

# Impact of Procurement Methods and Project Types on Construction Projects Performance

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## ABSTRACT

*Procurement systems provide the general framework and organisation of line of responsibilities for stakeholders within the construction process. It is a major contributor to client satisfaction in achieving successful completion of projects. This paper focused on examining the impact of different procurement methods and project types on performance of construction projects. The research employed a quantitative approach using structured questionnaires to elicit information from 420 stakeholders in the Nigerian construction industry. The relationship between project types and procurement systems was established as well as their influence on project delivery. The data were analysed and discussed. The results showed that there is correlation between procurement methods and factors used in assessing project success, while no relationship exists between procurement methods and project type. The implication is that cost, time and quality are factors affecting the selection of procurement methods.*

**Keywords:** Construction project; procurement methods; project performance; project types; Nigeria

## INTRODUCTION

The construction industry globally is highly fragmented; therefore the coming together of participants in the building process on an *ad hoc* basis has significant effect on project delivery and performance. Hence, the obvious separation of clients, main or general contractors and subcontractors requires an arrangement to procure the projects and establish authorities between the stakeholders for construction work to commence (Gruneberg and Hughes, 2006). Since Emerson's (1962) and Latham's (1994) reports have been published, the need to implement procurement methods in building process has heightened. However, evidence from the literature indicates that though there are many distinct methods available for realising construction projects, but in practice only a relatively few procurement methods are employed (Love *et al.*, 1998; Masterman, 1992; Ng, Luu and Chen, 2002).

Broadly, construction procurement systems are classified as traditional and non-traditional procurement systems (Harris & McCaffer, 2005). For a very long time in the UK, traditional construction procurement system has been the major route for procuring constructed facilities after the industrial revolution, and to date, it remains the foremost procurement system in the UK (Saad, Jones and James, 2002; Royal Institution of Chartered Surveyors (RICS), 2007). This option appears as the most preferred system of procuring construction project by client who is involved in the construction process. The continued increase in the complexity of buildings, the need to manage project finance, the need to reduce design coupled with the need to have constructed facilities realised faster without compromising the client objectives has resulted in the decline in the use of the traditional procurement system to procure building works across the globe (Love *et al.*, 1998; Maizon, 1996). Xue, Wang, Shen and Yu (2007) and Eriksson, Nilsson and Atkin (2008) advanced the reasons for this decline to include acrimonious relationship which often leads to conflicts and disputes; poor collaboration among parties, poor focus on customers' needs, and incessant failure to meet clients' requirements which have become prevalent in the construction industry.

Literature on research that examined procurement systems in the Nigerian construction industry established that both traditional and non-traditional procurement options are being practised in the industry (Babatunde *et al.*, 2010; Ibrahim, Daniel and Ahmad, 2014). However, traditional procurement method is more popular in the Nigerian construction industry than the non-traditional, while the use of traditional construction procurement option in the industry accounts for most of the projects underperformance in terms of cost and time (Ojo *et al.*, 2006; Ibrahim *et al.*, 2014). As a result of this and the demand for suitable procurement method to be employed in achieving successful projects to reduce the impact of time overruns, poor quality and cost overruns of construction projects on the growth and performance of the construction industry, other procurement systems have been explored.

Considering the plurality of research in the industry that investigates procurement systems being used in the Nigerian construction industry, none of them examines the influence of procurement methods and project types on performance (time, quality and cost) in Nigeria. To achieve this aim, the research presented in this paper addresses the following hypotheses:

- *There is statistical significant relationship between the different types of procurement methods available for procuring building projects and the various project types.*
- *There is statistical significant relationship between the different types of procurement methods available for procuring building projects and project success criteria.*
- *There is significant relationship between project performance measures (cost and time overruns) and different procurement methods.*

## **OBJECTIVE PERFORMANCE OF THE VARIOUS PROCUREMENT METHODS**

The construction industry professionals will be able to produce any project with any procurement method, if given unlimited time and cost resources and the client not being too enthusiastic about quality requirement. However, because of cost of finance and advantages in putting the building into early use, particularly by the private developers, clients have to impose limits on cost and time, and must be satisfied with the quality of the building (Naoum and Langford, 1987). Hence construction industry professionals have resorted to using the 'appropriate' procurement method to achieve the constraints imposed by the client. Naoum and Langford (1987) opined that the use of appropriate procurement method can define the project's success on cost, time and quality objectives. Construction project may be considered as being successful if the constructed facility is delivered on time, within the estimated cost and quality standards, and meets the client high level of satisfaction (e.g. Cookie-Davies, 2002; Naoum and Langford, 1987). Construction projects performance is a function of meeting client's need and satisfaction with regards to the roles and responsibilities of participants engaged in the construction process (Gruneberg and Hughes, 2006). This is the desire of many construction clients, but the project performance considered in this paper is measured against the widespread and traditional measures of performance based on the iron-triangle of cost, time and quality (Cookie-Davies, 2002).

However, Masterman (1992) argued that the approach being used by many construction project clients and their professional advisors in selecting the procurement methods can be haphazard, ill-timed and illogical. Therefore, wrong choice or inappropriate usage of suitable procurement options has been established to be one of the main problems of project performance and successful completion. Although, each procurement method exhibits different characteristics, have distinctive benefit and inherent disadvantages, but 'one-cap-fits-all' does not exist as there is no single best system that could suit all kinds of clients and projects (Ng *et al.*, 2002). This research thus investigates which procurement method is more appropriate for different project types and what is their performance effect in meeting client's objectives in terms of cost, time and quality.

## **METHODS**

This research employs quantitative research approach using structured questionnaires to elicit information as it has been successfully employed in previous similar studies (e.g. OJo & Ikpo, 2013). However, a number of researchers have acknowledged that survey questionnaire as a method of obtaining information often suffers from poor response rate, but it permits views from a wide range of credible participants to be elicited (e.g. Bryman, 2008). The list of active professionals and contractors on the register of relevant professional bodies in Abuja (Federal Capital Territory) were obtained amounting to 551 using formula technique to determine the minimum sample size (see Table 1). Thus, 551 questionnaires were self-administered using simple random sampling among main contractors, consultants, and clients (construction professionals working in client organisations), and of these, 420 were returned and used for the analyses. In an effort to obtain and ensure the credibility of the results, the questionnaires were administered to the participants with over five years' experience and who are actively involved in construction procurements in their respective organisations. This criterion was unambiguously stated in the request for information notice provided in the survey questionnaire. Nonetheless, the authors were unable to determine if this requirement in any way influence the response rate obtained, but the desire to get experienced participants that have requisite knowledge and to ensure that credible responses prevailed. This high response rate of 76.2% was possible because of the self-administration of the questionnaires and the series of follow-ups on phone and mails. A period of six (6) months was used in the administration of the questionnaires. The data obtained were analysed using correlation and regression methods of analyses to establish relationship and at the same time test the hypotheses.

Table 1: Sample size derivation table

S/No	Description Of Population	Population	Source Of Population	Sample Size At 95% Confidence Level
	<b>CONSULTANTS</b>			
1	Architects	64	Nigeria Institute of Architects, Abuja Chapter	56
2	Structural Engineers	58	Council for the regulation of engineering in Nigeria	51
3	Quantity Surveyors	76	Nigeria Institute of Quantity Surveyors, Abuja Chapter	64
4	Electrical & Mechanical Engineers	51	Council for the regulation of engineering in Nigeria	46
	<b>CONTRACTOR</b>			
5	Contractors	200	Federal Ministry of Works Registration Board	134
	<b>CLIENTS</b>			
6	Federal Ministries	57	Federal Ministry of Information	50
7	FCT local councils/ Municipal Authority	16	Federal Capital Authority	16
8	Corporate/ financial Institutions	127	Corporate affairs commission	97
9	Private individuals/ private developers	48	Corporate affairs commission and Federal inland revenue service	43
Total Questionnaires distributed				<b>557</b>

## RESULTS AND DISCUSSION

Table 2 provides the breakdown of the 551 administered and 420 returned questionnaires. Of 134, 206 and 211 questionnaires that were self-administered to contractors, clients and consultants in building

projects in Abuja, 132, 180 and 108 questionnaires were returned from contractors, clients and consultants respectively, giving a total of 420 questionnaires returned.

Table 2 also reveals the length of time or the period the respondents have been operating in the Nigerian construction industry. The respondents that have spent 20-25 years have the highest percentage of 42.8% with a response count of 180 followed by those that have spent 15-20 years with a response count of 84 representing 17.9%. The newest staff members that have been there for 5-10 years have the least response count of just 24 with 5.1%. On the other hand, the respondents that are oldest in the industry, spending 31 years and above have a response count of 60 accounting for 12.8% of the total respondents. In general, most of the respondents have at least five years working experience in the construction industry. Based on the number of years spent in the construction industry, majority of the respondents are well informed about the activities in the industry.

Table 2: Background information of respondents'

Group	Categorisation of the groups		
	Number of questionnaires sent	Number returned	Response rate
Contractors	134	132	98.51%
Clients	206	180	87.38%
Consultants	211	108	51.19%
Total	551	420	76.23%
Year of experience in the construction industry			
Year of experience	Frequency	Percent	
5-10 years	24	5.1	
10-15 years	72	15.4	
20-25 years	84	17.9	
25 - 30 years	180	42.8	
31years and above	60	12.8	
Total	420	100.0	
Respondent profession in the organisation			
Professional role in the organisation	Frequency	Percent	
Architect	83	19.8	
Builder	85	20.2	
Quantity Surveyor	42	10.0	
Engineer (Civil, Structural, Mechanical and Electrical)	48	11.4	
Project Manager	162	38.6	
Total	420	100.0	

## Project Type and Procurement Methods

Using the quantitative survey approach to elicit information, a number of projects and constructed facility types as well as procurement methods were identified. Table 3 presents the project types and the respective procurement systems employed in delivering the projects obtained from the questionnaire survey. Table 3 indicates that traditional lump sum methods were majorly the procurement route used in the Nigerian construction industry to procure new projects 33.3% (amounting to 140). Design and build route was the closest indicating 26.2% of the total responses. Construction management methods account for 22.9% of the total survey, Contract Management and PPP have the lowest with counts of 56 and 18 representing 13.3% and 4.3% respectively. In all, most of the respondent's organisations execute combination of traditional, design & build, construction management, management contracting and PPP. This result shows that the organisations are well acquainted with the various procurement methods, hence their capabilities to give accurate answers to the questions asked. Also, the result confirms the study carried out by Babatunde *et al.* (2012), they ranked traditional method as the highest and most frequently used procurement method for procuring building projects in Nigeria. This finding is also in line with Saad, Jones and James (2002) study who argued that traditional construction procurement system has been the major route for procuring

constructed facilities for a very long time in the UK. This is not surprising as Nigeria still follows the UK construction industry ways of doing things.

Table 3 shows that respondents were involved in the procurement of a variety of project types, the most prominent project types were commercial and administrative offices (27.3%), followed by residential buildings (22.7%). This result affirms the nature of the study area which is the Federal Capital of Nigeria with many office buildings both for administrative and commercial purposes.

Table 3: Project types and procurement methods

Types of Project Awarded				Frequency	Percent
Offices				36	27.3
Industrial (Factories, Shopping Complexes and warehouses)				11	8.3
Health (Hospital)				18	13.6
Residential Houses				30	22.7
Commercial (Hotels, Banks, Markets, Shopping Mall)				23	17.4
Educational (Schools and Universities)				14	10.6
Total				132	100.0
Procurement methods				Frequency	Percent
Traditional Contract Method (Lump Sum)				140	33.3
Design and Build				110	26.2
Construction Management				96	22.9
Management Contracting				56	13.3
Public Private Partnership (PPP)				18	4.3
Total				420	100.0

## Relationship between project type and procurement system

The previous research that focused on the Nigerian construction sector asserted that both the traditional and non-traditional procurement systems are in use in the industry. However, a major problem identified with traditional procurement system is the non-integration of design and construction (Ojo *et al.*, 2006). To mitigate this shortcoming that is associated with the use of traditional procurement method, non-traditional systems such as design and build, management contracting and construction management have been encouraged (Dada, 2013; Oladinrin *et al.*, 2013). Hence, the following hypothesis was formulated and tested:

*H1: There is a statistical significant relationship between the different types of procurement methods available for procuring building projects and the various project types*

Table 4 shows the correlation coefficient, level of significance between procurement methods and project types. The decision taken is based on the categorisation by Field (2013), a correlation of  $\pm 0.1$  denotes small effect,  $\pm 0.3$  represents medium effect and  $\pm 0.5$  is a large effect. The results show that offices have a correlation coefficient of 0.217, a value that is weak but positive. It is statistically significant ( $p = 0.007$ ). The same applies to Health (Hospital) with a value of 0.326. All other Project Types give values that are statistically insignificant. Conclusively, with 2 “reject” and 4 “accept”, the correlation results show that most of the project types are statistically insignificant and hence, the hypothesis that stated that there is correlation between procurement methods and project types is partially supported. Hence, the procurement methods available are not dependent on the types of project available.

Table 4: Correlation analysis of procurement methods and project type

Project Type	Correlation Coefficient	P-value	Significance of Correlation	Decision
Offices	0.217**	0.007	Significant	Reject
Industrial (Factories, Shopping	0.054	0.506	Not Significant	Accept

Project Type	Correlation Coefficient	P-value	Significance of Correlation	Decision
Complexes and warehouses)				
Health (Hospital)	0.326**	0.000	Significant	Reject
Residential Houses	0.067	0.405	Not Significant	Accept
Commercial (Hotels, Banks, Markets, Shopping Mall)	0.151	0.059	Not Significant	Accept
Educational (Schools and Universities)	-0.007	0.931	Not Significant	Accept

## Procurement methods and project success criteria

In order to determine the relationship between the various procurement methods studied and the identified project success criteria, the following hypothesis was tested:

*H2: There is statistical significant relationship between the different types of procurement methods available for procuring building projects and project success criteria.*

Table 5 shows weak correlation coefficient between procurement method and project success criteria except health and safety measures (i.e. when no causalities recorded to complete a project) that indicate medium effect on construction projects. However, the procurement methods used have significant effects on all the measures of project success criteria except “When no conflicts recorded to complete a project” that is statistically insignificant. The correlation results show that most of the factors are statistically significant and hence, the hypothesis that states that there is statistical significant relationship between the different types of procurement methods available for procuring building projects and project success criteria is accepted. That is, there is correlation between procurement methods and project success criteria. The implication is that cost, time and quality are factors affecting the selection of procurement methods. Hence, the procurement methods available are dependent on the project success criteria. These results are in line with the findings of Eytoupe *et al.* (2012), who inferred that completing a project within its budgeted cost is more relieving and satisfying to the client. The findings are also in consonance with assertion of Peter *et al.* (2008) who argued that causalities constitute hindrances to the progress of work and consequently impede the success of the project. Nonetheless, conflict within a project also constitute a great hindrance to the progress of work as this could amount to disruption of work, which could lead to time overrun as posited by Maizon *et al.* (2006) but the study shows its effect is insignificant.

Table 5: Correlation analysis of procurement methods and project success criteria

Factor	Correlation Coefficient	P-value	Significance of Correlation	Decision
Completing a project within budgeted cost	0.210**	0.008	Significant	Reject
Completing a project within the estimated construction time	0.225**	0.005	Significant	Reject
Satisfying with the quality of a project	-0.170**	0.033	Significant	Reject
When no conflicts recorded to complete a project	-0.068	0.402	Not Significant	Accept
When no causalities recorded to complete a project	-0.435**	0.000	Significant	Reject

## The effect of the different procurement systems on project performance (cost and time overruns)

Construction projects performance is measured using the most commonly used parameters of cost, time and quality. This is due to the fact that construction clients want their project completed on time, within the budgeted cost without compromising the quality and safety. The performance of project with respect to the procurement method used is measured using cost and time. Therefore, to establish whether the various procurement systems have any effect on project performance, the hypothesis stated below was tested.

*H3: There is significant relationship between project performance measures (cost and time) and different procurement methods.*

Table 6 shows the results of the regression analysis of different procurement types on cost performance of construction projects. The coefficient of determination  $R^2$  ranges from 0.52, 0.88 for the entire projects considered. The significant level shows that there is a significant effect of cost overrun on contract sum for traditional method, which implies that other procurement routes should be considered for procurement as it relates to reliability of estimated cost. These findings are in tune with the findings of Jaafar and Nuruddin (2012) and Eyitope *et al.* (2012), who confirmed that the increasing awareness of construction stakeholders to the benefits of other procurement methods as opposed to the traditional procurement method. However, this is contrary to the submission of Adesanya (1992) and Enekwechi (1993) which identified traditional procurement as the best method in Nigeria to achieve estimated time target and cost budget. The reason for this may not be farfetched in that these studies were conducted more than 20 years when designs and construction were simpler than what we have presently. The findings also supported the result of Rose and Manley (2011) who reported their research work based on forty-two case studies that 78% of management contracting projects were completed within or less than their budgeted cost compared with only 30% traditional contracts. The results of similar research work by Mathonsi and Thwala (2012) in Southern Africa confirmed the above result.

Table 6: Summary of regression analysis of cost overrun for different procurement methods

Regression Analysis of Cost Overrun (Co) on Contract Sum (Cs)				
Project Size	Traditional Method			
	R2 (Adjusted)	Regression Equation	P.valu e	Remarks
1-10 million	0.64	Cs = 0.633+3.725Co	0.0001	Significant
11-100 million	0.73	Cs = 0.368+2.7776Co	0.0000	Significant
Above 100 million	0.58	Cs = 0.356+1.655Co	0.0000	Significant
Design and Build Method				
1-10 million	0.69	Cs = 0.452+3.895Co	0.1000	Not Significant
11-100 million	0.62	Cs = 0.321+2.651Co	0.2000	Not Significant
Above 100 million	0.88	Cs = 0.821+1.612Co	0.2000	Not Significant
Project Management Method				
1-10 million	0.76	Cs = 0.410+3.521Co	0.2000	Not Significant
11-100 million	0.79	Cs = 0.201+2.416Co	0.1000	Not Significant
Above 100 million	0.59	Cs = 0.301+1.430Co	0.5000	Not Significant
Management Contracting Method				
1-10 million	0.81	Cs = 0.391+3.310Co	0.0000	Significant
11-100 million	0.73	Cs = 0.290+2.201Co	0.1000	Not Significant
Above 100 million	0.64	Cs = 0.910+1.343Co	0.2000	Not Significant
PPP Method				
1-10 million	0.64	Cs = 0.150+3.267Co	0.2100	Not Significant
11-100 million	0.52	Cs = 0.482+2.722Co	0.0700	Not Significant
Above 100 million	0.58	Cs = 0.290+1.327Co	0.1000	Not Significant

Table 7 presents the results of the regression analysis of different procurement routes and its effects on time performance of construction projects in terms of time overrun. The coefficient of determination  $R^2$  ranges from 0.24 to 0.71 for whole projects considered. The results showed that insignificant effects exist between other procurement methods and project duration except traditional methods. This result is supported by earlier researchers (e.g. Maizon et al., 2006; Peter *et al.*, 2008) that asserted that other procurement methods other than traditional route allow for more efficient and effective coordination of works, materials, manpower and plants, thus making construction time shorter compared to other procurement systems.

Although in the construction industry, it is only in few instances that the same contractor can be involved in identical buildings with different procurement methods. This therefore, makes the research work of Oztas and Okmen (2004) to be of particular interest. Oztas and Okmen (2004) evaluated the time performance of ten design and build projects against seven traditional industrial projects. These projects were executed by the same contractor who built all the seventeen industrial projects for various owners and consultants in the United Kingdom. They reported that design and build projects were constructed within an average of eighteen months while the traditional projects took an average of twenty-seven months. Oztas and Okmen (2004) by focusing on one type of building and one potential contractor eliminate certain variable concerned with the technology of the building and variance in pricing procedure. This suggests that differences in results are more likely to be the different procurement methods employed upon the projects.

Table 7: Summary of regression analysis of time overrun for different procurement methods

Regression Analysis of Time Overrun (To) on Contract Sum (Cs)					
Project Size	Traditional Method				
	R2 (Adjusted)	Regression Equation	P_ value	Remarks	
1-10 million	0.24	$C_p = 0.421 + 3.920 T_o$	0.0000	Significant	
11-100 million	0.53	$C_p = 0.388 + 2.329 T_o$	0.0002	Significant	
Above 100 million	0.58	$C_p = 0.856 + 1.545 T_o$	0.0001	Significant	
Design and Build Method					
1-10 million	0.43	$C_p = 0.353 + 3.655 T_o$	0.1000	Not Significant	
11-100 million	0.61	$C_p = 0.368 + 2.457 T_o$	0.1000	Not Significant	
Above 100 million	0.38	$C_p = 0.956 + 1.855 T_o$	0.1000	Not Significant	
Project Management Method					
1-10 million	0.54	$C_p = 0.733 + 3.765 T_o$	0.7500	Not Significant	
11-100 million	0.48	$C_p = 0.568 + 2.7876 T_o$	0.1000	Not Significant	
Above 100 million	0.51	$C_p = 0.456 + 1.455 T_o$	0.7000	Not Significant	
Management Contracting Method					
1-10 million	0.70	$C_p = 0.561 + 3.671 T_o$	0.3000	Not Significant	
11-100 million	0.71	$C_p = 0.356 + 2.810 T_o$	0.6000	Not Significant	
Above 100 million	0.62	$C_p = 0.626 + 1.510 T_o$	0.2000	Not Significant	
PPP Method					
1-10 million	0.60	$C_p = 0.562 + 3.720 T_o$	0.1500	Not Significant	
11-100 million	0.47	$C_p = 0.389 + 2.682 T_o$	0.7000	Not Significant	
Above 100 million	0.39	$C_p = 0.630 + 1.673 T_o$	0.3000	Not Significant	

## CONCLUSION

Selection of appropriate procurement method is a herculean task for all the stakeholders especially the client due to various factors regulating the execution and realisation of construction projects. Individual client has different needs and requirements and as such measure project success differently as no two construction projects are entirely the same in every respect, thus, no single method of procurement can be appropriate for every project. The research presented in this paper examined the impact of different procurement methods and project types on performance of construction projects. Mostly, project performance or success is measured using the iron triangle of cost, time and quality which are considered as the three essential parameters of project performance,

but health and safety has found its way into these performance criteria as shown in the study. The research showed that construction clients in Nigeria are becoming more informed due to the quest to have their project completed on time, within budget and with the right quality; the adoption of different procurement methods show that the construction industry is now trying to meet the clients' needs. The study indicated that different procurement method have different effect on the cost and time performance of construction projects. The results established that there is a relationship between procurement methods and factors used in assessing project success, while no relationship exists between procurement methods and project types. The implication is that cost, time, quality and health and safety are factors affecting the selection of procurement methods.

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