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A COMPARATIVE ANALYSIS OF THE PERFORMANCE OF TRADITIONAL CONTRACTING AND DESIGN-BUILD PROCUREMENTS ON CLIENT OBJECTIVES IN NIGERIA

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Abstract. Client objectives in a building project are to build within the budget and estimated construction period and being satisfied with the quality of the project. The ability of the procurement methods in achieving these objectives does influence the client to choose any to implement the project. The performance of two of such procurement methods: the traditional contracting and design-build against client objectives were determined using data set of 53 traditional contracts and 15 design-build projects gathered through a questionnaire survey administered unto respondents in three locations in Nigeria. Time overrun, cost overrun and clients' satisfaction with quality standard were used as basis for comparison. Analysis showed that, the mean cost overrun, and time overrun for design-build were 21.4% and 36.8% respectively as compared with 42.6% and 135.6% for traditional contracting projects. As for quality standard, 78% of design-build clients were satisfied with their projects as compared with 51% for traditional contracting. The overall conclusion is that both methods involve overrun but design-build performed better.

Keywords: procurement methods, client objectives, time and cost overrun, quality standard.

1. Introduction

In the building industry, according to Moshini and Botros (1990), there are two ways of acquiring a building. One is to purchase, lease or rent as one does to equipment. The other is to decide to acquire the building by designing and constructing it. The latter process is complex because it brings together professionals within the building industry to form an organizational team to acquire the building. Each of these professionals brings into the design and construction phases his organization's expertise. However, often when this more complex form of project procurement was initiated, there was still mainly one way to organize the team, the traditional way, characterized by the sequential design-bid-build process particularly in the developing countries.

This method offers the contractor the lowest chance to be integrated since he has no input during the design phase. Adesanya (1998) observed that, it is generally not easy to integrate the design team with the construction team during the construction phase; this is because the normal split between design and construction often results in "psychological barrier" between the two teams. This view is supported by Graves (1982) who described the "psychological barrier" as a proverbial valley between the two teams. He opined that the outcome of the battles on project is delay, claims and large extra cost. However, Malpass (1987) and Banwell (1964) have noted that some construction works are so complex, that the design and construction can no longer be two separate fields. According to Higgins and Jessop (1965) this separation has led to lack of effective communication and coordination and therefore creating uncertainty. These shortcomings led to Emerson's (1962) and Banwell's (1964) reports. Both reports concluded that there was a need for an improved coordination and co-operation between the industry's practitioners.

Since then, there has been a proliferation of procurement methods to organize and manage both the design and construction phases. As observed by Mohsini and Botros (1990) these alternatives evolved because the traditional contracting had become inadequate in meeting the organizational changes taking place both in the construction industry and the society as a whole. However, the alternatives seem to address only few shortcomings of the traditional contracting method. Hence any one of these alternatives is most effective under certain specific conditions (Mohsini and Botros 1990). The alternative methods include the various management methods and the design-build method.

A project is regarded as successful in the building industry, if completed within the estimated cost, time and achieves the quality standard. The fulfillment of these criteria has been associated with the choice of appropriate procurement method. Clients in the industry however, as a result of not being aware of the strengths and weaknesses of other procurement methods, do always implement their projects with the ones they are familiar with. This is the case in the Nigerian construction industry particularly the public clients which uses the traditio-

nal contracting method because of civil service procedure. It is against this background, that, a survey was conducted to determine the performances of the traditional contracting method and the design-build used mostly by private clients on client's objectives. By this the client can decide which of the options is best suited for their project setting.

1.1. The Traditional Contracting Method

In the traditional contracting method, a client approaches an architect to lead the design group which includes the structural, mechanical and electrical engineers. The architect assembles this team. According to Rowlinson (1987) the architect most of the times takes the client's brief and then develops it into architectural form. The engineers then come in for the structural, mechanical and electrical designs. These designs are detailed to a point where the various elements of the structure can be taken-off and worked up to a bill of quantities by the quantity surveyor appointed by the client. At this stage contractors are invited to tender for the construction part. Their tenders are examined, compared and the successful contractor (most of the cases, the lowest bidder in the Nigerian context) is appointed to carry out the construction part of the project under the guidance of the architect. As observed by Rwelamila *et al.* (2000) and Rowlinson (1987), the successful contractor is expected to posses and start on site within some few days with very little knowledge or understanding of the building to be constructed. In addition, probably not having made acquaintances with the client and other project participants. In this method, the standard forms of contract is used which defines in a clear term what is to be built, the roles of the various parties and the terms of bargain between them. It also specifies the client requirements, stipulates the measures to be taken to assure compliance and states the remedies available to each party in the event of default (Rwelamila *et al.* 2000). The method is essentially a sequential (design-bid-build) approach in which the client allows the professionals to play their full part in the correct sequence. By this arrangement, the contractor is expected to bid for a building project based on a completed contract drawings. This must be the case because it is unrealistic to ask contractors to give a firm lump sum price for an innovative construction work (Bennett and Grice 1990). This process is advantageous because although the design period may be longer than other procurement methods, it allows the client to make necessary changes during design, which are less costly than changes during construction (Molenaar *et al.* 1998). It should however be noted that, there is also a chance to change orders during construction arising from the designers' errors and omissions. The major benefit in using this method for projects lies in the checks and balances created by separating the architect's and contractor's responsibilities. This encourages quality work from both parties. This method however, has been criticized for the multi-point responsibility that the clients have to endure and the conflict in relationships that it engenders (Franks 1990). Okereke- Onyeri (1994) observed that there is absence of a clearly identifiable single party ready, able and willing to take vital decisions on behalf of the clients. This Osemenam (1992) believes can lead to long delays in project conception and delivery, invariably leading to high cost of projects. Regardless of these known problems of the method, in Nigeria it is the widely used procurement method (Ojo 1999). It is not that, the traditional contracting method is all together ineffective, but other procurement methods could be more effective and appropriate when used on similar projects.

1.2. Design-Build Method

The design and build system is an integrated procurement approach in which a contracting organization takes responsibility for all aspects of the project (Moore and Dainty 1999). It has been described by Ireland (1984), as a single financial transaction under which one person or organization designs and builds a building to the firm of another person or organization, the customer. Hence the design and build organization combines all the fundamental tasks in construction project design, production and management in single package (Kwakye 1997).

The common features of design and build contract according to Ireland (1984) are:

1. the contract is signed before the building has been defined by full documents;
2. design is not fully completed before construction commences;
3. a bill of quantities is not normally prepared so variations are priced according to a schedule.

The growth of the design and build method in the UK and elsewhere as an alternative procurement method to the traditional contracting system, has been the result of the belief that design and construction should be integrated, i.e. the commencement of construction before the design is fully complete (Kwakye 1997). He and Molenaar *et al.* (1998) claim that, the design and build system, has the potential to reduce the incidence of misunderstanding (less adversarial relationship), improves communication, reduction of errors and omissions, claims, rapid reaction to scope changes, promotes the production of buildable designs and reduction of project duration. It is claimed also by Ayanlekoko (1992), that by using this method, the client meets his demand for a single point of contract, securing his building for a pre-agreed price and possibly in a time scale not otherwise achievable without considerable risk. However, the extent to which these benefits are realized in a given project depends in the working relationship of the parties involved (Ngowi 2000). Despite the claimed advantages of the system, it has the potential for disputes and claims at the construction stage particularly if the client's requirements had not been well defined at the early stage (Anumba and Evbuomwan 1997). Also by this system, the client has reduced representation and fewer checks and balances (Molenaar *et al.* 1998) and hence quality assurance can be an issue of concern for the client (Al Khalil 2002).

The system has two major variants, the "pure design-build" and "fragmented design-build". The categorization of the variants is based on the differentiation that each mode brings in terms of spatial, temporal and sen-

tient differentiation (Rowlinson 1987). Both variants are commonly used in Nigeria to procure building projects but the performance of the "pure design-build" against client's objectives was determined in this survey. For the "pure design-build", all necessary design and construction expertise is within one organization (the contractor's), which has the responsibility to take client brief, design and construct to cost, time and satisfaction of the clients.

1.3. Client Objectives

Clients, in whichever category they belong to, would have identified some needs prompting the client to make a decision to invest in construction. These needs are always defined by the client and then become the project's requirements and constraints. Fundamentally however, clients' macro objectives have been agreed by construction industry researchers (e.g. Sidwell 1984; Naoum and Langford 1984, 1987) to be cost, time and quality standard. Meeting these strategic objectives is paramount in construction procurement for the project to be regarded as successful by the client (Richards and Bowen 2007).

The amount which a project could cost is usually the responsibility of the quality surveyor. It is expected that this cost is set at the end of the design stage and before the production of the project. This is called the initial price. Clients however, are less worried by this price but rather "interest" in an early prediction of total cost of the project and the variance between this prediction and the actual cost (Sidwell 1984). Although the cost of a building is mostly predicted on consideration of costs per square and other techniques as cost indexing and libraries of cost data, it is still difficult to predict accurately how much a project should cost.

The time to design and construct a building depends on the abilities of the designers and the builder, the techniques and resources deployed to the project. Moreover, Sidwell (1984) believes, the design and construction duration, to an extent are a function of cost, size and complexity of the project. The major difficulty in the measurement of a building project time objective is that there is not time scale to indicate how long a project should take. Mansfield *et al.* (1994) suggested that, greater attention must be made in obtaining more accurate estimates from contractors to produce more realistic time scales.

The quality objective of a building project is subjective in nature (Sidwell 1984; Naoum 1994). To Sidwell (1984) it could be considered to be "an amalgamation of client satisfaction, architectural excellence, standard of finish and utility". In this research work, quality was taken as client satisfaction with the building as built in terms of satisfactory standard of workmanship and specifications. The client's satisfaction is the degree of conformity between expectation, interpretation of the client brief and realization of the project. According to Idoro (2010) quality can be measured using two categories of variables namely: objective and subjective variables.

2. Research Methodology

The study was carried out through structured questionnaire survey. Respondents were asked to indicate a particular procurement method they had used to implement their projects or been involved with and then supply empirical data on such projects. They were asked to supply initial contract sum, the final contract sum, the initial project period and the completion period. Also respondents were asked to indicate whether the client was satisfied with the project as – built taken into consideration client's brief in terms of workmanship and specifications. Moreover, respondents were asked to identify factors that had led to cost and time overruns in projects they were involved in.

A total of 84 questionnaires (see Table 1) were administered to organizations selected by random sampling. The three types of organizations targeted were:

1. Clients;
2. Consultants (architects, engineers and quantity surveyors);
3. Contractors (medium and large sized).

The distribution of the questionnaires was done in three locations of Lagos (1), Oyo (2) and Osun (3) states in Nigeria. Lagos is the commercial nerve centre of the Nigerian economy while Oyo and Osun states are the neighbouring states. The clients were picked randomly from the list of public and private institutions. While the consultants were picked from membership lists of each profession. The contractors were picked from the register of the Federation of Construction Industry (FOCI) sited in the locations.

Table 1. Distribution and number of completed questionnaires

Location	No distributed	No and class of respondents			Total responses
		Client	Consultant	Contractors	
1	41	4	12	10	26
2	23	4	8	4	16
3	20	5	2	2	9
Total	84	13	22	16	51

Data set of projects executed between 1993 and 1998 were supplied for analysis.

2.1. Method of Data Analysis

The time and cost variables were analyzed as follows using the procedure by Naoum and Langford (1990):

1. Construction time overrun – this was calculated by the mean percentage increase on the initial contract period, i.e. $\frac{T_2 - T_1}{T_1} \cdot 100\%$, where T_1 is the initial estimated project duration and T_2, the final construction duration in months;

2. Construction cost overrun – this was calculated by the mean percentage increase on the estimated construction cost, i.e. $\frac{C_2 - C_1}{C_1} \cdot 100\%$, where C_1, is the initial contract sum and C_2, the final contract sum.

The population mean of each variable was estimated from the sample mean by statistical computation. The two independent group means, were then compared using the Student "t" test. The analyses were carried out at the 5% level of significance, using a 2-tailed test. The null hypothesis was that, "there was no significant difference in the aggregate means of the independent samples on a particular variable". While the alternative hypothesis was that, "there is significant difference in the aggregate means of the independent samples on a particular variable".

Data sets of 68 building projects were analyzed to investigate the performances of the two procurement methods. 33 were traditional contracting projects while 15 were design-build projects. As for quality, client's satisfaction with standard of workmanship and specifications were used as the basis for comparison. This is how Naoum and Langford (1990) subjectively measured quality.

3. Results and Discussion

This research work was performed to establish if there is a difference in the performances of these two methods on client's objectives of time and cost and also if clients are more satisfied than other with their projects as built using either of these two methods. These then will enable a client decide to choose one to implement his building projects based on their performances.

3.1. Time Overrun

Construction delays have been the bane of the Nigerian construction industry. However, as a result of scarce resources and inflationary trends in the country, clients would prefer completing their projects as early as indicated in the contract documents, using the appropriate procurement method. The performances of the traditional contracting method and the design-build are presented in Table 2.

Table 2. Mean construction time overrun

Procurement method	Number of valid cases	Mean time overrun %	Standard deviation	Inference from test
Traditional contracting	51	135.9	20.1	Significant
Design-build	12	36.3	17.3	$P < 0.002$

The analysis revealed that projects implemented using the traditional contracting method had an average time overrun of 135.9% while the design-build had an average of 36.3%. These results were tested statistically using the "t" test and if revealed that, there is significance difference ($P < 0.002$) between the two procurement methods on time overrun in favour of the design-build method. Hence the null hypothesis is rejected, indicating that the design-build is superior to the traditional contracting in performance on time overrun.

The implication is that design-build projects of similar size and complexity could be built faster than those of the traditional contracting projects. Similar research work by Molenaar *et al.* (1998) indicated also that design-build projects are constructed faster than those of traditional contracting in the US and UK.

Reasons adduced by respondents for relatively slow construction speed of traditional contracting projects were:

i) separation of the design from construction;
ii) Low speed of decision making by project participants;
iii) Changing order (variation) during construction by clients.

The separation of the design from construction can lead to the problem of buildability which can cause delay. This separation also causes inter-professional conflict as reported by Graves (1982) which invariably leads to ineffective communication between project participants and hence the progress of the project. Chan and Kumaraswamy (1997) found out that variations and low speed of decision making by project participants can significantly affect construction period.

As for the design-build performance, respondents agreed that, it was because the method allows for "fast-trekking" (i.e. design and construction overlapping). For design-build project, construction can start before the project is fully designed and full contract documentations are ready. In addition, since the same organization is responsible for design and construction, conflict arising from engaging various professionals/organizations is eliminated. This could hasten up the decision making process and hence avoid delay.

3.2. Cost Overrun

Cost of construction project has been associated with construction delays. It is believed that construction projects overshoot their initial budget when such projects are constructed beyond their estimated construction period. This is common in a developing country such as Nigeria due to inflationary trends.

Table 3 shows the valid cases for each procurement method and the cost overrun of the methods over their estimated construction costs.

The test of association between the performances of the procurement methods on cost overrun revealed that there was no significant difference between their means. Hence it can be concluded that, design-build does not

Table 3. Mean construction cost overrun

Procurement method	Number of valid cases	Mean cost overrun %	Standard deviation	Inference from test
Traditional contracting	53	42.6	22.1	($P > 0.005$) Not significant
Design-build	15	21.4	14.2	

perform better than the traditional contracting on cost overrun. Similar works by Molenaar *et al.* (1998) however reported that the design-build can achieve a cost saving of 6% for a variety of building types in the US and 13% cost saving for UK projects. In the Nigerian context, this research work suggests that the design-build method can achieve a cost saving of 21% if used to procure similar traditional contracting projects. As regards the poor performance of the traditional contracting method, respondents attributed it to the ease at which clients could change orders in the form of variations. Also though the contractual arrangement allows for fluctuations, the Nigerian contractor however at the slightest change in prices of construction materials would utilize the fluctuation clause to claim extra money. In fact it has been observed by Naoum (1994) that under the traditional contracting methods "…from the moment a contract is signed, the contractor keeps careful records of the evidence that a claim for increased cost will be based on".

3.3. Quality

Quality was measured subjectively using client's satisfaction with standard of workmanship and specifications. This procedure was used by Naoum and Langford (1990) and also because quality is subjective in nature. Clients were asked to indicate for each project implemented using these two methods, whether they were highly satisfied, moderately satisfied or dissatisfied with the project as built. The survey result is presented in Table 4.

Table 4. Procurement and client satisfaction with quality

Procurement methods	Highly satisfied %	Moderately satisfied %	Dissatisfied %
Traditional contracting	51	41.5	7.5
Design-build	78	22	–

This result shows that 78% of the design build projects fell into the "highly satisfied" cell compared with 51% of the traditional contracting projects. It can also be observed that, it is only in the traditional contracting projects that the clients were dissatisfied. The result of this research work suggests that clients were more satisfied with their design-build projects than that of the traditional contracting projects. The performance of the design-build projects on quality in this survey is however contrary to the observation of Kumaraswamy and Dissanayaka (1998). They observed that, "the design-construct method may not be the best to evoke high quality levels" because quality control is usually left to the contractor who is also the designer (Ajanlekoko 1992). As regards the traditional contracting method, Naoum (1994) reported a higher percentage (72%) of the method's projects falling into the "highly satisfied cell than the 51% reported in this survey. The traditional contracting method is however regarded to be able to produce a "highly satisfied" project because of the checks and balances embedded in it project process.

4. Conclusions and Recommendations

This paper presented the performances of traditional contracting method and the design-build method on client objectives of time, cost and quality. The findings based on the 51 traditional contracting projects and 12 design-build projects revealed that the design-build method significantly outperformed the traditional contracting method on time objective. It is then concluded that, the design-build method can be used to procure building projects much faster than the traditional contracting method.

As regards cost, there was no significant difference between the performances of the two methods, but the design-build can be used to save 21% of the cost of similar traditional contracting projects.

By this study, more (78%) clients were highly satisfied with their design-build projects as-built as compared with 51% clients of traditional contracting projects. In the Nigerian context client's objective on quality can best be achieved by using design-build method rather than the traditional contracting method. Although the traditional contracting method is highly believed to produce better quality projects because of the checks and balances embedded in the system.

As regards the performance of the traditional contracting, it is recommended that clients make clear their briefs to the designers to limit variations during construction and the client representatives to ensure good workmanship. And for the design-build, the client should appoint a representative at the design stage who shall also be part of the production process.

Since both methods involved overrun in cost and time, the client cannot achieve his objectives with both methods but the design-build performed better.

5. The Value of Research, Limitations and Future Research

This research work was a follow up to an earlier work by Ojo (1999) in the quest to determine the performance of procurement methods against client objectives. It was believed that by this, a client can decide on the appropriate procurement method to implement his project. This study is limited however because of the few projects sampled and by not grouping the projects studied into categories in terms of type, complexity and cost. It is therefore being suggested that future comparison should be based on larger samples and similar projects.

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TRADICINIŲ STATYBOS RANGOS IR PROJEKTAVIMO BEI STATYBOS PIRKIMŲ VYKDYMO, ATSIŽVELGIANT Į UŽSAKOVO TIKSLUS, LYGINAMOJI ANALIZĖ NIGERIJOJE

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Santrauka

Užsakovo, vykdančio statybos projektą, tikslai – pastatyti statinį neviršijant numatyto biudžeto, statybos trukmės ir būti patenkintam projekto kokybe. Pirkimų metodų galimybė pasiekti šiuos tikslus veikia užsakovo sprendimą, kurį iš šių metodų pasirinkti ir įgyvendinti. Naudojant 53 tradicinių statybos rangos sutarčių ir 15 projektavimo bei statybos sutarčių duomenis, surinktus apklausų būdu trijuose Nigerijos regionuose, buvo nustatyti du statybos darbų pirkimo vykdymo būdai: tradicinis statybos darbų pirkimas ir projektavimo bei statybos pirkimas, atsižvelgiant į užsakovo tikslus. Statybos trukmės viršijimas, kainos viršijimas, pasitenkinimas atliktų darbų kokybe buvo naudojami kaip palyginimų pagrindas. Atlikta analizė parodė, kad vidutinis trukmės ir kainos viršijimas projektavimo ir statybos sutartyse buvo atitinkamai 21,4 % ir 36,8 %, o tradicinėse statybos rangos sutartyse – 42,6 % ir 135,6 %. 78 % projektavimo bei statybos užsakovų buvo patenkinti atliktų darbų kokybe, o darbus vykdant pagal tradicines sutartis, patenkintųjų darbų kokybe buvo 51 %. Bendra išvada yra ta, kad abiem metodais buvo viršyta trukmė ir kaina, bet taikant projektavimo bei statybos metodą šie rodikliai yra geresni.

Reikšminiai žodžiai: pirkimo būdai, užsakovo tikslai, trukmės ir kainos viršijimas, kokybė.

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