ASSESSMENT OF PROCUREMENT SYSTEM SELECTION CRITERIA FOR PUBLIC INFRASTRUCTURE PROJECTS IN NIGERIA

Nurayn O. Aliu , Luqman O. Oyewobi, Maroof O. Anifowose and Bashir O. Ganiyu

Department of Quantity Surveying, Federal University of Technology Minna
Corresponding author: aliulanren@gmail.com

ABSTRACT

In the public sector, project success or failure is often directly tied to the procurement approach underpinning the contract. Given the varieties of procurement options available, choosing the best procurement strategy for a given construction project can be challenging. In order to help the client, identify the most suitable procurement techniques, various procurement selection variables are available. This study assessed the selection criteria for three construction procurement options commonly used in the Nigerian construction industry. A quantitative survey approach was adopted to obtain data from professionals in the public sector involved in the management, design and operations of construction projects in Lagos and Abuja. A total of 411 questionnaires were distributed, 216 were returned and found suitable for the analysis conducted. The data were analysed using descriptive statistical methods by employing relative importance index to develop a procurement path decision chart. Size of projects, nature of projects as well as authority and government policies were found to be the most important selection criteria for all the procurement options based on the findings of the study presented in this paper. The study concluded that Public Private Partnership is more favourable in delivering public infrastructure. The findings have practical implications for government and agencies to consider when selecting the appropriate procurement method, which can lead to enhanced public infrastructure project delivery.

Keywords: construction, procurement selection, infrastructure, types of procurement options, Nigeria.

INTRODUCTION

Procurement is the process of creating, managing, and fulfilling contracts related to the provision of goods, services, and construction works and its importance in achieving success in project cannot be understated (Luu et al., 2005; Ali et al., 2016). The construction business has seen significant progress in terms of technological advancement and an increase in demand for more complex and easily accessible infrastructure projects. As a result of this development, the construction industry has also witnessed tremendous growth (Suleiman, 2013). This development in construction has brought attention to the need for an improvement in the procurement strategy and procedures that are employed in the process of bringing about these projects (Ngam et al., 2016). This is premise on the fact that an overwhelming majority of construction professionals believe that good procurement is synonymous with a successful project.

Most of the time, a procurement system is selected on the basis of the knowledge and experience of clients or the direction provided by external consultants. This decision is typically made without an in-depth analysis of the benefits and drawbacks of each system, as well as without any consideration of the elements and features that influence the success of each project (Ali et al., 2016). According to the Chartered Institute of Building (2010) and Ali et al. (2016), there are three different types of procurement systems: the traditional system (which is known as Design-bid-build), the Design-Build (DB) system, and the Construction Management system (CM). In a related development, Chan (2007) and Noor (2011) stated that there is one procurement system that is significantly better than all other procurement systems for a specific project. Nevertheless, it is unlikely that any one procurement system will be better than other procurement systems for all projects. Within the context of the client's overarching strategic project goals, it is essential to keep in mind that the selection of the procurement system should be carried out by the client's consultant in a manner that is practical, comprehensive, and under control (Love et al., 1998; Luu et al., 2005; Thwala and Mathansi, 2012). Nevertheless, comprehending the requirements of a customer in the context of their aims and priorities can be a difficult undertaking. Because of the special nature of their interests and the demands placed on them by technology, certain needs and goals will have to be sacrificed in favour of others (Love et al., 1998). Depending on the needs, the client or his representative can select from a variety of alternative procurement methods. Every type of procurement system has its own set of advantages and disadvantages for the project owner (Noor, 2011). But the question that really has to be asked is, which of these options is the best one to go with? It has been proven to be challenging to select the ideal procurement system due to the fact that even knowledgeable clients do not know all of the potential benefits and drawbacks associated with each approach (Worosch, 2014).

Construction projects have historically been carried out within an environment that is fragmented and contentious, with delays and conflicts being quite commonplace (Norberg-Johnson, 2015). As such, there is the need to identify and select suitable procurement system for the delivery of public infrastructure projects in Nigeria. Although the classification by CIOB indicated that traditional, design and build, and construction management procurement systems are the most common options (CIOB, 2010), evidence on the adoption of construction management procurement systems in the delivery of construction projects in Nigeria is scarce (Jimoh et al., 2016). However, literature has shown that collaborative procurement options such as public-private partnerships (PPPs) has received considerable attention in the development and financing of public infrastructure facilities and services in Nigeria (Babatunde et al., 2015).

In fact, Atkinson et al. (2022) stated that there is a plethora of advantage to be gained from effective collaboration within the construction industry. Amongst the primary advantages of collaborative efforts are a reduction in project costs and schedules, as well as better constructability and effectively respond to needs of the users (Bresnen and Marshall, 2000). According to research conducted by Lang (2019), a vast number of clients and contractors agree that partnership approach helps minimize the total risk that is associated with infrastructure projects.

Many factors prevent the Nigerian construction industry from selecting and implementing an optimal procurement strategy, according to Ekung et al. (2013). So many studies have proposed methods to aid in choosing appropriate procurement strategies for building projects on a global scale. As an illustration, Ratnasabapathy and Rameezdeen (2007) created a procurement selection based on the Multi Attribute Utility Technique, which serves as a Decision Support System for the client, and Cheung et al. (2001) used the analytical hierarchy process (AHP) to determine which procurement options to pursue.

While Okunola et al. (2010) adopted the use of ICT in the selection process within the Nigerian construction industry, Ekung et al. (2013) developed a decision-based model for bettering the procurement selection process by illustrating the utility weighting factor that is central to the use of decision support tools in procurement. Important factors for choosing the best procurement systems were often ignored by many of the models. Some models only include a limited number of criteria, while others take into account only the characteristics of the project. Therefore, this study aims at developing a procurement path decision chart for public infrastructure project delivery in Nigeria.

LITERATURE REVIEW

Procurement systems

The procurement technique can be considered as a flow of actions starting right from the identification of the demand and concluding with the completion of the project. This has necessitated a multitude of project procurement systems that have been implemented with the purpose of improving the system's effectiveness, efficiency, and overall performance (Bhutto et al., 2019). These procurement systems include the traditional method of procurement, which has been around for a long time, was the only procurement system available to customers for a good portion of that time, and is the approach most customers are familiar with (Chartered Institute of Building [CIOB], 2010). According to Windapo et al. (2021), the design and build approach having a single company manage both the design and building phases of a project. Following the privatization of key public sector infrastructure, PPP emerged as a viable procurement strategy for bridging the infrastructure deficit, particularly in Nigeria (Sanda et al., 2016).

Lewis-Faupel et al. (2016) reached the conclusion that an effective public procurement process is an essential means of bringing infrastructure projects to fruition. Although public procurement has become an important tool for addressing the socio-economic challenges that countries are facing, the procurement policies that many governments have instituted regarding contracting organizations may not clearly state several criteria that need to be followed in order to determine the best procurement systems for work, which could make the task a challenging one (Oluka et al., 2021). In most cases, the policy will outline the general criteria, as opposed to the specific considerations like price and delivery capacity, which are frequently used in the decision-making process of procurement outcomes (Chen, 2010). It is imperative to make a selection, utilize the appropriate tools and resources within the chosen procurement method, and adhere to the standard guidelines of the procurement in order to derive the greatest possible advantage from the method of procurement that has been selected. For example, Ojo and Gbadebo (2012) and Sawalhi and Agha (2017) have come to the conclusion that the merits of choosing a good procurement method can be obtained throughout the whole project because it reduces and solves problems that come up during the construction phase.

However, Ojo and Gbadebo (2012) and Hu and Chong (2020) contended that many factors, such as project time, project complexity, quality requirement, as well as competitiveness, among other selection criteria, are largely influenced by procurement methods. Having acknowledged the variety of options that are available, it can be difficult to choose the best procurement method (Adamtey, 2020). Premathilaka and Fernando (2018) suggested that the best procurement method can be selected after carefully weighing the elements that affect timeliness, stakeholder management, design, and cost. Meanwhile, Mathonso and Thwala (2012) submitted that clients should choose the best procurement approach by taking into account the endogenous and exogenous environments of the project. If these important considerations are disregarded, the construction process will experience delays,

adversarial relationships, and costs will rise above original estimates (Kesavan et al., 2015). This means that the right project procurement criteria need to be chosen with a lot of care.

Procurement selection criteria

Establishing procurement selection criteria (PSC) and the interaction between them have been seen as the first step in procurement system selection (Ali et al., 2016). However, Kumaraswamy and Dissanayaka (2001) earlier opined that the selection criteria for procurement should be based on the needs of the client, the nature of the project, and the situation in which it is being done.

The selection of procurement systems in the Malaysian construction sector is influenced by a number of factors (Maizon et al., 2006). Complexity, price certainty, competitiveness, time, controllable variation, quality level, accountability, risk avoidance, price competition, client familiarity, and government policy are established to be among the selection variables that influence the choice of procurement method (Maizon et al., 2006). It has been determined that 5% savings can be achieved in public sector construction projects by using the most suitable procurement method (Alhazmi & McCaffer, 2000; Rahmani, 2016). Also, several authors (including Onosakponome et al., 2011; Ogunsanmi, 2013; Jimoh et al., 2016 Perera et al., 2021) have classed these selection criteria under different headings, such as internal and external environments. The internal environment is under the direct control of the project team as well as the client. On the other hand, the client and the project team have no direct influence over the external environment. As a result, the client and the project team can only react to changes that occur in the external environment. Therefore, choosing the right procurement method to carry out a construction project is crucial to the project's effective delivery (Ericksson & Lind, 2012).

However, it is of the utmost importance to comprehend that some of these factors for selection can be country or project specific. For instance, Adamtey's (2020) study was solely on design and build procurement options in the United States, but the focus of Perera et al. (2021) was on choosing an appropriate procurement strategy for the construction of steel buildings in Sri Lanka. This suggests that the criteria indicated by some of these studies are not general and that they should not be interpreted outside of their original context. The majority of the procurement strategies that are discussed in this study can be categorised as either traditional procurement, design and build, or public-private partnerships. This study focuses on the significance of selecting the procurement method that is most suited to the characteristics of the project under consideration. Each of these different procurement choices comes with its own set of characteristics that might act as pointers when choosing a method for procuring construction projects. The selection criteria that were modified for this study are outlined in Table 1, along with the sources from which they were derived.

Table 1: Procurement Systems Selection Criteria

Code	Criteria	Reference(s)
SEC1	Familiarity and experienced clients	Chan et al. (2001); Luu et al. (2003); Maizon et al. (2006); Guangyu et al. (2008); Ratnasabapathy et al. (2008); Onosakponome et al. (2011); Gbadebo and Ojo (2012); Mathonsi and Thwala (2012); Ogunsanmi (2013); Eriksson (2017); Jimoh et al. (2016); Premathilaka and Fernando (2018); Fewings and Henjewele (2019); Adamtey (2020); Hu and Chong (2020); Prasetyo et al., (2020); Perera et al. (2021)
SEC2	Client's specific requirements and objectives can implement	
SEC3	According to client financial capabilities minimum risk	
SEC4	Size of the project (Contract sum)	
SEC5	Nature of the project	
SEC6	Technical complexity of the project	
SEC7	Qualified professional available and involved	
SEC8	Flexibility to change design during both design and construction periods	
SEC9	Allocation of responsibility	
SEC10	Client willingness to take risk	
SEC11	Market Competitiveness	
SEC12	Public accountability	
SEC13	Value of money	
SEC14	Available construction period	
SEC15	Time predictability	
SEC16	Certainty of cost	
SEC17	Good quality of construction project	
SEC18	Overlapping of design and construction Client involvement	
SEC19	Regulatory environment regulating feasibility	
SEC20	Source of project funding method	
SEC21	Authority and government policies	
SEC22	Market forces	

METHODOLOGY

A quantitative approach was adopted for this study, with the primary emphasis being placed on the evaluation of procurement selection criteria for public infrastructure projects in Nigeria. This study used a cross-sectional survey approach for data collection. This questionnaire survey approach enables data gathering from a specific study population and, in turn, makes it easier to draw conclusions about that population at any given time (Basheka et al., 2010). A questionnaire was developed after review of literature to identify the procurement selection criteria. The identified criteria are presented in Table 1. Data were collected for the study from the stakeholders (construction professionals) in both public sector and private sectors in Abuja and Lagos, Nigeria (see Table 2). The selection of these two regions was predicated on a number of criteria, including: the presence of procurement law or projects implemented using Act (Abuja: Procurement Act 2007; Lagos State: Public Finance Management law 2011) in the study area that set the rules and policies for procuring construction projects, the ease with which a survey could be conducted to obtain the necessary data, the availability of practitioners in management, design, and operations and the concentration of a larger percentage of construction professionals. The questionnaire was first piloted amongst 15 procurement officers in the public sector and after which the survey questionnaire was refined and administered in the study area. A total of 411 questionnaires were distributed, 216 were returned, with Abuja (FCT) accounting for 63% and Lagos accounting for the remaining 37%.

Table 2: Study population and sample size

S/NO	Description of Population	Population (Abuja and Lagos)	Sample size
1	Architects	378	103
2	Quantity Surveyors	206	56
3	Builders/contractors	396	108
4	Engineers	228	63
5	Others	296	81
	Total	**1504**	**411**

Note: The list of the professionals as obtained from NIQS, ARCON, ACEN and BPP

Data analysis

The purpose of descriptive statistics was to generate summaries about data samples that could be used to describe the features of a dataset. Following that, the approach used by Perera et al. (2021) was applied to determine the best procurement method for infrastructure projects. The study initially calculated the priority rating factor (PRF) of the infrastructure procurement selection criteria using the weighted mean rating (WMR) method to reflect the importance assigned by respondents to each of the selection variables.

Priority Rating Factor = WMR = $\frac{\sum_{i=1}^{5}(x_i \times f_i)}{R\%}$

Where: *WMR* = 5 mean rating for an attribute; f_i = 5 frequency of responses for an attribute (ranging from 1 to 5) and R% = percentage response to rating point of an attribute.

In addition, the primary value is obtained by multiplying the PRF of procurement selection factors by the UF, which is determined by the RII of the variables (PV). The utility factor indicates the degree to which each procurement selection factor is linked to each procurement method in terms of infrastructure projects, and the primary value is the score earned by each procurement system for each procurement selection factor.

Primary Value (PV) = Priority Rating Factor x Utility Factor

To determine which procurement strategy is best suited for infrastructure projects, the PV of each possible option was added up. Therefore, the best procurement strategy is the one that produces the highest value.

RESULTS AND DISCUSSION

Demographic analysis of the data

Table 3 reveals the background information of the respondents, their academic qualifications and years of experience in the industry. The result presented in Table 2 shows the general information of the respondents. From the table, it is clear that all the construction professionals were well represented in this study. From their years of working experience in the construction industry, they could be deemed to have sufficient knowledge in responding to the issues interrogated in the study.

Table 3: General Information of Respondents

Item	Frequency	Valid Percent	Cumulative Percent
Profession			
Architect	61	28.24	28.2
Quantity Surveyor	56	25.93	54.17
Builder	53	24.54	78.7
Engineer	45	20.83	99.5
Others	1	0.46	100
Highest academic qualification			
Diploma	13	6	6
Bachelor degree	110	50.9	56.9
Master degree	75	34.7	91.7
PhD	9	4.2	95.8
Others	9	4.2	100
Years working in construction industry			
Less than 5 years	26	12	12
5-10 years	37	17.1	29.2
11-15 years	62	28.7	57.9
16-20 years	40	18.5	76.4
21-25 years	14	6.5	82.9
Above 25 years	37	17.1	100

Descriptive statistics results

Table 4 shows the descriptive statistics for the three types of procurement systems considered in this study, as well as how the respondents ranked the selection criteria for procurement. This table has twenty-two selection criteria that were found in the literature and improved with the help of the Delphi method. "Size of project (contract sum)" was ranked first as the most considered factor for the selection of traditional procurement by respondents, with a mean item score of 3.795. Authority and government policies (3.609) and familiarity with experienced clients (3.609) were both ranked second. These three selection criteria were considered the most important selection criteria for the traditional procurement system. The results here are consistent with Kadiri and Ogunkola (2014) study. They argued that one reason why many organisations in both the public and private sectors choose to use the same procurement method is because it is already well-known and understood.

In examining the perceptions of the respondents with respect to design and build procurement system selection criteria, the nature of the project was ranked first, with a mean item score of 3.789. This is followed by how competitive the market is (3.776) and the size of the project (contract sum) (3.749), which are the second and third most important factors for choosing a procurement system. This finding is buttressed by the assertion that the best method to use when a public or private procurement strategy demands competitiveness, especially in terms of price, is Design and Build (Haskell, 2018).

With a mean item score of 4.043, Laws and Regulatory environment were ranked as the most important selection criteria for collaborative procurement systems (PPPs). This is followed by the source of the project funding method (3.981) and market competitiveness (3.973) as the second and third-ranked most important selection criteria, respectively. This is backed up by Pu et al. (2019), who stated that laws and regulations were the most important things to consider when choosing a PPP project procurement model. This finding is not surprising as Babatunde et al. (2015) maintained that poor financial projections and access to funds are the bane of public selection in adopting the PPP system of procurement. In considering the overall weighting for the 22 selection criteria, the size of the project

(contract sum), the nature of the project, and authority and government policies are the three most ranked criteria, respectively. This finding supports Maizon et al.'s (2006) assertion that government policies could affect the choice of procurement system.

Table 2: Descriptive Statistics of o Procurement systems Selection Criteria

		Traditional		Design & Build		Collaborative (PPP)		Overall		
	Procurement Selection Criteria	Mean	Rank	Mean	Rank	Mean	Rank	Overall Mean	Overall Ranking	RII
SEC1	Familiarity and experienced clients	3.609	3	3.716	4	3.802	19	3.709	4	0.742
SEC2	Client's specific requirements and objectives can implement	3.105	17	3.546	19	3.775	22	3.475	19	0.708
SEC3	According to client financial capabilities minimum risk	3.217	10	3.625	13	3.783	21	3.542	17	0.724
SEC4	Size of the project (Contract sum)	3.795	1	3.749	3	3.795	20	3.779	1	0.749
SEC5	Nature of the project	3.605	4	3.789	1	3.915	8	3.769	2	0.757
SEC6	Technical complexity of the project	3.209	12	3.716	4	3.903	11	3.610	7	0.742
SEC7	Qualified professional available and involved	3.345	6	3.667	8	3.919	6	3.643	6	0.732
SEC8	Flexibility to change design during both design and construction periods	3.248	9	3.591	15	3.946	4	3.595	8	0.717
SEC9	Allocation of responsibility	3.047	18	3.564	17	3.946	4	3.519	18	0.712
SEC10	Client willingness to take risk	3.260	7	3.642	10	3.860	15	3.587	11	0.728
SEC11	Market Competitiveness	3.364	5	3.776	2	3.973	3	3.704	5	0.754
SEC12	Public accountability	3.217	10	3.673	7	3.833	18	3.574	12	0.734
SEC13	Value of money	3.039	19	3.509	20	3.868	14	3.472	14	0.701
SEC14	Available construction period	3.116	15	3.640	11	3.872	13	3.543	16	0.727
SEC15	Time predictability	3.260	7	3.633	12	3.884	12	3.592	9	0.726
SEC16	Certainty of cost	3.202	13	3.610	14	3.857	16	3.556	14	0.721
SEC17	Good quality of construction project	2.915	21	3.576	16	3.841	17	3.444	20	0.714
SEC18	Overlapping of design and construction Client involvement	2.915	22	3.467	21	3.911	9	3.431	21	0.693
SEC19	Laws and Regulatory environment	3.116	15	3.522	18	4.043	1	3.560	13	0.704
SEC20	Source of project funding method	3.120	14	3.666	9	3.981	2	3.589	10	0.732
SEC21	Authority and government policies	3.609	2	3.709	6	3.911	9	3.743	3	0.741
SEC22	Market forces	2.333	20	3.403	22	3.919	6	3.218	22	0.680

Procurement assessment chart

Respondents were then asked to assign weights between (1) and (5) to each of the three procurement systems (traditional, design and build, and PPP) to indicate the degree to which the indicated selection criteria variables may be successfully attained using that particular system. Using their expertise and first-hand experience with infrastructure implementation, respondents have assigned relative importance to each component. When deciding how much weight to give various aspects, respondents' perspectives vary widely depending on their level of expertise.

Since this is the case, the study represents how well the procurement selection parameters can be met by each procurement strategy. As shown in Table 3, UF can be calculated. Each procurement technique has its own set of requirements, and respondents have assessed how

likely they are to be met. The results showed that using a design and build approach makes it more likely that the project will be finished within the allotted budget. For public sector infrastructure projects, the nature of the project is also a major consideration when deciding on a procurement strategy.

By multiplying the PRF of the identified procurement selection factors (Table 3) with the UF factor (Table 3), which represents the extent to which a procurement system achieves a criterion, one may determine the most effective procurement strategy for infrastructure development projects. When it comes to public construction projects, the utility factor is the connecting link between the many procurement selection factors and the various procurement approaches. A decision chart for the optimal procurement strategy is shown in Table 3. The study examined the three most widely used procurement systems in Nigerian (Babatunde *et al.*, 2015; Jimoh *et al*., 2016). The procurement strategy with the highest PV is chosen as the optimal one. With a total PV of 62.036, the analysis concludes that the collaborative (PPP) procurement technique is the most favoured option for public infrastructure development projects based on the procurement path decision chart. The PV for the traditional procurement strategy was 51.149, placing it below the PV for the design-and-build strategy, which was 60.361. However, Love *et al.* (1998) noted that no single procurement option is good for all situations.

Table 3: Procurement path decision chart

		PPP		**Traditional**		**Design & Build**	
Procurement Selection Criteria	PRF	UF	PV	UF	PV	UF	PV
Familiarity and experienced clients	3.716	0.760	2.826	0.719	2.671	0.747	2.776
Client's specific requirements and objectives can implement	3.546	0.755	2.678	0.619	2.194	0.752	2.666
According to client financial capabilities minimum risk	3.625	0.757	2.743	0.641	2.323	0.775	2.809
Size of the project (Contract sum)	3.749	0.759	2.845	0.756	2.834	0.731	2.742
Nature of the project	3.789	0.783	2.966	0.718	2.721	0.769	2.915
Technical complexity of the project	3.716	0.781	2.901	0.639	2.376	0.807	3.001
Qualified professional available and involved	3.667	0.784	2.874	0.666	2.443	0.747	2.740
Flexibility to change design during both design and construction periods	3.591	0.789	2.834	0.647	2.324	0.716	2.570
Allocation of responsibility	3.564	0.789	2.812	0.607	2.163	0.740	2.637
Client willingness to take risk	3.642	0.772	2.812	0.649	2.365	0.761	2.772
Market Competitiveness	3.776	0.795	3.000	0.670	2.531	0.798	3.014
Public accountability	3.673	0.767	2.816	0.641	2.354	0.794	2.914
Value of money	3.509	0.774	2.715	0.605	2.124	0.724	2.541
Available construction period	3.640	0.774	2.819	0.621	2.260	0.786	2.861
Time predictability	3.633	0.777	2.822	0.649	2.359	0.751	2.728
Certainty of cost	3.610	0.771	2.785	0.638	2.303	0.755	2.725
Good quality of construction project	3.576	0.768	2.747	0.581	2.077	0.794	2.841
Overlapping of design and construction Client involvement	3.467	0.782	2.711	0.581	2.013	0.715	2.478
Laws and Regulatory environment	3.522	0.784	2.761	0.621	2.187	0.706	2.489
Source of project funding method	3.666	0.796	2.919	0.622	2.279	0.780	2.858
Authority and government policies	3.709	0.782	2.901	0.719	2.666	0.721	2.675
Market forces	3.403	0.809	2.751	0.465	1.582	0.767	2.609
			62.036		**51.149**		**60.361**

Discussion of findings

The nature of the project, market competitiveness, and size of the project, technical complexity of the project, familiarity, and client's expertise are recognised as the five key selection criteria when choosing an appropriate procurement system for infrastructure

projects in public sector. The findings are in line with those reported by Okunlola and Olugbenga (2010), who stated that an increase in project size and complexity is a significant factor in choosing the best procurement system. Similar to this, Mathonsi and Thwala (2012) highlighted project size and technical complexity as a key selection criterion for procurement systems. Also, both the public and private sectors (Kadiri and Ogunkola, 2014) have found that familiarity with a certain procurement method has led to a preference for that method.

The study found 22 selection criteria that have a big impact on how clients responsible for infrastructure construction projects choose their procurement systems. A PRF was assigned to them to indicate the relative weight of these elements. Interestingly, all of the factors were deemed significant because they had PRF ratings higher than 3.0. Each of the 22 selection criteria's utility ratings (Table 4) gives an indication of how well each procurement system meets the criteria that were considered when it was chosen. The collaborative (PPP) procurement system, which integrated the effects of the PRF and the UF, has acquired the highest primary value in Table 4. The claim made in this study is that the procurement system that is chosen must have features that make it easier to deploy the resources that are available to ensure smooth project execution. In this context, it has been determined that Nigeria's infrastructure construction projects will benefit most from a collaborative procurement system. In order to meet community expectations and advance projects that the community needs and/or requests, the government uses a collaborative (PPP) procurement approach (Gorey, 2015).

However, Lee and Kim (2018) argued that PPPs are not necessarily more effective than traditional procurement methods. Improvements in PPP efficiency are possible only with well-drafted agreements and careful implementation. Babatunde et al. (2015) noted that the procurement system has not attained widespread approval despite the fact that PPP is widely seen as the solution to the infrastructure gap. Private investors from both domestic and foreign countries have lost interest as a result of this.

CONCLUSION

Important selection factors for choosing procurements for public infrastructure development projects were examined in this paper. The primary goal is to use a quantitative research approach to choose a viable procurement strategy for public infrastructure projects in Nigeria. When deciding on a procurement mechanism for Nigeria's infrastructure projects, all 22 selection criteria were deemed crucial. The most important factors in traditional procurement are the size of the project, the availability of relevant government resources, the familiarity of the clientele, and their previous successes with similar efforts. The nature of the project, market competitiveness, and project size were found to be the most important factors to consider when evaluating design and build procurement methods. The most crucial factors in choosing a collaborative (PPP) procurement system are the existing legal and regulatory framework, the chosen method of funding the project, and the competitiveness of the market. After ranking the 22 selection criteria based on the average mean item score and calculating the RII, the study concludes that when choosing a procurement approach for public infrastructure projects, it is most important to take into account the size of the project, the nature of the work to be done, and any relevant authorities or government policies.

After standardizing the PRF and utility factor, this analysis found that the collaborative procurement system was the best way to procure building infrastructure projects. Due to limited resources and the possibility presented by the collaborative procurement system (PPP) in terms of funding projects through partnership, it is possible that this method of procurement is chosen for infrastructure construction projects. As a result of the country's recent economic downturn and the slow development of the construction industry, the construction sector in Nigeria requires the implementation of a procurement system that is less rigid than the current one. Nigeria's economy is changing, so the country needs to set up a procurement system that will help the government catch up on infrastructure so that it can take advantage of investment opportunities in many sectors.

While this paper's theoretical analysis found the collaborative procurement system to be the best option for delivering infrastructure projects in Nigeria, putting that theory into reality may prove difficult given how different it is from the conventional approach. Still, the study focused on the most important criteria that must be taken into account when choosing a procurement method. To make sure the most important criteria are satisfied, the procurement system must be selected by competent individuals and modified so that it is an innovative system with solid governance.

REFERENCES

Adamtey, S. A. (2020). An empirical study to assist owners in selecting the right procurement method for design-build projects. *International Journal of Construction Education and Research,* 1–18. https://doi:10.1080/15578771.2020.1786482.

Al-Hazmi, T. McCaffer, R. (2000) project procurement system model. *Journal of Construction Engineering and Management,* 126(3), 176-184.

Ali H.A., Ola L.B, Bjorn A.C., Olav T.D., Nil O.E.& Jarder L.F., (2016).Selection Criteria for Delivery Methods for Infrastructure Projects. *Procedia-Social and Behavioral Sciences* 226, 260-268.

Atkinson, R.J., Tennakoon, M. and Wedawatta, G. (2022). Use of new models of construction procurement to enhance collaboration in construction projects: the UK construction industry perspective. *Journal of Financial Management of Property and Construction,* Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JFMPC-02-2021-0016.

Babatunde, S.O., Perera, S., Zhou, L. Udeaja, C. (2015). Barriers to public private partnership projects in developing countries: A case of Nigeria. *Engineering, Construction and Architectural Management,* 22(6), 669-691.

Basheka, B.C., Barifaijo, K.M. and Oonyu, J. (2010), *How to Write a Good Dissertation/Thesis: A Guide to Graduate Students* Kampala: New Vision Printing Press.

Bhutto, I., Memon, N., Khoso, A., Leghari, M. and Khahro, S. (2019). Factors affecting selection of procurement method in public sector construction projects. *10th International Civil Engineering Conference* (ICEC-2019) "Technological Transformation of Civil Engineering, Karachi, Pakistan.

Bresnen, M. and Marshall, N. (2000), "Partnering in construction: a critical review of issues, problems and dilemmas", *Construction Management and Economics*, Vol. 18 No. 2, pp. 229-237.

Chan, A.P.C., Yung, E.H.K., Lam, P.T.I., Tam, C.M., and Cheung, S.O. (2001). Application of Dephi Method in Selection of Procurement Systems for Construction Projects. *Construction Management and Economics*, 19(7), 699-718.

Chan, C. T. (2007). Fuzzy procurement selection model for construction projects. *Construction Management and Economics, 25*(6), 611-618.

Chartered Institute Of Building (CIOB) (2010), Procurement in the Construction Industry 2010, The Chartered Institute of Building, Berkshire.

Chen, Y., Okudan, G. and Riley, D. (2010). Sustainable performance criteria for construction method selection in concrete buildings. *Automation in Construction*, 19(2), 235-244.

Ekung, S. Siriwardena, M. and Lashinde, A. (2013). Optimised Selection and Use of Project Procurement Strategy in Nigeria: a Practical Case Study. Ethiopian *Journal of Environmental Science and Management*, 6(6): 661-9.

Eriksson, P.E and Westerberg, M (2012) "Effects of procurement on construction project performance", Available at: Available at http://www. Engineeringtoolbox.com (Accessed: 7 March 2012).

Eriksson, P.E. (2017). Procurement strategies for enhancing exploration and exploitation in construction projects. *Journal of Financial Management of Property and Construction*, 22(2), 211-230, doi: 10.1108/JFMPC-05-2016-0018.

Farrow, C.B. (2007). Procuring steel through an early-release steel package. *International Journal of Construction Education and Research*, available at: http://ascpro0.ascweb.org/archives/cd/2007/ paper/CPGT117002007.pdf.

Farrow, C.B. (2007).Procuring steel through an early-release steel package., *International Journal of Construction Education and Research*, available at: http://ascpro0.ascweb.org/archives/cd/2007/paper/CPGT117002007.pdf.

Gorey, A. (2015). Public Private Partnerships for Procurement. Available at: https://aca.org.au/public-private-partnerships-for-procurement/#:~:text=The%20PPP%20process%20enables%20government,the%20life%20of%20the%20asset.

Hu, X., and Chong, H. Y. (2020). Integrated frameworks of construction procurement systems for off-site manufacturing projects: social network analysis. *International Journal of Construction Management*, 1-9.

Jimoh, R. A., Oyewobi, L. O. and Aliu, N. O. (2016). Procurement selection criteria for projects in the public sector: Evidence from Nigeria. *Independent Journal of Management & Production*, 7(4), 1096-1114.

Kadiri D.S & Ogunkola O.M. (2014) "Assessment of procurement Methods Based on Clients Selection Criteria in Ogun State, Nigeria" *Convenant Journal of Research in the Built Environment (CJRBE*) 2(1), 31-41.

Kumaraswamy, M. M., and Dissanayaka, S. M. (2001). Developing a decision support system for building project procurement. *Building and Environment*, *36*(3), 337-349.

Lang, N. (2019). The importance of collaboration in a connected world", available at: www.weforum.org/agenda/2019/01/how-collaboration-is-the-modern-company-s-secret-weapon/ (accessed 29 October 2019).

Lee, H., and Kim, K. (2018). Traditional procurement versus public–private partnership: A comparison of procurement modalities focusing on bundling contract effects. *Asian Development Bank Economics Working Paper Series*, (560).

Lewis-Faupel, S., Neggers, Y., Olken, B. A. and Pande, R. (2016). Can electronic procurement improve infrastructure provision? Evidence from public works in India and Indonesia. *American Economic Journal: Economic Policy*, *8*(3), 258-83.

Love P.E. D, Skitmov, M. and Earl, G. (1998) "Selecting a Suitable Procurement Method for a Building Project, *Journal of Construction Management and Economics*, 16(2), 221-233.

Luu, D.T., Thomas Ng, S. and Chen, S.E. (2005) "Formulating procurement selection criteria through case-based reasoning approach", *Journal of Computing in Civil Engineering*, 19, (3), pp. 269-276.

Maizon, H., Li, M., Yin, Ng. Hoooi, Ng. Heng, S., and Yong, T. (2006) Factors Influencing The Selection Of Procurement Systems By Client. *International conference on Construction industry. Passing, Indonesia* Retrieved on 19th of July 2018 from: docplayer.net>38117647-Factors-influence

Ngam, M. C. *et al.* (2016) A conceptual framework for procurement decision making model to optimize supplier selection. The case of Malaysian construction industry.*IOP conference series: Earth and Environment Science*, 32/012034 retrieved From; https://ojs.ullib.ee/index.php.TPEP/article/download/.../7569/.

Noor, M.I. (2011) Investigating the Role of Procurement Practices in Effective Implementation of Infrastructure Projects in A Developing Country: A Case of Pakistan. Retrieved on the 10th of January 2018 from: https://researchbank.rmit.edu.au>view.

Ogunsanmi, O. (2013). Effects of procurement related factors on construction project performance in Nigeria. *Ethiopian Journal of Environmental Studies and Management*, 6(2), 215-222.

Ojo, A.E. and Gbadebo, M.A. (2012), "Critical selection criteria for appropriate procurement strategy for project delivery in Nigeria", *Journal of Emerging Trends in Economics and Management Sciences*, Vol. 3 No. 5, pp. 422-428.

Ojo, A.E. and Gbadebo, M.A. (2012). Critical selection criteria for appropriate procurement strategy for project delivery in Nigeria. *Journal of Emerging Trends in Economics and Management Sciences*, 3(5), 422-428.

Okunlola, O.J.O. and Olugbenga, A., (2010). Developing a decision support system for the selection of appropriate procurement method for a building project in Nigeria. *Global Journal of Researches in Engineering*, 18-30.

Oluka, P.N., Okoche, M. and Mugurusi, G. (2021), "Public procurement and competitiveness of women-owned businesses: a structural equation model (SEM) for gender-responsive procurement in Uganda", *World Journal of Entrepreneurship, Management and Sustainable Development*, Vol. 17 No. 2, pp. 209-226.

Oluka, P.N., Okoche, M. and Mugurusi, G. (2021). Public procurement and competitiveness of women-owned businesses: a structural equation model (SEM) for gender-responsive procurement in Uganda. *World Journal of Entrepreneurship, Management and Sustainable Development*, 17(2), 209-226.

Onosakponome, O.F., Yahya, A., Rani, N.S.A. & Shaikh, J.M. (2011). Cost benefit analysis of procurement systems and the performance of construction projects in East Malaysia. *Information Management and Business Review*, 2(5), 181-192.

Perera, G.P.P.S., Tennakoon, T.M.M.P., Kulatunga, U., Jayasena, H.S. and Wijewickrama, M.K.C.S. (2021). Selecting suitable procurement system for steel building construction. *Built Environment Project and Asset Management*, 11(4), 611-626.

Premathilaka, K.M. and Fernando, R.I.S. (2018), Critical Success Factors Affecting E-Procurement Adoption in Public Sector Organizations in Sri Lanka, Unpublished Thesis, Digital Repository, University of Sri Jayawardhanapura.

Pu, W., Xu, F., Chen, R. and Marques, R. C. (2020). PPP project procurement model selection in China: does it matter? *Construction Management and Economics*, *38*(2), 126-139.

Rahmani, F. (2016) "Conceptual Models For Selecting And Managing Early Constructor Involvement (ECI) Delivery System By Clients" PHD thesis, RMIT, University. Retrieved on 26th February, 2018 from: https://researchbank.rmit.edu.au>Rahmani.

Ratnasabapathy, S. Rameezdeen, R. and Gamage, I. (2006). Macro level factors affecting the construction procurement selection: A multi criteria model. The Joint International Conference on Construction, Culture, Innovation and Management (CCIM), 26th -29th Nov 2006 Dubai, UAE pp. 581–591.

Ratnasabapathy, S., Rameezdeen, R. and Lebbe, N.A. (2008). Exploratory study of external environmental factors influencing the procurement selection in construction. *Building Resilience*, p. 1576.

Rubasinghe, K., Disaratne, V. and Mahinkanda, M.M.M.P. (2019). Suitability of traditional procurement system for green buildings in Sri Lanka. *Proceedings of the 8th World Construction Symposium 2019*, Sri Lanka.

Sanda, N. Y., Daniel, M. M., Akande, E. M., and Adeagbo, D. O. (2016). A Review of Public-Private Partnership for Building and Infrastructure Procurement in Nigeria. *Developing Country Studies*, 6(2), 5-13.

Sawalhi, N.I. and Agha, O.E. (2017). Multi-attribute utility theory for selecting an appropriate procurement method in the construction projects. *Construction in Developing Countries*, 22(1), 75-96.

Singh, S. (1990) Selection of appropriate project delivery system for construction projects, In: Proceedings of CIB W-90 International Symposium on Building Economics and Construction Management, Sydney, Australia, 469- 80.

Suleiman, A. (2013. The impact of Project Risk Factors on the Selection of Public works Procurement Methods in Ghana. A focus on NCT. Kwame Nkrumah University of Science and Technology, Kumasi. [Retrieved 15 May, 2021] available at: https://citeseerx.ist.psu.edu>viewdoc>download.

Thwala, W. and Mathonsi, M. (2012), "Selection of procurement systems in the South African construction industry: an exploratory study", *Acta Commercii*, Vol. 12 No. 1, pp. 13-26

Windapo, A.O., Adediran, A., Rotimi, J. O. B. and Umeokafor, N. (2021). Construction project performance: the role of client knowledge and procurement systems. *Journal*

of Engineering, Design and Technology, 1726-0531, https://10.1108/JEDT-06-2020-0219.

Wörösch, M. (2014). End-to-end requirements management for multi-projects in the construction industry. DTU Mechanical Engineering.

Zhang, X. (2005). Criteria for Selecting the Private-Sector Partner in Public–Private Partnerships. *Journal of Construction Engineering and Management*, 131(6), 631–644.