

CONSTRUCTION MANAGERS' (CMs) SKILLS AND PROJECT PERFORMANCE

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ABSTRACT

Stakeholders' attention in construction industry is always drawn to the issue of project performance as more project are characterised by cost over, time over and low quality of work. Different reasons for poor project performance have been identified among which is Construction Manager (CM) skills. This study therefore examines the relationship between CM skills and project performance of cost and time. 88 skills were identified from literatures and these were categorised under six major types; technical, managerial, legal, construction industry and business, people and financial skills. The study was conducted in Lagos state among randomly selected construction firms from sampling frame of Lagos State Tender Board and Building Price Book. Two sets of questionnaires were employed in gathering data for the study. A total of 145 questionnaires were distributed and 106 retrieved and valid for analysis representing 73% response rate respectively. The respondents were majorly CM and their superior. Using Principal Component Analysis with Varimax Rotation, six factors were extracted and a total of 28 skills indicators identified. Mean and Spearman Correlation Analysis were used in analyzing the data. The findings reveal that CMs possess all the identified skills and a significant relationship was found between overall CM skills and project performance of cost and time. It was therefore concluded that the more a CM possesses skills, the higher is the project performance in terms of cost and time. The study recommends that CM should be trained regularly to improve their skills and project performance.

Keywords: Construction, Construction Manager, Cost performance, Skills, Time performance

INTRODUCTION

The successful delivery of project in construction industry is of great concern to participant in the industry. It improves the profitability and competitive advantage of firms and generally promote good image of the firms. However, most construction projects experience cost overrun and time overrun (Dakas et al., 2004) and in some instances abandonment of the project (Ayodele & Alabi, 2011). The recurring question then is how to improve performance of construction project in terms of cost and time. Previous authors examines various ways of improving project performance vis-à-vis cooperative procurement procedures (Eriksson & Westerberg, 2011), Contractors' management capability (Aje, et al., 2009), Project characteristics (Cho, et al., 2009), Project health (Almahmoud, et al., 2012), Social capital (Di Vincenzo & Mascia, 2012), Supply chain relationship (Meng, 2012), Environmental factors (Akanni, et al., 2014), and Contractors/Project Managers skills (Jaafar & Khalatbari, 2013; Sunindijio, 2015; Windapo, et al. 2015). Construction Managers (CMs) skills are said to affect project performance (Langer et al. 2008), how then do CMs skills affect project performance in terms of cost overrun and

time overrun. Based on this, the study seeks to find the relationship between CMs skills and project performance with the aim of improving construction project performance.

Previous studies examined the relationship between project managers 'skills and project performance using cost and time. These were measured subjectively. However, few studies concentrated on objective measures of cost and time. For example, Sunindijo (2015) examined the relationship between project managers 'skills and subjective measure of cost and time performance, the results show that interpersonal influence has positive relationship with time performance while emotional intelligence, interpersonal skills, apparent sincerity and budgeting influences cost performance. Jaafar & Khalatbari (2013) focused on the relationship between knowledge and technical skills of project managers and time performance, again time performance was subjectively measured. The study found that time management; scope management and risk management have significant effect on project time performance. Also, skill types like managerial skills and legal skills were not considered in Jaafar and Khalatbari's study. There is therefore a gap in objective measure of cost and time performance of construction project, this study therefore seeks to fill the gap by examining the relationship between CM skills and objective measure of construction project cost and time.

The findings of the study will assist construction firms to focus their human resource training and development on skills that are essential for good project performance. This will also assist them to create an enabling environment where CMs can develop and make full use of their skills. The study focuses only on the relationship between six CM skills namely technical skills, people skills, managerial skills, construction industry and business skills, legal skills, and finance skills and objective measure of cost and time performance. All, other factors are not considered in the study. The subsequent sections focus on review of literature on CM skills and project performance, the methodological issues and findings and conclusion.

LITERATURE REVIEW

Construction Managers Skills

Rigby and Sanchis (2006) define skills as knowledge, abilities and experience acquired before employment and during careers while Odusami (2002) describes skills as ability that can be developed which is apparent in performance. Thus, CM skills can be said to be the knowledge, abilities and experience related to construction work acquired by CM before employment and during careers for improved performance. CM skills in construction project can be classified into various types.

Many studies such as Edum-Fotwe and McCaffer (2000) and Farooqui, et al. (2010) identify different project managers' skills types based on different classification. Goodwin (1993) identifies essential project manager skills as conceptual skill, human skill, negotiating skills and technical skills while Windapo et al. (2015) broadly classify construction project manager skills as managerial skills, technical skills, personal skills and legal skills. Managerial skills were further subdivided into leadership skill, negotiation skills, problem solving skills, project decision-making skills and communication skills.

Edom-Fotwe and McCaffer (2000) classify project manager skills as leading, communicating, negotiating and problem solving skills while Zadeh et al. (2016) concentrated on technical skills and human-related skills, Jaafar and Khalatbari (2013) focus on technical skills of project managers only. Sunindijo (2015) skills types include conceptual skills, human skills, political skills and technical skills. The interesting thing about the various categorizations of skill types is the fact that each skills types are further broken down into different types. Odusami (2002) identifies important skills of project manager as decision making, communication, leadership and motivation, problem solving, time management, organizing. Others include, planning and goal setting, technical knowledge, financial management, quality management, listening, delegating and negotiating. Conceptually, CM skills in this study can be classified as technical skills, managerial skills, legal skills, people skills, construction industry and business skills and finance skills.

Technical skill is a basic requirement in the implementation of projects including construction projects. According to Goodwin (1993), technical features of a project represents the elements of a project which must be integrated into the other elements of the system and conform to project requirement of cost, time and specification. In essence, technical skills are needed for integrating technical features of a project to conform to project requirement in terms of quality, time and cost. Katz in Goodwin (1993) defines technical skill as skill that entails understanding and proficiency in specific kind of activity majorly involving methods, processes, procedures or techniques. Technical skill further entails specialized knowledge, analytical ability within the specialty and facility in the use of tools and techniques of specific discipline. Technical skills are further broken into forecasting techniques skills, site layout and mobilization skills, material procurement, operation research, technical writing, design activities and background, reading and understanding drawings, construction management activities, planning and scheduling, estimating and tendering, productivity and cost control, work study, plant hire and management and quality control, information and documentation, quality project structure, control and report, start-up and close out (Edum-Fotwe & McCaffer, 2000; Jaafar & Khalatbari 2013).

Managerial skills are skills require for making business decisions and leading subordinates in an organisation. Edum-Fotwe and McCaffer (2000) identify CM managerial skills as leadership, time management, decision making, negotiation, delegation, strategic planning, human behaviour, motivation and promotion, recruitment, team working and top management relations. Farooqui et al. (2010) divide managerial skills required of CM into fifteen. They are health and safety management, quality assurance/total quality management, inspection/quality control, organizational, document control, project management administration and cost control. Others include leadership, team building, site planning and management, personnel/resource management, risk planning, assessment and control, productivity management, managing labour issues, knowledge and information management and financial management. Windapo et al. (2015) managerial skills include leadership, negotiation, problem solving, project decision-making and communication.

Financial skills are skills that involve competency in reporting systems, project finance arrangement, investment appraisal, VAT and taxation, stock control and evaluation, establishing cash flows and lastly, establishing budgets (Edum-Fotwe & McCaffer, 2000).

CIB skills: Farooqui et al. (2010) industrial and business skills include knowledge of health and safety regulations, knowledge of building codes and regulations, knowledge of environmental impact assessments, marketing with clients/developing client relations, knowledge on permitting process, construction trade knowledge. Others include understanding procedural issues, understanding cultural issues, appreciation of construction industry supply chain and partnering.

People skills: Elements of people skills are written communication, verbal communication, diversity, trade coordination, ability to speak different language /multilingual, meetings, managing relationship/networking/collaboration, motivation capabilities, negotiations/conflict resolution, coaching and mentoring (Farooqui *et al.*, 2010).

Legal skills include skills on general legal background, drafting contracts, industrial relations, health and safety issues, preparation of claims and litigation and lastly trade unions and public authorities (Edum-Fotwe and McCaffer, 2000). Farooqui et al. (2010) identifies legal skills as interpreting contract documents, knowledge of construction law and legal environment, contract administration skills, knowledge of bidding procedures, dispute avoidance and resolution skills, knowledge of project delivery and contracting strategies, change management, understanding labour laws, claims preparation and presentation skills and lastly claims defence skills.

Project Performance

The main objective of construction project is to complete project within the stated criteria, which serve as the measure of performance. Mwita (2000) defines performance as a multidimensional concept for achieving stated goals. Most performance measures in construction industry are at the project level and are measured in terms of cost, time and quality (Chan et al., 2002).

The determinant of project performance in terms of cost is the final cost of construction project. Cost can be measured using cost or percentage of net variation over final cost (Chan, 2001). Unit cost is a measure of relative cost and is defined as the final contract sum divided by gross floor area. Percentage net variation over final cost is the ratio of net variations to final contract sum expressed in percentage form (Chan, 2001). The budget of a project at the beginning is usually use as reference point to determine cost overrun (Love, 2012). The cost performance of project is measured by comparing the budget cost to the final cost of the project which is usually in percentage. Previous authors like Meng (2012), Memon, et al. (2012), Ade-Ojo and Babalola (2013) measure the performance of project based on cost overrun. The results show that most construction project performs poor due to cost overrun.

Timely completion of construction project is one of the objectives of construction project, it is therefore important that a project is completed within the stipulated time. Previous authors like Xiao and Proverbs (2002) measures project performance in terms of time. According to Chan (2001), time can be measured in terms of construction time, speed of construction and time overrun. He explains construction time to be absolute time from project commencement date to practical completion date, Speed of construction as gross floor area divided by the construction time in day/weeks. Variation is measured as percentage of increase or decrease in the estimated project with reduction of extension of time granted by the client.

CM skills and project performance

Previous studies (Langer et al., 2008; Haggerty, 2000; Jaafar and Khalatbari, 2013; & Windapo et al., 2015) found a relationship between CM skills and project performance. It was also discovered that CM skills play a very important role in project delivery. Therefore, it could be said that CM skills affect project performance in terms of project cost and time through the skills types possessed by CM.

As mentioned previously, several studies tested the relationship between CM skills and project performance, although most studies focused on subjective measure of project performance in terms of cost and time. Jaafar and Khalatbari (2013) propose a framework showing the relationship between knowledge and technical skills of project managers and time performance of power plant in Iran. The framework focuses on subjective project time performance only with exemption of cost performance. It also focuses on technical skills of project managers.

Sunindijo (2015) examined the relationship between PM skills of conceptual, human, political and technical skills and performance measure of scheduling, budgeting, quality performance, document and contract administration, risk management and procurement management. The results show a positive relationship between four CM skills of emotional intelligence, interpersonal skill, apparent sincerity and budgeting and project cost performance. Only one skill type of interpersonal influence has a positive relationship with project time performance.

Awan et al. (2015) investigated the relationship between soft leadership skills of project manager and project success. They conceptualized soft leadership skills of project manager as communication, interpersonal coordination, team building and delegation, problem finding, analyzing and solving skills. A significant positive relationship was found between each soft leadership and project success.

The relationship between the number of skills possessed by construction project managers and project performance in Lagos state was examined by Windapo et al. (2015). The independent variable which is construction project managers' skills were measured using communication, leadership,

decision making, problem solving, technical, personal effectiveness, negotiation and legal. The dependent variable was measured as the degree of client satisfaction with the project. The result shows a relationship between the numbers of skills CM possessed and project performance based on client satisfaction. The study did not consider cost and time as project performance.

Mixed results have been reported on relationship between skills and project performance. Based on this, it is thus hypothesized that:

- H1. There is no significant relationship between skills types possessed by CM and project cost performance.
- H2. There is no significant relationship between skills types possessed by CM and project time performance.

Based on the different skills types identified in literature above, the following are conceptualized to be skill types possessed by CM; Technical skills, Managerial skills, Legal skills, Finance skills, Construction Industry and Business skills and People skills.

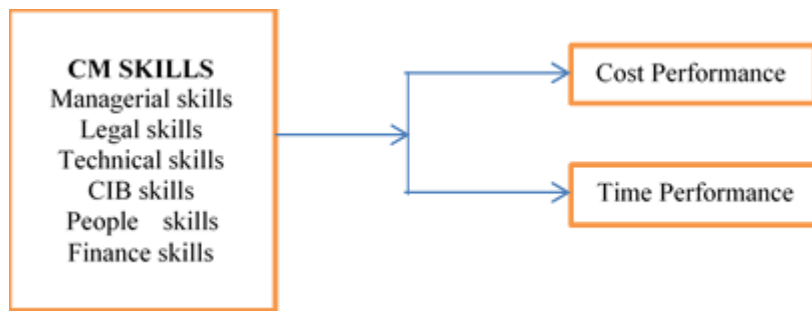


Figure 1: Relationship between CM Skills and Project Performance

METHODOLOGY

The research design adopted for this study is cross-sectional survey research. Two questionnaires were designed to find the correlation between CMs' skills and project performance. To achieve this goal, the first questionnaire measures the skills types of CMs while the second questionnaire is based on the initial and final cost and time of building projects. The samples for the study were selected from a sampling frame of construction companies in Lagos state. The sampling frame is gotten from the Lagos State Tenders Board list of registered construction contractors and Building price book. The list consists of 200 registered contractors. To arrive at the sample size, random sampling technique was employed in which every sample in the population has equal chance of being selected. Thus, a total of 145 questionnaires each was distributed from 134 sample size calculated using Yamane formular in equation 3.1. The construction projects used in this study were purposively selected based on the most recent completed building project executed by the selected firms. The CM in charge of the selected projects and his/her superior were thus asked to fill the questionnaires. A total of 106 questionnaires were retrieved and valid for analysis representing 73% response rate.

$$n = N/1 + (e^2) \qquad \text{eqn. 3.1}$$

Where n = Sample size
 N = Population size
 e = Level of precision (5%)

Based on the six CM's skills identified in literature, a supervisor's rated questionnaire was constructed. The questionnaire was partly adapted from Edum-Fotwe and McCaffer (2000), Farooqui et al. (2010), Jaafar and Khalatbari (2013) and Windapo et al. (2015). CMs superiors were asked to rate the skill types possessed by CM on a two-point scale of Yes =1 and No =2. The skill types were measured using latent and observable variables. The latent variables were broadly divided into managerial skills,

legal skills, technical skills, CIB skills, people skills and finance skills based on the literatures mentioned above. Managerial skill was measured with 22 items namely: leadership skills, time management skills, decision making skills, and so forth, legal skill has 11 items among which are: negotiations/Conflict resolution skills, interpreting contract documents skills, claims preparation and presentation skills. 17 items were used to measure technical skill (site layout and mobilization skills, material procurement skills, planning and scheduling skills, and so forth). 15 items were also used to measure CIB skills (knowledge of building codes and regulations, marketing with clients/ developing client’s relations skills, knowledge of the permitting process, and so forth.). People skill was measured using 8 items (written communication skills, verbal communication skills, ability to speak different languages/ multilingual skills, and so forth.) Finance skill consists of 7 items (establishing cash flows skills, establishing budgets skills, finance reporting skills and so forth.).

Project performance was measured objectively using initial and final cost and initial and final duration of construction project. Initial project cost means the calculated cost of the project forecasted at the inception of the project measured in Naira while final project cost is the total cost of the project at the end of the project, also measured in Naira. Initial project time is the calculated time estimated at the beginning of the period measured in months while final project time is the total time spent on the project measured in months.

Project cost performance was further analysed using final contract sum minus initial contract sum divided by initial contract sum multiplied by 100. Project with percentage cost overrun above 20% was regarded as poor project and assign numeral 1, project with percentage cost overrun between 10% and 20% was regarded as average and assign numeral 2 and finally project with percentage cost overrun below 10% was regarded as outstanding project and assign numeral 3. This was based on Kometa et al. (1996).

Project time performance was also measured in terms of time overrun using final contract duration minus initial contract time duration divided by initial contract time duration multiplied by 100. Project with percentage contract duration above 20% was regarded as poor project and given numeral 1, project with contract duration between 10% and 20% was given numeral 2 and regarded as average. Finally, project with contract duration below 10% was regarded as outstanding and given numeral 3. This was also based on Kometa et al. (1996). Table 1 presents the percentage cost overrun and time overrun for 10 of the selected projects.

Table 1: Cost Overrun and Time Overrun for Selected Projects

S/N	IC (N)	FC (N)	CD (N)	IT(Mts)	FT (Mts)	TD (Mts)	% CO	% TO
1	720000000	615000000	-105000000	12	8	-4	-17	-33
2	130000000	94762600	-35237400	9	7	-2	-37	-22
3	79000200	84761849	5761649	10	11	1	7	10
4	40000000	35004720	-4995280	4	3	-1	-14	-25
5	800000000	725000240	-74999760	9	7	-2	-10	-22
6	600000000	700254236	100254236	9	7	-2	14	-22
7	900000000	1300000000	400000000	14	19	5	31	36
8	3000000000	3500000000	500000000	36	48	12	14	33
9	450000000	455000000	500000	12	12	0	1	0
10	80000000	80000000	0	5	5	0	0	0

Notes: IC- Initial Cost, FC- Final Cost, CD- Cost Difference, IT-Initial time, FT- Final Time, TD- Time Difference, CO- Cost Overrun, TO- Time Overall, Mths- Months, N- Naira

The values of cost overrun and time overrun in Table 1 show that the project cost and time performance based on Kometa et al. (1996) categorisation fall within the categorisation of poor, average

and outstanding performance. This confirms that the building projects considered are all within the range of poor, average and outstanding.

The Eighty CM skills were factor analyzed using principal component analysis with Kaiser Normalization and varimax rotation. The analysis extracted 6 factors with eigenvalues ≥ 1.00 . 28 items were extracted from the original 80 items based on Stevens in Field (2005) recommendation; a factor loading is significant when it is greater than .512 for sample size of hundred. The 28 items were further classified under Six factors of CM skills namely; CIB skills with 7 items, Technical skills with 6 items, Finance skills with 5 items, Legal skills with 4 items, Managerial skills with 4 items and others skills with 2 items. See Table 2 for details.

Table 2: Factor Analysis of CM Skills

CM SKILLS	1	2	3	4	5	6
CIB SKILLS						
Knowledge of the permitting process	0.829					
Awareness of industry trends skills	0.808					
Understanding complimentary fields/ disciplines skills	0.684					
Marketing with clients/ Developing clients relations skills	0.684					
Knowledge of environmental impact assessments	0.661					
Construction trade knowledge skills	0.655					
Knowledge and information management skills	0.642					
TECHNICAL SKILLS						
Knowledge of construction materials		0.887				
Knowledge of construction equipment		0.845				
Construction management activities		0.733				
Planning and scheduling skills		0.572				
Material procurement skills		0.54				
Health and safety management skills		0.519				
FINANCE SKILLS						
Stock control and evaluation skills			0.804			
Establishing budgets skills			0.742			
Establishing cash flows skills			0.729			
Finance reporting skills			0.676			
Investment appraisal skills			0.634			
LEGAL SKILLS						
Interpreting contract documents skills				0.818		
Knowledge of bidding procedures				0.78		
Diversity skills				0.642		
Knowledge of construction law and legal environment				0.603		
MANAGERIAL SKILLS						
Human behaviour skills					0.831	
Motivation and promotion skills					0.655	
Recruitment skills					0.63	
Delegation skills					0.573	
OTHERS						
Project management/administration skills						0.769
Document control skills						0.765

Extraction Method: Principal Component Analysis
 Rotation Method: Varimax with Kaiser Normalization
 a Rotation converged in 6 iterations

To determine the skill types possessed by CM, the mean of each skill variable was calculated. For the purpose of interpretation, skills with mean value between 1-1.50 were interpreted as ‘Yes’ while the skill types with mean value between 1.51-2.00 were interpreted as ‘No’. The result is presented in Table 2. CM possessed all the skill types with mean value ranging from 1.06 to 1.18. Overall, CM possessed all the skills types with mean value 1.12 and SD 0.15.

Table 2: Skills types possessed by CM

CM Skills	Mean	Std. Deviation	Remark
Technical	1.06	0.17	Yes
Legal	1.09	0.22	Yes
Others	1.11	0.23	Yes
CIB	1.12	0.24	Yes
Management	1.13	0.24	Yes
Finance	1.18	0.29	Yes
Combined CM Skills	1.12	0.15	Yes

Note: 1-1.50 = Yes, 1.51-2.00 = No

To determine the relationship between CM skills and project performance and to test the hypothesis ‘there is no significant relationship between CM skills and project cost and time performance. Spearman non-parametric correlation analysis was employed. This was because the data were not normally distributed. Table 3 presents correlation analysis results. When all the CM skills are combined together, the result shows a significant positive relationship in CM skills and project performance, thus the hypotheses were rejected at $p \leq 0.05$. The combined CM skills namely CIB, Technical, Finance, Legal, Management and other skills relate with cost performance ($r = .229$, $p = .018$) and time performance ($r = .219$, $p = .024$). The implication is that the combined CM skills have influence on cost and time performance. The result in Table 3 also shows a non-significant relationship between individual CM skills and project cost and time performance except for legal skills. Legal skills have a significant relationship with cost performance ($r = .226$, $p = .020$) and time performance ($r = .201$, $p = .039$).

Table 3: Correlation between CM skills and project performance

CM Skills		Cost Performance	Time Performance
CIB	Correlation	0	.072
	Significance	.998	.461
Technical	Correlation	.071	.047
	Significance	.472	.634
Finance	Correlation	.182	.155
	Significance	.062	.112
Legal	Correlation	.226*	.201*
	Significance	.02	.039
Management	Correlation	.151	.086
	Significance	.123	.381
Others	Correlation	.032	-0.006
	Significance	.744	0.948
Overall CM skills	Correlation	.229*	.219*
	Significance	.018	.024

*Correlation is significant at the 0.05 level (2 tailed)

RESULTS AND DISCUSSIONS

From table 2, there is an indication that CMs who participated in the study have all the skills types (technical, legal, CIB, management, finance and others) with mean value of 1.12. The standard deviation which ranges from 0.17- 0.29 shows that there is little fluctuation on the level of agreement among the respondents on whether CM possesses the skills types. Ogundele et al. (2014) described the possession of skills as the act of acquiring productive assets which are transferred to the task. Thus, CM possessed skills that are transferrable to their task. While some CMs have little knowledge on different skills types, others have detailed knowledge. The level of skill possession determines the competency level of CM. The result is in line with Abas-Mastura et al. (2013) in which skills required for task were sufficiently acquired by employees. The result of the study also confirms Oladiran (2015) findings in which professionals working in construction firms were said to possess different skill types which are paramount in the execution of their task.

In finding the relationship between CM skills and project performance, a significant relationship was found between overall CM skills and project performance. This implies that CM skills influences project cost and time performance and an increase in overall CM skills will lead to an increase in project cost performance. Hence, when CM possesses the identified skills, there will be decrease in project cost and time overrun. This is in line with Jaafar and Khalabari (2013), Sunindijo (2015), Windapo et al. (2015) findings on the relationship between skills and project performance in which it was all concluded that there is a significant positive relationship exists between skills and project performance. This shows the importance of skills to CM in project execution as combination of the different skills will enhance and improve the performance of CM and subsequently the project.

Surprisingly, of all the individual significant CM skills identified in the study, only legal skills have significant relationship with project cost ($r = .226$, $p = .02$) and time ($r = .201$, $p = .039$) performance. This shows that the more a construction manager possesses legal skills, the better the cost and time performance in construction project. This also implies that when CMs have the skills of interpreting contract documents, knowledge of bidding procedures and knowledge of construction law and legal environment, then there will be better performance in terms of reducing cost and time overrun. Atout (2008) succinctly express that document control and proper detailed recording of contract document in a systematic way during construction period is one of the functions of CM. Thus, CM must possess legal skills to be able to perform this function which has strong impact on project cost and time performance.

CONCLUSIONS AND RECOMMENDATIONS

Cost and time performance is determined by different factors among which are the skills of CM. This study investigated the relationship between CM skills and project cost and time performance in Lagos state Nigeria. It was observed that CMs possess finance, legal, managerial and technical skills. Also, CM skills influences project performance and the more CM possess these skills; the more they perform better in terms of cost and time performance. Therefore, it can be concluded that increase in CM skills acquisition will lead to higher project cost and time performance. Based on this, CMs should focus on developing the identified significant skills so that they perform better in terms of cost and time performance. Construction firms should train their CMs for them to possess technical, managerial, legal and finance skills. They should focus their training and development in the areas of significant skills identified in the study. Future research should focus on replicating this study in other locations in the country and also focus on predicting project performance from CM skills.

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