignoring items with abnormal rates during tender evaluation, especially items with provisional quantities.
9. Some tendering manoeuvres by contractors, such as front-loading of rates.

The most important variables of cost overruns have been identified as: unpredictable weather, inflationary material cost, inaccurate materials estimates, complexity of the project, contractor's lack of geographical experience, contractor's lack of project type experience, and non-familiarity with local regulations (Kaming *et al.* 1997). Morris (1990) conducted a studied on the factors that influencing cost overruns in public sector projects, he found that escalation in costs is attributable partly to the fact that the original estimates were prepared at the then current prices, and partly to delays which enhance the effect of inflation and to direct escalation in costs arising out of change in scope, errors and mistakes etc.

Civil Engineering Construction Projects:

CE construction projects have been regarded as an essential project that contributes to the nation's economy both in terms of its benefits after completion and fundamental to meeting the nation's mobility needs to facilitate commerce, national defence, and growth (Hillebrandt, 2000; Fadhlin, 2004). The product of this CE is for public consumption not for the sake of the producer, (Ofori, 1998). CE projects involved many organizations and subcontractors that have the same functional role with their own objectives and pressure. However, for the CE projects to achieve its set objectives, the project manager has to manage overall costs, time and quality of action undertaken (Holmes *et al*, 1999). Shen and Wenquan, (2006) outline the characteristics of CE projects such as big in size, mostly government is the client's, high construction cost, the distinctive nature of demand, the unpleasant nature of the work, large series of technologies, and difficulty in the management of the project.

Methodology:

The research methodology adopted for this study is a questionnaire survey approach, the questionnaire survey was used in the field of studies the sample of individuals from a population with a view towards making statistical inference about the population using the sample (Groves *et al* 2009). It also used to pull out about public opinion, such as beliefs, perception, ideas, views and thought about some things. Therefore, the questionnaire survey is mostly used for scientific purposes, since it provides important information for all kinds of research fields, for example, the current situation on the ground, psychological perception and views of the population. However, the CE construction firms in Nigeria is being one of the biggest construction sectors in the construction industry, with different categories such as multinational, national and local construction companies scattered all over the country. These categories of CE construction companies have different professionals with different kind of knowledge and work jointly to produce the product of the companies and sometimes these professionals were in different workplaces. Therefore, in order to obtain the data required for the research work, a survey questionnaire was adopted as a results fragmentation and diversification of the CE construction firms in Nigeria.

Population and Sample Techniques:

In order to have a reliable data for this paper, questionnaire survey method was adopted for data collection, because of the CE construction firms are fragmented and diversified in nature with different types of professionals involved in the construction projects and sometimes at different location as mentioned above. Therefore in order to obtain the require population for this study, the CE construction companies in Nigeria were divided into three categories. These are multinational CE construction companies (foreign companies); national CE construction companies (indigenous companies that operate in every part of the country with many branches) and local CE construction companies (local companies that operate within a community or a state). This division was done to facilitate the right selection without bias. However, the stratified random sampling technique was adopted for the selection of the CE construction companies that participated in this research work. Thirty five (35) numbers of CE construction companies that fully participated in the CE construction projects were selected for the questionnaire survey. A total of three hundred and fifty (350) numbers of questionnaire were distributed to Engineers, Architecture, Quantity Surveying, Builders, Project manager, Information manager and others experts across the selected CE construction companies in Nigeria. However 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 two hundred and fifty three (253) numbers of questionnaire that were used for the regression analysis.

The Questionnaire Designed:

The questions in the questionnaire were designed based on the following items considered as KM benefits used to examine the significance impacts of KM practices on cost overruns in the CE construction projects, these are improved the knowledge and experience sharing to solved problems, improved the ability to respond to market and client needs; improved the economic profitability, reduce unnecessary cost especially variations and additional works, improved project delivery in terms of time, cost and quality, reduce the adjustment of prime cost and provisional sums and improved the standard of drawing during the construction process etc. The questionnaire that was used to record the responses of each participants contained mainly closed ended questions using a five- point Likert scale ranged from very none (1) to high (5). However, the scores of the participants were calculated based on the relevant items in the questionnaire as mentioned above.

Analysis of Data:

The starting point in data analysis was to convert the raw data recorded in the questionnaires into numbers and arrange them into SPSS version 18.0 databank for the analysis. Descriptive analysis was used to analyse the data collected from 253 participants in the CE construction companies in Nigeria. However, the mean statistic was used to simplify the arithmetic average of the values in the set, obtained by summing the values and

dividing by the number of values. In addition, the standard deviation was used for summarises the measure of the differences of each observation from the mains. The t-test was used to compare the values of the means of two samples and test whether it is likely that the samples are from populations having different mean value. When two samples are taken from the same population it is very unlikely that the means of the two samples will be identical. When two samples are taken from two populations with very different means values, it is likely that the means of the two samples will differ. The reliability test was conducted to confirm the reliability and validity of the statistical data, and also the internal consistency method was adopted for the cronbach alpha reliability coefficient. The factor analysis was also conducted to measure the ability or trait to data collected and also ensure the questions in the questionnaire are related to the study area.

Discussions and Findings:

Discussion of the Results:

The results obtained from the descriptive analysis and cronbach alpha analysis were summarized intabular form for clear understanding. The result was presented in tabular form as shown below.

Table 1: The reliability and validity of data.

KM attributes measured	Cronbach's Alpha	Cronbachs Alpha based on standardized items	Number of items
Knowledge capturing and storing	0.967	0.943	4
Knowledge sharing and re-using	0.865	0.872	3
Using database to create knowledge	0.754	0.756	4

Table 1 shows the cronbach's alpha values obtained from the KM attributes range from 0.754 to 0.967 respectively. This implies that the data is very statistical significance. Because the cronbach's coefficient has a value of more than 0.5 (Nunnally, 1978) and 0.7 (Nunnally and Bernstein, 1994) is considered adequate for such exploratory work. This implies that there is a high degree of internal consistency in the responses of the participants in the questionnaires.

Two hundred and fifty three participants from the selected CE construction firms were randomly selected to form the sampling frame. As shown in Table 2, the high value of 0.701 for the Kaiser-Meyer-Okin measure of sampling adequacy and the P value of 0.00 for the Bartlett's test of sphericity indicate that the analysis is significant in factor analysis.

Table 2: KMO and Bartlett's Test analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.701
Bartlett's Test of Sphericity	Approx. Chi-Square	1056.823
	Df	496
	Sig	.000

The factor analysis was used Varimax with Kaiser Normalization method to determine statistical validity.

Table 3: The level of impact of KM practices on cost overruns in the CE construction firms.

Items	Mean N=253	Std. Deviation	Remarks
Improved the knowledge and experience sharing to solve problems	2.02	0.966	These are top influence of KM on the cost overrun with the mean value greater than the overall mean value of 1.905 (Exploitive)
Improved the ability to respond to market and client needs	2.01	0.932	
Improved the economic profitability	2.01	0.962	
Reduce unnecessary costs especially variations and additional works.	1.96	0.974	
Improved the project delivery process in term of quality, cost and time.	1.95	0.823	
Reduced the adjustment of prime cost and provisional sums	1.94	0.881	
Enhancement of company's competitive advantage	1.93	0.840	
Improved the standard of drawing during the construction process.	1.92	0.824	
Integrate knowledge within construction company	1.91	0.845	
Improved the problems solving and decision making	1.91	0.838	
The problems of site/poor soil conditions easily identify with previous experiences	1.87	0.817	These are top influence of KM on the cost overrun with the mean values less than the overall mean value of 1.905 (Explorative)
Reduce construction rework problems	1.87	0.862	
Enhancement in personal capability	1.84	0.838	
Raise the morale of the spirit of works	1.79	0.780	
Improved the cost planning/monitoring during pre and post contract stage.	1.78	0.766	
Improvement in bidding performance	1.77	0.803	
Overall mean and standard deviation	1.905	0.859	

From the Table 3 overall mean and standard deviation of the 16 significant impacts of KM practice on the cost overrun in the CE construction projects are 1.905 and 0.859 respectively. These were used to conduct the T-test analysis to determine the level benefits of KM practices in the CE construction firms in Nigeria as shown in the Table 4.

Table 4: The Sample T- test of the significance impact of KM practices.

	t	Df	Test Value=0.05		95% Confidence Interval of Difference	
			Sig (2-tailed)	Mean Difference	Lower	Upper
Exploitive	141.024	9	0.000	1.906	1.8754	1.9366
Explorative	94.458	5	0.000	1.786	1.7380	1.8353

Table 4 shows the significant impacts of KM practices on cost overruns in the CE construction projects. The results obtained from the descriptive analysis shows the followings as the major top significance impacts of KM practices on cost overruns in the construction projects: improved the knowledge and experience sharing to solve problems; improved the ability to respond to market and client needs; improved the economic profitability; reduce unnecessary costs especially variations and additional works; improved the project delivery process in term of quality, cost and time; reduced the adjustment of prime cost and provisional sums; enhancement of company’s competitive advantage; improved the standard of drawing during the construction process; integrate knowledge within construction company and improved the problems solving and decision making. In addition, the results obtained from the independent T-test of these significant benefits of KM practices on cost overruns in construction projects (exploitive) shows that there is statistically significant differences with the P value of $0.000 < 0.05$ and the value of 95% level of confidence are lower value is 1.8754 and and upper value is 1.9366 respectively. This implies that KM practices are the best strategies and approach to eradicate the cost overruns problems in the CE construction projects. This is because the concept of KM is to create, capture store and share knowledge and experiences of professionals for re-use in the future projects in order to prevent the reinventing the wheels and also enhance the construction organisational efficiency and effectiveness in term of project delivery. This was in line with the results of studies conducted by Newcombe, (1999) and Ribeiro, (2005) that the knowledge associated with past construction works whether success or failure is a good resource that provides sustainable competitive advantage for construction organizations.

In other hand, the descriptive analysis shows the followings as thesecond major significant impacts of KM practices on cost overruns in the CE construction projects. These are: the problems of site/poor soil conditions easily identify with previous experiences; reduce construction rework problems; enhancement in personal capability; raise the morale of the spirit of works; improved the cost planning/monitoring during pre and post contract stage and improvement in bidding performance. Furthermore, the T test analysis shows that there is statistically significant differences with the P value of $0.000 < 0.05$ and the value of 95% level of confidence are lower value is 1.7380 and and upper value is 1.8353 respectively. This implies that the major causes of the cost overrun problems during the construction phase can be eradicated with the KM practices, because KM practices mean share experiences and skill and new knowledge among the employees for re-use to avoid the problems that have already solved to re –appear in the subsequent projects (Kasimu *et al.*, 2013). Ipe, (2003) stressed that knowledge sharing is significant, because it provides a link between he individual and the organization by moving knowledge that resides with individuals to the organizational level, where it is converted into economic and competitive value for the organization.

The findings of the Result:

The results acquired from the analysis shows that KM practices in the CE construction firms in Nigeria are now a necessity, because the practices of KM boost the construction organizational efficiency and effectiveness in term of the project delivery within the predetermine sum with good quality at the stipulated timeline. Since the CE construction firms in Nigeria have been criticized in term of delivery of a substandard project with time and cost overruns make the KM practice a necessity as other options of controlling cost escalation and good quality project delivery were tried and failed (Elinwa and Buba, 1993). From the results obtained KM practices are the only possible solution to time and cost overruns, disputes, poor planning and management, construction reworks, variations, conflicts during construction and unnecessary claims by contractors and supplies. This result took its origin from Tserng and Lin (2004) that KM involves creating, securing, capturing, coordinating, retrieving and distributing knowledge. Sometimes knowledge, experiences, and skills build during the construction phase of the projects exist in the minds of individual that participated in the construction works. This knowledge, experiences and skills can be re-used and shared among the professionals and other employees that participated in the construction projects in order to improve the construction process and reduce the time and cost of solving problems. Although sharing and reusing depends on the level of capturing, acquisition and

storage of the knowledge, experiences and skills during the construction works (Tserng and Lin, 2006). Similarly, Van Donk and Riezebos, (2005) added that KM is really a procedure that supports the construction organizations to create, organize, store, use, and share the lesson learnt, experiences, information and knowledge among the employees in order to stimulate the problem solution, continuous learning, strategic planning, and decision making. This is because the role of effective management of knowledge is evident in producing innovation, reducing project time, improving quality and customer satisfaction (Kamara *et al.*, 2002, Bresnen *et al.*, 2003; Chika *et al.*, 2008 and Adnan *et al.*, 2012). The knowledge associated with previous construction project's success and failure, services, customers and products are resources that can produce a long term and sustained competitive advantage for construction organizations (Adenfelt and Larserstrom, 2006). However, based the results obtained from the analysis, the frameworks of KM practices reduce the cost overruns was developed as shown in the Figure 3.

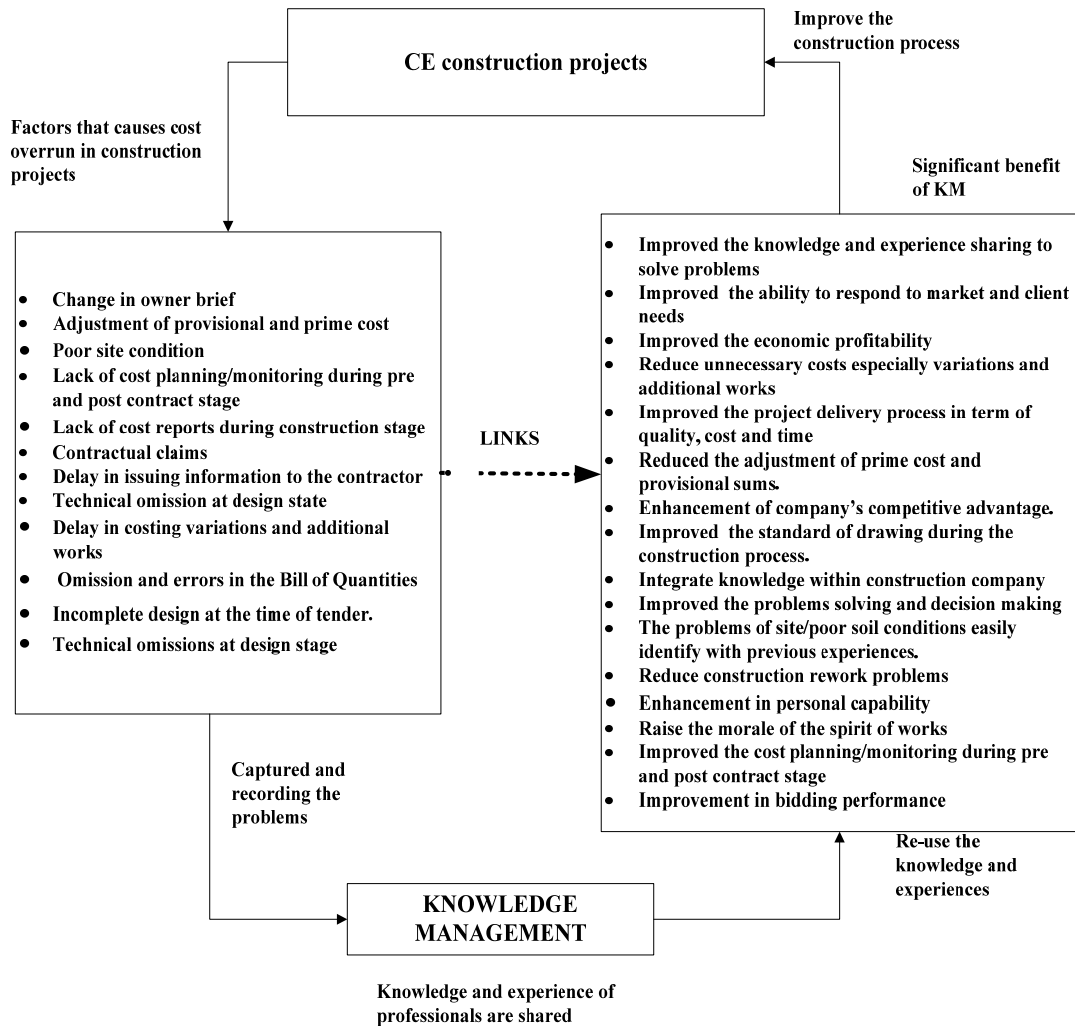


Fig. 3: The significant impacts of KM practices in the CE construction firms.

Conclusion:

The CE construction firms in developing countries especially in Nigeria is where the highest capital investment is made, and also is a strong competitive organization with high risk and low profit margin. These organizations faced the difficulty of construction delays, cost overruns, disputes, poor planning and design, construction reworks, mistakes/errors as a result of inexperienced employees and project delivering failures etc. These problems occurred as a result of ineffective and inadequate strategy/policy to manage the construction project problems. The effective policy/strategies to manage project problems is to capture, records, secure, store, and share these problems and their solutions among other professionals that involves in the construction works for re-use in the subsequent projects in order to prevent the mistakes/errors or the problems encountered before

to re-occurred in the subsequent projects. Tserng and Lin (2004) stressed that knowledge and experiences of engineers and experts are the most valuable, because their accumulation depends not only on manpower but also on the spending of much money and time. Considering the results obtained from the descriptive and T-test analysis that the KM practices improve the organizational performances and innovation. Therefore, the paper recommended that the each CE construction firm should develop strategies that will facilitate the full practices of KM in order to improve the organizational standard. The governments support the contractors to implement the KM in the construction organization in order to avoid time and cost overruns during the construction phase of the projects. The professionals and engineers that participated in the CE construction projects should be educated about the significance of KM practices in order to smooth the implementation of KM in the construction organization. The study's implication is that the study contributes to KM theory in general and especially to the theoretical underpinnings KM practices in the CE construction firms. The study revealed the factors that causes the cost overruns in the construction projects and also the significant benefits of KM practices were outlined. The finding of this study improves the understanding of KM in the construction firms by developing the conceptual framework of the significant benefits of KM practices in the construction project. This is because every day passes by problems occurs in the construction projects in different types and kinds, but if the knowledge and experiences of past projects are shared then it reduces the re-occurrence of such problems in the future and this is only possible ways the cost overruns can be reduced in the CE construction projects.

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