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Impact of Contractors' Prequalification Criteria on Civil Engineering Project Quality Performance

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Abstract— *Considering the high premium placed on quality by clients, this study was set to reveal the importance as well as the impact of contractors' prequalification criteria on quality performance of civil engineering project. Its purpose was to proffer solution to the quality problem associated with civil engineering project of the construction industry by enabling the client and consultants saddled with the responsibility of selecting contractors to identify the set of criteria that can produce project of expected quality standard. The data used was solicited from Quantity Surveyors and Civil/Structural Engineers expressing client's opinion. The data were analysed by employing regression method. Results showed that contractors' prequalification criteria reflect two different forms of relationship with quality performance of civil engineering project. Hence, contractor's prequalification criteria affect quality performance of civil engineering project in different ways. Ability of contractors' prequalification criteria to predict the quality performance of civil engineering project differs from one and another. Some of the contractors' prequalification criteria emerged as weak predictors while some proved to be strong predictors of quality performance of civil engineering project. Consequently, it recommended that less attention be accorded the weak predictors as a result of having insignificant impact on quality performance of civil engineering project. Emphasis should be on the strong predictors of quality performance because they have significant impact on quality performance of civil engineering project.*

Keywords— Contractors' prequalification criteria, quality performance, civil engineering project.

I. INTRODUCTION

The construction industry is symbolically characterized by the uniqueness of its products which emanates from three distinct project categories comprising building, civil engineering and heavy/industrial engineering and involvement of different participants specializing in specific area of professionalism in the built environment. Its participants, as a matter of necessity, are engaged at initial stage, during construction and after practical completion of a project to perform assigned functions. Civil engineering projects are apparently diverse in nature and public sector driven. Inyang-Udoh [2014] argue that projects in this group records low performance rate relative to private projects despite the high rate of adoption of prequalification exercise. With reference to the research result in Ramus [1981], Manthosi and Thawala [2012] and Ganderton [2012], Ogunsanmi [2013] admit that contractors are selected through tendering by means of appropriate method. These researchers believe that contractors are selected by adopting suitable criteria predetermined by either the client or consultants. It is worthy to note that adopting the right prequalification criteria gives the assurance that the right contractor will be selected which will eventually eliminate the likelihood of project getting to the hands of a wrong contractor. According to Ogunsemi [2005] cited in Inyang-Udoh [2014], it is extremely important to make the right choice of contractor since wrong choice is capable of straining the relationship between the client and contractor which may result to wastage of resources in the long run. This is a major cause of harm to success of construction project and serves as evidence to show that the reason for prequalification is being defeated. Contractor prequalification process is time demanding because it involves enormous activities. This includes securing requested information and documents from contractors, carrying out mandatory investigations to establish the authenticity of contractor's documents and assessing the contractors based on predetermined criteria. The research results in Peter, Pascale and Todd [2010] indicate an expression of displeasure with the unpleasant low performance and productivity rating that characterizes the construction industry relative to other industries. Noting that products of the construction industry are numerous, the performance of the industry is measured in accordance with the quality of its product. Without any iota of doubt, selected contractor is expected to deliver product that meets predetermined quality standard [Azian and Ismail, 2010]. Unfortunately, Gardiner and Stewart [2000] deduce that the

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chances of construction projects meeting expected quality standard is slim because promoters of construction projects often get uncomfortable since projects are occasionally completed to specifications. Zipporah [2016] stress that organization within the construction industry strife to overcome impediments to achieving quality products due to need for success and survival in the face of competition. Attainment of global excellence status by construction organizations can become possible by producing products of high quality, prioritizing customer's satisfaction and reducing cost while maximizing profit [Arauz and Suzuki, 2004 cited in Zipporah, 2016]. However, quality of construction project is not accorded the high premium it deserves since Gardiner and Stewart [2000] submit that monitoring activities of managers of projects centers on project cost and time targets. Consequent upon the foregoing, this study set out to reveal the nature of the relationship between contractors' prequalification criteria and quality performance of civil engineering project. Its purpose is to establish the importance of contractors' prequalification criteria to quality performance so as to determine the contractors' prequalification criteria that is capable of producing project that meets quality target. Result of this study will assist clients and consultants, saddled with the responsibility of selecting contractors, in identifying the criteria to prioritise during contractor prequalification process. This will ultimately reduce the long length of time usually spent on prequalification of contractors.

Research questions

The following pertinent research questions were addressed.

(a) what is the relationship between contractors' prequalification criteria and quality performance of civil engineering project
(b) what is the impact of contractors' prequalification criteria and quality performance of civil engineering project

Study objectives

The objectives stated below were the focus of this work.

i. to assess the relationship between contractors' prequalification criteria and quality performance of civil engineering project
ii. to evaluate the impact of contractors' prequalification criteria on quality performance of civil engineering project

II. REVIEW OF LITERATURE

In the construction industry, construction projects are procured through direct labour in addition to contracting system. Inyang-Udoh [2014] observes that contracting is more popular because of inability of direct labour to cope with increasing demand of clients in the industry. Moreover, the client is relieved of any form of risk associated with acquiring construction project by adopting contracting method. Based on observations from the submissions in some literatures, it is undoubtful that prequalification is peculiar to contracting system of executing construction project [Ogunsemi and Aje, 2005; Salama, Abd, El and El, 2006 and Puoy, 2011]. The diverse definitions and purposes of prequalification have appeared in these literatures and a host of others. Its adoption in the selection of contractors and the degree of usage for both private and public sector projects in the construction industry is confirmed in Inyang-Udoh [2014]. This work and host of others evidently show that prequalification is common among construction project clients and professionals, stressing its importance. As a matter of fact, construction project usually pass through different stages before coming to reality. Obligation of the client and consultants to choose contractor is performed when it is ripe to place the contract for the construction and completion of project on the most suitable and competent contractor. Inyang-Udoh [2014] further explains that selection of the contractor is absolutely essential to achieving a successful project. During prequalification, the client customarily demands for different documents from the contractor willing to be prequalified. The documents, which constitute the prequalification criteria, vary from client to client and depends on the nature and type of project as well the degree of importance attached to the capability of the exercise to ensure the emergence of the most qualified contractor. It can further be deduced from literatures that prequalification criteria are numerous with civil engineering projects requiring more criteria. In spite of this, the prequalification criteria revolve around contractor's background, technical ability, financial ability, management ability, reputation, past performance, health & safety, relationship, and environmental & socio-political criteria. These form the basis for assessing and rating the contractors. Visit to contractor's office, project site(s), plant yard and other designated locations with a view to authenticating the genuineness of the contractor's documents is essential before decisions are taken. Unfortunately, Inyang-Udoh [2014] observes that this important activity is neglected in most cases, citing time and cost as reasons. This often

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makes the exercise to be counter-productive by leading to the emergence of incompetent contractor.

However, research scholars in the construction industry view quality performance from different perspectives which led to the absence of consensus definition for it. For instance, the work of Peter *et al.* [2010] showcases the basic elements of quality performance as contained in the submission of various authors. These include ability of construction project to meet expectations of the customer, reduce rework or defect, repeat business, conformance to ISO 9000 criteria, completion time and cost. According to Arazi, Mahmoud and Mohamad [2011], quality is the ability of completed construction project and process to meet predetermined client's and end user's requirements. This is a crucial factor which determines the client's and end-user's satisfaction. Supporting this view, Doan [2011] sees project quality as critical to client's satisfaction and serves as means to guarantee contractor's survival and sound business relationship with the client. Similarly, Soetanto and Proverbs [2004] opine that construction product quality is fundamental to client's satisfaction in the construction industry. Bearing in mind that every construction project is expected to be delivered at specific standard of quality, Ogunsemi and Aje [2005] and Barbara [2004] opine that the expected quality of construction project is defined in the specification for the project. In same vein, Brian, Edward and Deepak [2003] observe that specification provides guideline for the design and construction of a project and spells out the kind of materials, plant and equipment and workmanship to be utilised in the project. Hence, contractor's ability to deliver construction project to the set standard of quality depends largely on the managerial, financial, technical and organizational performance of the contractor [Roshana and Akintola, 2002]. Once the quality standard of a project is set, it must be monitored and controlled to avoid non-conformity. In view of this, Barbara [2004] suggests specifications, inspections test and user surveys as essential quality monitoring and control tools to achieve good quality construction project. Supporting the need to satisfy the end-user of products of the construction industry, Peter *et al.* [2010] suggests quality management as an antidote to the numerous quality challenges, problems and failure usually experienced by the industry.

In the construction industry, emphasis on quality is based on conformity of its product to established requirements which are the characteristics of the product set out in the specification initially determined by the client or his representatives [Azian and Ismail, 2010]. The task of achieving a completed construction project that meets client's quality expectations requires collective effort of the client, consultants and the contractor. Hence, the need to build construction project quality requirements into contract price and other contract documents as well as committed to carry it out is stressed in Ganaway [2006]. Similarly, construction project quality is determined by the extent to which it meets the standard predetermined by the owner or his representatives [Janoun, 2000]. Since poor quality construction project lead to unhappy client and end-user, Arazi *et al*. [2011] asserts that completed construction project must meet client's and end-user's expectations so as to satisfy them. In order to measure construction project quality performance, the yardstick to use include conformance to specifications, quality of management and supervising staff, quality of equipment and construction materials, quality control measure adopted by the organization, quality assessment system in the organization and quality training meeting [Adnan, Sherif and Saleh, 2009].

III. METHODOLOGY

The ordinal data utilized in this study were obtained by means of questionnaire survey administered to 156 respondents comprising quantity surveyors and civil/structural engineers in client organizations in the state capital of the six states that made up the south-west states of Nigeria. The questionnaire, which was designed to investigate the objectives stated in this study, allowed respondents to score the options between 1 and 5. The data were analyzed using multiple regression method. According to Kothari [2004], this analysis tool is a non-parametric test technique where a set of independent variables can be measured against a number of individual dependent variables for comparison purposes. This tool also determined the predicting power of the independent variables and the pattern of prediction of the dependent variable. In this case, the independent variable having the highest standardized coefficient beta value, t-value and significance level less than or equal to 5% (0.05) was taken to have significant impact on the dependent variable. The degree of association between the dependent variable (quality) and independent variables (contractors' prequalification criteria) as well as the causal relationship between the independent variables was determined by Karl Pearson correlation generated by the regression analysis. The closer the value of r is approaching 1, the stronger is the degree of correlation between the variables.

Karl Pearson's Coefficient of correlation

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$$(r) = \Sigma \frac{(Xi - \overline{X})(Yi - \overline{Y})}{n - \sigma_x - \sigma_y}$$

Here:

r stands for correlation coefficient

Xi stands for ith value of independent variable

$\overline{X}$ is the mean of the independent variable

Yi represents ith value of dependent variable

$\overline{Y}$ is the mean of the dependent variable

n stands for pairs of observations of independent and dependent variables

σ_x represents the standard deviation of independent variable

σ_y is the standard deviation of dependent variable

The decision rule adopted was that the independent variable having the highest correlation value with the dependent variable was taken to have uniquely strong relationship with the dependent variable. This was based on the following:

If r is -1, there is perfect negative correlation

If r is 0, there is no correlation

If r is +1, there is perfect positive correlation

IV. RESULTS

From table 1, both positive and negative relationship exists between quality performance of civil engineering project and contractors' prequalification criteria at both r<0.05 and r>0.05 levels of correlation. At r=0.284, 0.286 and 0.227, contractors' background, management ability and reputation recorded positive relationship with quality performance of civil engineering project. This is considerably low, suggesting that they made noticeable influence on quality performance of civil engineering project. Contractors' technical ability (r<0.076), financial ability (r<0.028), past performance (r<0.181), health and safety (r<0.047), relationship (r<0.086) and environmental, socio-political criteria (r<0.109) had extremely low positive relationship with quality performance of civil engineering project. This indicated that they had little effect on quality performance of civil engineering project. Also, the result depicted that positive relationship existed between criteria for selecting civil engineering contractors, implying that they influenced one another while affecting quality performance of civil engineering project.

The consensus opinion of the respondents indicated that not all contractors' prequalification criteria had positive effect on quality performance of civil engineering project. Only financial ability negatively correlated with quality performance of civil engineering project. This means that it had negative effect on quality performance of civil engineering project having registered its role in achieving quality civil engineering project from different direction. However, management ability ranked the most influential contractors' prequalification criteria affecting quality performance of civil engineering project with r=0.286. This indicated that respondents agreed that quality performance of civil engineering project can better be achieved by prioritizing management capability of the contractor. This decision can be attributed to the opinion in Slobodan [2003] where planning, organizing, coordinating and controlling were found to be crucial to realization of civil engineering project. These activities were management inclined and essential to achieving quality performance of civil engineering project.

The impact of criteria for prequalifying civil engineering project contractors and their predicting power on quality performance of civil engineering project is shown in table 2. At $p \leq 0.05$, contractors' background (p=0.026) made significant unique contribution to quality performance of civil engineering project. Furthermore, contractors' background, financial ability, management ability, and health and safety recorded high standardized coefficient beta value (0.327, -0.338, 0.272 and -0.263) and t-value (3.456, -3.411, 2.696 and -2.251), implying that they had high predicting power on quality performance of civil engineering project. The p-value of contractors' ability, reputation, past performance, relationship, and environmental and socio-political criteria is above 0.05. This implied that they were insignificant to quality performance of civil engineering project. The adjusted R^2 value is 0.171, meaning that about 17% of quality performance of civil engineering project was impacted upon by criteria for selecting civil engineering project contractors. Considering the opinion that quality was determined by the technical and workmanship standard of a contractor, this result opined that strong relationship existed between technical ability and quality performance of civil engineering project. This contradicted the result in this study because it was shown that technical ability does not contribute to quality performance of civil engineering project. This is an indication that less importance was attached to technical ability. Therefore, it was rated low by respondents. This was considered not to be good enough because civil engineering project was admitted to be plant and equipment intensive, requiring corresponding technical ability from contractors.

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Table.1: Correlation between contractors' prequalification criteria and civil engineering project quality performance

	Quality	**Background**	**Technical ability**	**Financial ability**	**Management ability**	**Reputation**	**Past performance**	**Health & safety**	**Relationship**	**Environmental & socio-political**
Quality	1.000									
Background	0.284	1.000								
Technical ability	0.076	0.317	1.000							
Financial ability	-0.028	0.478	0.318	1.000						
Management ability	0.286	0.405	0.249	0.427	1.000					
Reputation	0.227	0.464	0.088	0.479	0.587	1.000				
Past performance	0.181	0.404	0.140	0.240	0.480	0.604	1.000			
Health & safety	0.047	0.446	0.062	0.328	0.408	0.582	0.665	1.000		
Relationship	0.086	0.505	0.128	0.473	0.351	0.593	0.597	0.699	1.000	
Environmental & socio-political	0.109	0.496	0.192	0.491	0.297	0.604	0.596	0.623	0.727	1.000

Table.2: Impact of contractors' prequalification criteria on civil engineering project quality performance

Variables	**Standardised Coefficient Beta**	**t-value**	**p-value**	**Adjusted R^2**
(Constant)		7.013	0.000	0.171
Background	0.327	3.456	0.001	
Technical ability	-0.005	-0.061	0.951	
Financial ability	-0.338	-3.411	0.001	
Management ability	0.272	2.696	0.008	
Reputation	0.167	1.435	0.153	
Past performance	0.028	0.242	0.809	
Health and safety	-0.263	-2.251	0.026	
Relationship	-0.008	-0.06	0.952	
Environmental and socio-political	0.085	0.693	0.489	

Dependent variable – Quality

P is significant at 5% ($p \leq 0.05$)

Findings

This study indicates that both positive and negative relationship exists between criteria for prequalifying contractors and quality performance of civil engineering project. Most of the contractors' prequalification criteria, comprising background, technical ability, management ability, reputation, past performance, health and safety, relationship, and environmental and socio-political criteria show positive correlation with quality performance. This means they have positive effect on quality performance of

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civil engineering project. Financial ability show negative relationship with quality performance of civil engineering project indicating that it has negative effect on quality performance of civil engineering project. In spite of this, the result does not render financial capability less important to quality performance of civil engineering project. Therefore, it is very important to submit that emphasis on financial ability during contractor prequalification exercise will not be counter-productive or undermine achievement of targeted quality performance as far as civil engineering project. Also, contractors' prequalification criteria affect quality performance meaning that making the choice of inappropriate contractors' prequalification criteria will turn achievement of good quality project to a mirage. It can further be deduced that management ability registers its importance to quality performance of civil engineering project by ranking among the contractor's prequalification criteria having significant impact. Hence, this study opines that management ability is primarily essential to achieving expected quality standard in respect of civil engineering project. By so doing, it supports the submission in Pooria, Muhd and Jeffrey [2015] which argued that contractor's management ability was an important criterion to be adopted in selecting contractors having spoken against the poor attention given to it on several occasions. It is also shown that a positive interrelationship exists between criteria for contractors prequalification while impacting on quality performance of civil engineering project. This result shows that contractors' financial ability, background, management ability, and health and safety greatly affect quality performance of civil engineering project as perceived by clients. However, this result partially agrees with the result in Puoy [2011], which focuses on building projects. Here past performance, technical ability, and management ability were found to affect quality performance. In view of this, it can be inferred that opinions about the effect of contractors' prequalification criteria on civil engineering project quality differs from those of building project. This result can be traced to the characteristic and peculiar resource requirement difference existing between civil engineering and building projects.

V. CONCLUSION AND RECOMMENDATION

Contractor's prequalification criteria exhibit relationship with quality performance of civil engineering project but from different perspectives. All the contractor's prequalification criteria, except financial ability, have positive effect on quality performance of civil engineering project. At this point, it is important to state that it is not an indication that contractor's financial ability does not affect quality performance. The criterion (financial ability) only registered its influence on quality of civil engineering project from different direction. Its importance is evident by ranking among the significant contributors to quality performance of civil engineering project. Ability of contractors' prequalification criteria to predict the quality performance of civil engineering project differs from one and another. While some of these prequalification criteria are weak predictors, some are strong predictors of quality performance of civil engineering project. However, it is important to recommend that less attention be accorded the weak predictors, comprising relationship, technical ability, past performance, environmental and socio-political, and reputation. This is necessary because they have insignificant impact on quality performance of civil engineering project. Having registered significant impact on quality performance of civil engineering project, emphasis should be on contractors' background, financial ability, management ability, and health and safety criteria in the order of appearance. These criteria constitute the strong predictors of quality performance of civil engineering project and indicated that quality performance of civil engineering project principally depends on them.

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