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CONTRACTORS' PREQUALIFICATION CRITERIA AND CONSTRUCTION PROJECT COST PERFORMANCE

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ABSTRACT

Purpose: Project failure in Nigeria could be linked to poor procedures for selection of contractors, among other causes. This study aimed at examining the impact of Contractor Prequalification Criteria (CPC) on cost performance of construction projects with a view to developing a model for predicting cost performance from prequalification criteria
Design/methodology/approach: A well-structured questionnaire was used to gather data from the construction professionals who were registered members of their professional institutions, drawn from contracting, consulting and public client organisations in Ondo State, Nigeria. A sample size of 171 was calculated from the sample frame of 350 using Digeebird statistics sample size calculator at 10% confidence interval and 95% confidence level. Stratified random sampling technique was adopted for the administration of the research instrument. The data were analysed using frequency table and percentage, factor analysis, relative important index (RII), and regression model.
Findings: The results indicate a strong relationship between contractors' prequalification criteria and project cost performance as validated with F value significant at 0.000
Research limitations/implications: It is suggested that more emphasis should be placed on health and safety practices, management capability, organisation reputation, and work experience and capability as they have shown to have impact on cost performance.
Originality/value: The study develops a useful model for predicting cost performance from prequalification criteria by construction practitioners and clients.

Keywords: Contractors; Construction project; Cost performance; Criteria; Prequalification.

1. INTRODUCTION

Selecting a contractor that can complete a construction project satisfactorily is a crucial decision to be made by client to achieve a project completion within the specified budget (Hatush & Skitmore, 1997). This is due to the uncertainty facing construction project and the situation may be worsen if an inappropriate contractor is chosen. A contractor's capabilities are required to be thoroughly evaluated using the appropriate criteria so as to avoid cost overrun, litigation, and insolvency.

Ajayi (2010) observed that the widely used lowest tender award technique has been abused, especially in Nigeria. Olatunji (2007) found that approximately 25 percent of respondents view the lowest bid option that seeks to save costs as a wrong approach because

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the project is at risk of failing to achieve optimum performance if the entire project life circle is considered. Hatush and Skitmore (1997) opined that lowest bidder approach affects the project performance, and the burden is borne by the client. It is now evidenced that selection of contractors by prequalification has clearly been a shift away from the lowest price wins concept to multi-criteria selection technique. Also, new criteria for contractor selection are continually been added due to the sophisticated nature of construction projects and radical change in the construction industry. Prequalification is of no use until the impact of each criterion on the main goals of the project is understood. Hence, the need for this study to evaluate the current contractors' prequalification requirements in use in the Nigerian construction industry and to determine their relationship on project cost performance. Thus, the study is aimed at evaluating the impact of the prequalification criteria of contractors on construction project cost performance with a view to developing a model for predicting cost performance from prequalification criteria. The objectives of the study are to: examine the level of importance of contractors' prequalification criteria from the perspective of client, consultant and contracting organizations; assess the cost implication on construction project; examine the relationship between contractors' prequalification criteria and construction project cost performance. The study also hypothesised that there is no significant relationship between contractor prequalification criteria and project cost performance.

2. LITERATURE REVIEW

2.1. Contractor Prequalification Requirements

The need to prequalify contractors is widely recognised and globally accepted, especially for major construction projects. It is therefore necessary to collect and analyse data about the contractor and the company as a whole. A contractor's financial soundness tackles monetary issues, making sure asset and available resources meet not only the required demand but also with the quality efficiency and cost (Jerome, 2005). The financial functionality of a contractor is linked to bank credibility, which offers an indicator of the contractor's financial capacity and their relationship with banks in the event of indebtedness. The yearly balance sheet accounting record of the firm, which indicates the financial position may be used to assess a contractor's financial credibility. Technical capability is principally concerned with the past experience that is still recent and shows ability and capability significant to a monetary edge in any of the recommended field of work to be executed. In order to match the prerequisites, the contractor must tender the detailed information of work that include past experience on similar work, including the method statement and outline program. Also, complexity of work executed, size of project completed, types of past project completed, curriculum vitae of technical staff, quality of personnel, ability of contractor and plant and equipment owned will all be supplied. (Jerome, 2005; Oke & Aje, 2012).

Ajayi (2010) stated that the contractor's management capability is a measure of the quality of work executed in the past, quality assurance policy of the company, possession of quality assurance certificate, experience of technical personnel, management knowledge, curriculum vitae of management staff and project management organisation. It can be seen that the criteria deal with important issues in relation to the key principals who will be engaged with the work. Furthermore, the efficient management of site aids the project cost performance. The experience of quality personnel is hugely required on site to achieve good quality of any construction project (Gransberg & Riemar, 2009). The safety information relates to the reduction of construction costs by means of accident control through client

selection of safe contractors (Oke & Aje, 2012). Proverbs, Oloke and Heasom (2007) further explained that health and safety competence does not only determine safe performance but also guarantee that a construction activity can be carried out practically in a best achievable way without any form of accident. Several factors are checked by the safety officer during the pre-award meeting, this includes safety record available, company safety policy, level of adherence to health and safety policy, accident book, and provision of health and safety regulation. Organization reputation is the identity and character of the contractor's officers, principals, and owners, also the capacity of the firm, knowledge and qualifications of each of its officers, principals, and the key personnel in the organisation (Eady, 2007). However, Alarcan and Mourgues (2002) observed that the evaluation of the image and reputation of contractors is difficult to measure because it is subjective. Aje (2012) and Ajayi (2010) observed that organisation reputations are assessed on the basis of past failure in completed project, number of years in construction, percentage of previous work completed on schedule, evidence of incorporation/business name registration, evidence of tax/VAT clearance, registration with state/federal ministry, certificate of work already completed and past client relationship.

2.2. Project Cost Performance

Historically, clients are mostly concerned about the cost of their projects. Most clients want to know how much the projects will cost before the inception of the projects so that cost can be managed efficiently and effectively (Hatush & Skimore, 1997). The rate of facilitation of the general conditions in executing a project within the calculated budget is known as cost performance (Abdelnaser & Siti, 2011). The commonly used methodology in the construction industry to calculate cost performance is the cost variance (Salter & Torbett, 2003). Furthermore, the method of calculating cost variance takes into consideration not only the tender sum but also other costs incurred in a project from inception of the project to the final completion. The total cost covers all the costs involved in altering, adjusting and even the costs incurred in settling any dispute, such as litigation or arbitration during the construction period. Cost variance is the difference of project earned value and actual cost (Chan & Tam, 2000). The project is on budget when cost variance is zero but over budget when the value of cost variance is negative. However, the project is termed under budget when the value of cost variance is positive.

This study shall measure cost performance as the percentage change in the initial contract sum over the final contract sum. According to Ajayi, Ogunsanmi and Idoro (2016), projects whose percentage fall below 0% are very good, 0%-5% are good, 6%-10% are satisfactory, 11%-19% are poor while those greater than 20% are very poor.

3. METHODOLOGY

The population of the study comprised construction professionals that are registered members of their professional institutions drawn from contracting organisation, consulting organisation and public client organisation in Ondo State, Nigeria. The list of the construction professionals was obtained from their individual professional association. A sample size of 171 was calculated from the sample frame of 350 using Digeebird statistics sample size calculator at 10% confidence interval and 95% confidence level, but for factor of safety, the survey sample was 189. A total of 44 were Architects, 23 were Builders, 44 were Civil Engineers, and 60 were Quantity Surveyors. Stratified random sampling technique was used in administering the research instrument to the professionals. The 189 questionnaires administered were all found usable for analysis and were analysed with

SPSS version 21.0 using frequency table and percentage, factor analysis, relative important index (RII), and regression model.

The well-structured and self-administered questionnaire was designed to gather data on the level of importance of contractors' prequalification criteria, and cost performance indications on construction project. The respondents were to express their opinions on the level of importance of the 37 listed Contractor's Prequalification Criteria (CPC) on a Likert type scale of 5, ranging from "Very important" = 5, "Important" = 4, "Moderately important" = 3, "Slightly important" = 2, to "Not important" = 1. In addition, the respondents were to provide the initial contract sum and final contract sum of any project they have been involved in for the last five (5) years in relation to the CPC.

The percentage cost performance indication was calculated using:

$$\frac{final\ contract\ sum - initial\ contract\ sum}{initial\ contract\ sum} \text{ x } 100 \text{ …… eqn.1}$$

The equation of model for cost performance was derived using:

$$Cp = \beta_{\circ} + CSC_1\beta_1 + CSC_2\beta_2 \cdots\cdots\cdots\cdots + CSCn\beta n \text{ …….. eqn. 2}$$

where: $Cp = Cost\ Performance, \beta_{\circ} = Constant,$ CSC = Contractor selection criteria that were significant with a prior expectation $\beta > 0, \beta_2 > 0, \cdots\cdots\cdots\cdots \beta n > 0.$

4. Presentation and Discussion of Results

4.1. Demographic Characteristics of the Respondents

Table 1 highlights the summary of the respondents' demographic characteristics. The Table shows that 49.2% of the respondents work with a contracting firm, 38.1% work for a consultancy firm while 12.7% work for public firm. The result also shows that 41.3% of the respondents have postgraduate qualifications, 55.5% have at least Higher National Diploma while 3.2% have other qualifications. Furthermore 34.9% of the respondents are Quantity Surveyors, 25.9% are Civil Engineers, 25.9% are Architects, 13.2% are Builders. On membership of professional institutions, the result shows that 56.1% of the respondents are on graduate membership grade, 40.2% are on corporate membership grade while 3.7% are on fellow membership grade. Moreover, 62.3% of the respondents have been in construction business for over 5 years and 50.8% have been involved in more than three numbers of prequalification over the last five years. From the analysis, the respondents have adequate exposure and experience in contractor selection process. Hence, the data provided are reliable for analysis.

4.2. Factorizing CPC Variables

Factor analysed using principal component analysis with Kaiser–Meyer–Olkin (KMO) sampling adequacy, Bartlett test of sphericity and Varimax rotation was used to categorized the 37 variables listed on the CPC. From Table 2, KMO measure of sampling adequacy was 0.899, meaning the sample was suitable for factor analysis as it was greater than the acceptable value of 0.5. The Bartlett Test of Sphericity showed the significant level of 0.000, less than 0.050, which further affirmed the suitability of the variables for factor analysis as correlation matrix was not an identity matrix. The analysis extracted 8 components with eigenvalues ≥ 1.00. A factor loading of 0.4 was used to suppress the small coefficient. After the Varimax rotation, 7 factors were derived from the 8 components due to the non-convergence of the eighth component. 31 variables were extracted from the original 37 variables listed on the CPC and the variables were categorized under the 7 factors namely: Health and Safety practices, Management capability, Personnel capability,

Organization reputation, Financial capability, Work experience and capability and Technical capability.

Table 1: Demographic characteristics of the respondents

	Frequency	**Percentage**
Types of Organization		
Contracting Organization	93	49.2
Consulting Organization	72	38.1
Public Clients Organization	24	12.7
Total	189	100.0
Academic Qualification		
Diploma	14	7.4
Bachelor	91	48.1
Masters	76	40.2
Doctorate	2	1.1
Others	6	3.2
Total	189	100.0
Professional Discipline		
Quantity Surveying	66	34.9
Civil Engineering	49	25.9
Building	25	13.2
Architecture	49	25.9
Total	189	100.0
Professional Qualification		
Graduate member	106	56.1
Corporate member	76	40.2
Fellow	7	3.7
Total	189	100.0
Respondent's years of experience in the construction industry		
Less than 5years	71	37.6
6-10years	67	35.4
11-15years	22	11.6
16years and above	29	15.3
Total	189	100.0
Number of prequalification over the past five years		
1-3	93	49.2
4-6	51	27.0
7-9	16	8.5
10 and above	29	15.3
Total	189	100.0

Table 2: KMO and Bartlett's Test

			Remarks
KMO measure of sampling adequacy		0.899	Good KMO
Barlett's test of sphericity	Approx. Chi-Sqare	4217.630	Not Identity matrix
	Df	666	
	Sig.	0.000	

4.3. Level of Importance of Contractors' Prequalification Criteria among Contracting, Consultant and Public Client Organisation

From Table 3, under health and safety practices criteria, the top most ranked factors were level of adherence to health and safety regulation (RII =0.89), safety record available (RII =0.881), provision of health and safety regulation (RII =0.878) and company safety policy (RII =0.875). the least ranked factors were, experience modification rating (RII =0.838) and accident book (RII =0.803), which could be as a result of no record data for accident and injury on a construction site. Under managerial capability criteria, factors ranked highest were management knowledge (RII =0.855), project (business) management organisation (RII =0.853), quality assurance policy of the company (RII =0.834) and possession of quality assurance certificate (RII =0.82). This indicated that management knowledge is the managerial assurance that a contractor can successfully carryout the bidding project. It's the first insight, evidence and assurance of determining a contractor's capability to satisfactorily carry out a project by assessing the overall experience and knowledge of the managerial staff. The least ranked managerial capability were curriculum vitae of management staff (RII =0.811) and experience of geographical location of the place. Table 3 further showed that personnel capability criteria are very important as all the factors had relative important values above 0.9. The highest ranked factor was ability of contractor (RII =0.931), followed by quality of personnel (RII =0.929) and experience of technical personnel (RII =0.912). Under organisation reputation, the results indicates that evidence of incorporation or business name registration (RII =0.91), evidence of tax/VAT clearance (RII =0.888), and certificate of work completed (RII =0.877). The least ranked was registration with state/federal ministry (RII =0.859). On financial capability of contractors, most important financial capability criteria were company audited account (RII = 0.832), and income statement (RII =0.806). The least overall financial capability criteria were current fixed asset (RII = 0.775) and credit rating system (RII =0.766). This is an indication that the banking sectors do not encourage contractors sourcing for capital from them because construction projects are full of uncertainties. For overall work experience and capability criteria, the most ranked were: percentage of previous work completed on schedule (RII =0.906), number of years in construction (RII = 0.902), and the least ranked was past failure in completed project (RII =0.846). The overall ranked of technical capability were past experience on similar work (RII =0.965), past performance and quality (RII =0.929) and plant and equipment owned (RII =0.876).

Table 3: Relative Importance Index for Contractors' Prequalification Criteria

	Contracting Organisation		Consulting Organisation		Public client Organisation		Overall	
	RII	R	RII	R	RII	R	RII	R
Health and Safety Practices								
Level of Adherence to Health and Safety Regulation	0.908	1	0.9	1	0.792	3	0.89	1
Safety Record Available	0.895	2	0.889	3	0.808	2	0.881	2
Provision of Health and Safety Regulation	0.89	3	0.894	2	0.783	5	0.878	3
Company Safety Policy	0.886	4	0.889	3	0.792	3	0.875	4
Experience Modification Rating (EMR)	0.856	5	0.819	5	0.825	1	0.838	5
Accident Book	0.806	6	0.814	6	0.758	6	0.803	6
Management Capability								
Management Knowledge	0.86	3	0.85	1	0.85	1	0.855	1
Project (business) Management Organization	0.862	2	0.847	2	0.833	2	0.853	2
Quality Assurance Policy of the Company	0.869	1	0.817	3	0.75	6	0.834	3
Possession of Quality Assurance Certificate	0.843	4	0.806	4	0.775	5	0.82	4
Curriculum Vitae of Management Staff	0.822	5	0.794	6	0.817	3	0.811	5
Experience of Geographical Location of the Place	0.791	6	0.803	5	0.792	4	0.796	6
Personnel Capability								
Ability of Contractor	0.948	1	0.914	2	0.917	1	0.931	1
Quality of Personnel	0.944	2	0.917	1	0.908	2	0.929	2
Experience of Technical Personnel	0.923	3	0.903	3	0.9	3	0.912	3
Organization Reputation								
Evidence of Incorporation/Business Name Registration	0.914	1	0.908	1	0.9	1	0.91	1
Evidence of Tax/VAT Clearance	0.89	2	0.889	3	0.875	3	0.888	2
Certificate of Work already Completed	0.873	3	0.892	2	0.85	4	0.877	3
Registration with State/Federal Ministry	0.852	4	0.858	4	0.892	2	0.859	4
Financial Capability								
Company Audited Account	0.826	1	0.828	1	0.867	1	0.832	1
Income Statement	0.815	2	0.786	2	0.833	2	0.806	2
Current fixed asset	0.791	3	0.758	3	0.758	3	0.775	3
Credit Rating System	0.781	4	0.75	4	0.758	3	0.766	4
Work Experience and Capability								
Percentage of Previous Work Completed on Schedule	0.912	1	0.9	1	0.9	2	0.906	1
Number of Years in Construction	0.908	2	0.889	2	0.917	1	0.902	2
Past Failure in Completed Project	0.839	3	0.847	3	0.867	3	0.846	3
Technical Capability								
Past Experience on Similar Work	0.972	1	0.961	1	0.95	1	0.965	1
Past Performance and Quality	0.942	2	0.914	2	0.925	2	0.929	2
Plant and Equipment owned	0.865	3	0.889	3	0.883	3	0.876	3

RII= Relative Importance Index; R= Rank

4.4. Cost Performance of Construction Projects

Table 4 shows the cost performance of sampled projects calculated from the initial and final project duration of sampled construction projects. A total of one hundred and eighty-nine (189) construction projects were provided by respondents for this study. Five out of 189 construction projects were rejected because the information provided on contract sum were incomplete. Thus 184 construction projects were used for the analyses to calculate the percentage (%) cost performance. 21.7% of the sampled construction projects were categorized as very good, 20.7% were good, 14.7% were categorized as satisfactory. 15.8% and 27.2% were categorized as poor and very poor projects respectively in terms of cost.

Table 4: Percentage of cost performance on construction projects

Performance variable	% cost performance	No of projects	% of projects
Cost	<0% (Very good	40	21.7
	0-5% (Good)	38	20.7
	6-10% (Satisfactory)	27	14.7
	11-19% (Poor)	29	15.8
	>20% (Very poor)	50	27.2
	Total	184	100

4.5. Relationship Between Contractors' Prequalification Criteria (CPC) and Construction Project Cost Performance

The multiple regression analysis that predicted the contractor performance in terms of cost is shown in Table 5. The seven Contractors Prequalification Criteria (CPC) from factor analysis were used. The coefficient of determination (R^2) for the analysis is 0.507 and the F value is significant at 0.000. This shows that the predictors and the dependent variable have a strong relationship, and that the regression model is statically significant. According to Field (2009); Ajayi et al. (2016), the effect is small when the value of R^2 is 0.001, a medium effect when the value is 0.09 and a large effect when the value is 0.25. Hence, the value of R^2 in this study is of a high effect. Thus, the alternative hypothesis that there is a significant relationship between contractors' prequalification criteria (CPC) and construction project cost performance is accepted. The results indicate that Health and safety practices (H/Sp), Management capability (Mc), Organisation reputation (Or) and Work experience and capability (Wec) are significant at 95% confidence interval. When there is multicollinearity among the independent variables, the result may be skewed (Jin, Han, Hyun & Cha, 2016). To counter this, Variance Inflation Factor (VIF) value below 10 was used to check. The result showed that there is no multicollinearity among the predicting variables.

Health and safety practices, Management capability, Organisation reputation and Work experience and capability were indicated as significant variables that have impacts on cost performance as shown in Table 5. This agrees with the assertion of Victor, Ernest and Theophilus (2019) which opined that 8.5% of contract price can be attributed to accident and injuries. Victor et al. (2019) further stated that management capability and

organisation reputation had substantial influence on project cost performance. Thus, health and safety practices, management capability and organisation reputation play a critical role in the cost management.

Table 5: Relationship between CPC and cost performance

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	4.321	0.782		5.526	0.000		
Health/Safety practices (H/Sp)	-1.393	0.164	-0.767	-8.472	0.000	0.342	2.925
Management capability (Mc)	-2.151	0.192	-1.008	-11.187	0.000	0.345	2.897
Personnel capability (Pc)	-0.335	0.195	-0.122	-1.716	0.088	0.558	1.792
Organisation reputation (Or)	0.573	0.134	0.27	4.271	0.000	0.701	1.426
Financial capability (Fc)	-0.179	0.113	-0.096	-1.586	0.115	0.757	1.321
Work experience and capability (Wec)	0.751	0.132	0.394	5.696	0.000	0.586	1.705
Technical capability (Tc)	-0.335	0.181	-0.123	-1.857	0.065	0.635	1.574

Variables are significant at p <0.05

4.6. The Equation of Model for Cost Performance

$Y = \beta_{\circ} + \beta_1 X_1 + \beta_2 X_2 \cdots\cdots\cdots + \beta n X n$

$Cp = \beta_{\circ} + CSC_1\beta_1 + CSC_2\beta_2 \cdots\cdots\cdots\cdots + CSCn\beta n$

$\beta_{\circ} = Constant$

$CSC = Contractor\ Selection\ Criteria\ that\ are\ significant$;

Or = Organisation, H/Sp= Health and Safety practices, Mc= Management capability, reputation, Wec = Work experience and capacity

$\beta_1, \beta_2 \cdots\cdots\cdots \beta n =$ the regression coefficient for the significant independent variables.

Thus, the regression equation for the relationship between cost performance and CPC is hereby stated as:

$Cp = 4.321 + 0.573Or - 1.393H/Sp - 2.151Mc + 0.751wec$ *……eqn. 3*

4.7. The Model Validation

Table 6 below shows the mean values for Contractors' Prequalification Criteria that are significant to construction projects cost.

Table 6: Contractors' Prequalification Criteria Significant to Cost

Prequalification Criteria	**Mean**
Organisation reputation (Or)	4.314
Work experience and capability (Wec)	4.074
Management capability (Mc)	3.860
Health/Safety practices (H/Sp)	3.800

$Cp = 4.321 + 0.573Or - 1.393H/Sp - 2.151Mc + 0.751wec$

$CP = 4.321 + 0.573(4.314) - 1.393(3.800) - 2.151(3.860) + 0.751(4.074)$

$Cp = 4.321 + 2.472 - 5.293 - 8.303 + 3.060$

$Cp = -3.743\,\%$

As stated in Table 4, construction cost performance is very good when the cost performance is less than 0%.

5. CONCLUSION

Selecting an appropriate contractor for a construction project is one of the client's most important tasks that determines the project performance and achievement of best value for money. This study established that the important criteria for selecting competent contractors are health and safety practices, management capability, personnel capability, organisation reputation, financial capability, work experience and capability and technical capability but to ensure an appropriate contractor to execute a project within the stated cost, organisation reputation, health and safety practices, management capability, and work experience and capability are the appropriate criteria for making a critical judgement as they have been evidenced to have impact on cost performance of construction projects. To enhance value for money and achieve cost performance of construction project, the construction practitioners and clients should ensure that the above listed significant criteria and the model developed in this study from these criteria are a must use to predict contractor's potential cost performance prior to contract award.

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