



COMPARING THE PLANNING AND PERFORMANCE OF DIRECT LABOUR AND DESIGN-BID-BUILD CONSTRUCTION PROJECTS IN NIGERIA

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Received 09 Jul. 2009; accepted 09 Feb. 2011

Abstract. This study compares the levels of planning and the outcome of projects procured by direct labour and traditional contract procurement options. For this comparison, a survey of 130 projects was carried out. Data were collected using structured questionnaires and analysed using percentage, mean and t-test. The study discovers that whereas the levels of conception and overall planning done in projects procured by the two options are the same, the levels of design and construction planning done in DBB and DL projects differ. The study also discovers that the time-overruns of projects procured by the two methods differ but their cost-overruns are the same. The study concludes that projects procured by DBB and DL options differ in planning and time-overrun and suggests improved planning at the design stage when DL option is adopted and improved planning at the construction stage when DBB option is adopted.

Keywords: design-bid-build, direct labour, Nigeria, project planning and project performance.

1. Introduction

The methods adopted for the procurement of construction projects deserve attention because of the important roles that construction products play in economic development. The methods may have significant impact on the quantum, quality and success of construction products delivery and they are capable of slowing down or increasing the pace of economic development. In every economy, Chan (2000) and Yakowenko (2004) maintained that several procurement options exist by which a project could be procured and that no single method is appropriate for all projects. One of the notable challenges that clients and other stakeholders in the construction industry face is how to choose one from the several procurement options that are available. The most appropriate option is usually regarded as the option that will assist the client to achieve his requirements and guarantee maximum success at the close of a project.

In the Nigerian construction industry, research studies (Iyagba, Idoro 1985; Idoro 2007) discovered Direct Labour (DL) and Design-Bid-Build (DBB) to be the most prominent methods for procuring construction projects in both public and private sectors. When evaluating the performance of projects and the methods used to procure them, planning is an issue that cannot be over-looked. Studies conducted by Faniran *et al.* (1994, 1998), Kharbanda and Pinto (1996), Elinwa and Joshua (2001) and Naoum *et al.* (2004) showed that planning plays a major role in the success or failure of projects or the methods by which they are procured. The importance of planning in project success prompted the evaluation of the level of

planning done and the outcome of projects procured by DL and DBB which are the prominent methods of procuring construction projects in Nigeria. The study compares the level of project planning achieved and the performance of projects procured by the two options. The aim of the study is to ascertain whether or not DL and DBB methods that are the dominant procurement options in Nigeria compares with one another in planning and performance. The objectives are to compare the levels of use of selected project plans, the levels of conception, design and construction planning and the outcome of projects procured by DL and DBB methods. The results of the study are expected to assist Nigerian clients in their choice of the two procurement methods and in the planning of projects procured by the methods.

2. Hypotheses of the study

Two hypotheses were postulated in the attempt to achieve the objectives of the study. The first hypothesis of the study states that the levels of project inception, design, construction and overall planning done when projects are procured by DBB and DL methods are not significantly different. This hypothesis is tested to ascertain whether or not the two procurement methods perform better than each other in project planning. The second hypothesis of the study states that the differences in the outcome of projects procured by DL and DBB methods are not significant. The hypothesis is tested to ascertain whether or not the performances of projects procured by the two systems compare with one another.

3. Variables of the study

The variables used in the study were classified into three categories namely: procurement methods, project planning and project outcome. The procurement methods selected for the study are two namely: Direct Labour (DL) and Design-Bid-Build (DBB). Fourteen important project plans were selected as indicators of project planning in the study. The plans were classified into three project delivery stages namely: inception, design and construction. The plans selected in project inception stage are project brief, feasibility & viability study and project life-cycle chart. The plans selected in project design stage are architectural, structural, electrical and mechanical drawings, bill of quantities and project specifications. The plans selected in construction stage are programme of work, material, labour and plant schedules and contractor's cash-flow chart. Tendering stage which is equally an important project stage was not included because as Faniran *et al.* (1998) observed, planning is often not carried out during the tender process due to insufficient time and low rates of bid success.

The parameters selected as indicators of project outcome are classified into two categories namely: subjective and objective indicators of project outcome. Three parameters namely: clients' assessment of project duration, cost and quality used in the study are subjective indicators of project outcome. Four parameters namely: project time-overrun and cost-overrun, percentage of time-overrun to initial contract period and percentage of cost-overrun to initial contract sum are used as objective indicators of project outcome.

4. Theoretical framework for the study

In the study, two procurement methods are investigated. The variables that are investigated in the methods are project planning and outcome. The relationship between these two variables and the procurements methods is that the projects procured by these two methods may differ in the level of planning done and the outcome of the projects. This relationship that is investigated in the study is

presented in Fig. 1. Further relationship that may exist between the variables based on previous studies is that the variables of project planning may influence those of project outcome. However, this last relationship is not investigated in this study.

5. Survey of previous studies

Every construction project is usually procured by a chain of processes which is described as procurement method. Franks (1990) referred to procurement method as the arrangement and the activities to be undertaken by a client to realize a project. Sanvido and Konchar (1998) described it as a set of relationships, roles and responsibilities of project team members and the sequence of activities required for the deployment of capital projects. Idoro and Iyagba (2008) described it as the responsibilities and/or contractual obligations of the parties required to carry out the numerous activities involved in delivering a project to the owner and observe that variations in project participants and/or their obligations account for the differences in procurement systems. This study examines two options namely: design-bid-build and direct labour methods.

Iyagba and Idoro (1995) identified direct labour as a prominent procurement method in Nigeria. Idoro *et al.* (2007) discovered in another study on the use of procurement methods in Nigeria that DL method is very pronounced in government or public sector projects and that the option has greater economy over contract methods. They describe direct labour as a method whereby a developer plans and organizes the project delivery process, carries out the design, the planning and procurement of resources and the construction of a project using client-employed supervisory staff and labour. They regard the method as an in-house arrangement because client's staffs as different from contractor's staff carry out the project delivery process and activities. They also observe that the arrangement may involve both design and construction otherwise regarded as in-house design and construction or a mixed system involving in-house design and contract construction or contract design and in-house construction.

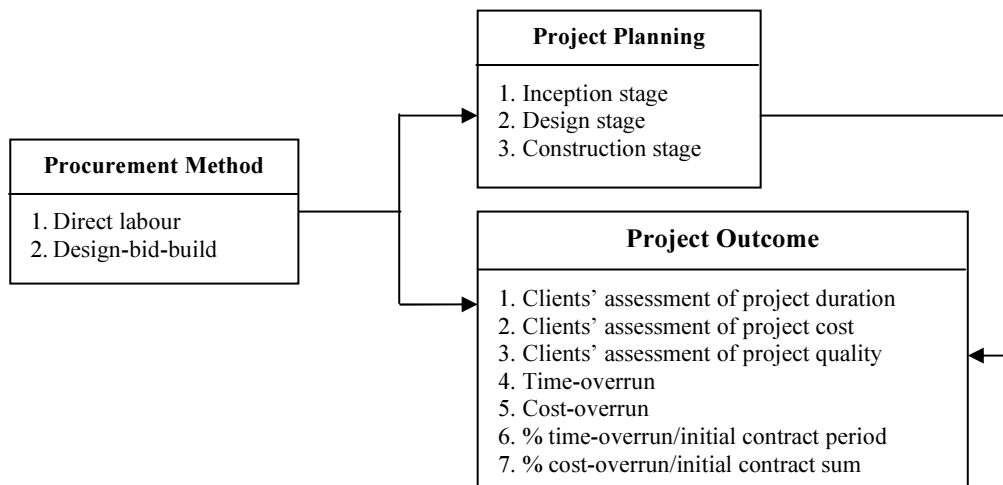


Fig. 1. Framework for comparing the level of planning and the outcome of projects procured by direct labour and design-bid-build procurement methods

Hovet (1996) regarded DBB method as the traditional contract procurement system. Mohsini and Davidson (1992), Bennett and Grice (1990) in separate studies described the option as an arrangement whereby the owner contracts separately with a designer and a constructor to design and construct a facility respectively. Idoro and Iyagba (2008) maintained that the arrangement is concerned with a project delivery process, which involves separating the design and construction phases, the parties and the contracts for carrying them out.

Project planning is one and perhaps the most important project management function. Naoum *et al.* (2004) described project planning as one of the key tools that stakeholders use to ensure that construction projects are successful. Hore *et al.* (1977) and Faniran *et al.* (2000) in separate studies described project planning as the systematic arrangement of project resources in the best way so as to achieve project objectives. Project planning requires that project objectives be defined thereafter the strategies to achieve them are formulated. It can be described as the process of defining project objectives, determining the framework, methods, strategies, tactics, targets and deadlines to achieve the objectives and communicating them to project stakeholders. The process of project planning requires that client's expectations or requirements and available resources be defined first, matched to set project objectives, available options identified and evaluated and the most appropriate frameworks, strategies and tactics to achieve the objectives selected. It also involves communicating the objectives and the frameworks, methods, strategies, targets/deadlines to achieve them to persons, parties and organisations concerned with their implementation, monitoring and control. The process involves preparing numerous project plans; each representing defined strategies to achieve defined project objective(s).

Project planning and project performance are two complementary issues in project management. The basis of project success or failure is defined in project planning therefore, without planning stakeholders have no bases for measuring progress and determining whether a project is a success or failure. Also, as Faniran *et al.* (1998) observed, the objective of project planning is project performance that is to complete a project within a fixed time, at a previously estimated cost and to a specified standards of quality. This assertion implies that the effectiveness of project planning is measured by project performance. Naoum (1991), Ling and Chan (2002) and Thomas *et al.* (2002) also regarded project performance as the basis of evaluating the effectiveness of project planning. Project planning cannot be separated from project performance also; project performance cannot be separated from project planning.

Faniran *et al.* (1998) described project planning as the process of determining appropriate strategies for the achievement of predefined project objectives. Dvir *et al.* (2003) identified three levels of project planning namely: 1) the end-user level where planning focuses mainly on the functional characteristics of the project end-product; 2) the technical level which focuses on the technical spec-

ifications of project deliverables that are needed to support the functional requirements and 3) the project management level which focuses on planning the activities and processes that are needed to be carried out to ensure that the technical work proceed effectively. These three levels of planning can otherwise be regarded as project conception planning, project design planning and construction planning.

Project performance remains a prominent issue in project delivery all over the world. This is so because projects involve defined objectives which must be achieved and numerous resources which need to be efficiently utilised. The need for participants involved in construction project delivery to develop and use tools for performance measurement was emphasised in separate studies carried out in UK and Sweden (Bennett *et al.* 1996). Several researchers also developed numerous parameters for measuring project performance (Naoum 1999; Ling, Chan 2002; Thomas *et al.* 2002; Josephson, Lindstrom 2007). In a review of parameters used for measuring project performance in 16 journal papers, Josephson and Lindstrom (2007) identified 250 parameters. From the review of previous research studies on project performance parameters, Ling (2004) identified and evaluates 70 potential factors for measuring project performance. These and other parameters that have been used in research studies can be classified into two broad categories namely: subjective and objective parameters. Ling (2004) stated that the performance of a project is multifaceted and may include unit cost, construction and delivery speeds and the level of clients' satisfaction. Pinto and Slevin (1988) classified project performance parameters into (1) internal factors which are project variables namely: schedule, cost and quality and (2) external factors which are concerned with stakeholders' satisfaction with the performance of a project and the perceived impact on organisation's effectiveness. Schedule, time, cost and quality are quantifiable, measurable and controllable as such they do not vary in assessment therefore; internal factors are regarded as objective performance parameters. However, project stakeholders are many and their satisfaction often varies from one stakeholder to another, therefore external factors are regarded as subjective performance parameters. Ling *et al.* (2004) also identified two categories of indicators of project success namely: product success which consists of measures of achievement of quality standards and process success which is made up of variables that measure the achievement of time and cost. Subjective parameters refer to stakeholders' satisfaction with the end-product that is completed structure while objective parameters refer to project variables such as schedule, cost and quality that are used for setting and defining project objectives and for setting targets and deadlines for project delivery.

Stakeholders' satisfaction has become prominent in modern approach to performance measurement and clients remain the most important stakeholder when considering project performance. Kotler (2000) maintained that satisfaction can be understood as a person's feeling resulting from the performance of a product as compared to

the person's expectation. Since clients' requirements are the focus of a project and project objectives are defined from them, it means that project success is all about achieving clients' requirements and satisfaction. Neto *et al.* (2007) stated that matching or exceeding the client's expectations result in a satisfied client. They opine further that this can reflect on how loyal a client becomes to a provider or a brand and result in higher sales volumes, lower levels of sensitivity to price and generates positive comments about the provider and the brand. Clients' satisfaction can be measured from several perspectives (Idoro 2008), however, three parameters namely: time, cost and quality have remained the most prominent in research studies. Josephson and Lindstrom (2007) maintained that project goal which considers clients' goals, is measured from several perspectives but the main aim is to stimulate clients to identify and clearly present their goals and to stimulate all managers involved to inform and remind all individuals of the goals. Hatush and Skitmore (1997) maintained that success in a project is generally operationalized into time, cost and quality. Michell *et al.* (2007) remarked that the primary concern of construction clients is that their projects are completed within budget, on time and at the required level of quality. On the basis of the above assertions, this study selected three parameters namely: project time, cost and quality which are described as the primary concern of clients as the variables for measuring clients' satisfaction.

Objective parameters of project performance are usually derived from the parameters used for defining project objectives and setting targets and deadlines for the delivery of a project. The same parameters are used for the monitoring, evaluation and control of a project. Although, these parameters are many, two of them namely: schedule and cost are common with research studies. The reasons for this are not farfetched. Michell *et al.* (2007) stated that timely completion of construction projects is frequently seen as a major criterion of project success by clients, contractors and consultants alike. They also opine that cost-overruns are identified by them as one of the principal factors leading to the high cost of construction. The third parameter (quality) which is commonly used when defining project objectives and setting targets and deadlines is not a common objective parameter in research studies because as Omachonu *et al.* (1997) put it: stakeholders see the goal of quality management as customer satisfaction. From the perspective of previous studies, two parameters namely: time-overrun and cost-overrun remain the prominent indicators of objective measurement of project performance. However, these two parameters have their limitation because their values depend to a great extent on the initial period or budget for a project. From the understanding of the parameters used in research studies, the study selected four parameters namely: time-overrun, cost-overrun, percentage of time-overrun to initial contract period and percentage of cost-overrun to initial contract sum as the variables for objective measurement of project outcome. The factors of time and cost-overruns to initial contract period and sum were selected based on the understanding that the initial con-

tract period and sum have significant influence on project time-overrun and cost-overrun.

6. Research methods

A field survey was conducted to collect the data used for the study. For the purpose of the field survey, a list of 211 organisations made up Federal government ministries and parastatals, selected State and Local governments and organised private firms was first prepared to serve as the population frame for the study. A project with the highest value being executed by each of the organisations was selected. From this population, a sample of 130 organisations was selected by stratified random sampling to cover the six geo-political zones (north-west, north-central, north-east, south-west, south-east and south-south) in Nigeria. In adopting the sampling technique, the organisations were classified into six strata or geo-political zones based on the locations of their projects. The organisations used for the study were thereafter selected from each of the six strata using random sampling. The distribution of the sample among the geo-political zones is shown in Table 1.

Table 1. Distribution of the study sample among the six geo-political zones in Nigeria

Zone	Population	Sample	%
North-east	17	10	58.8
North-west	17	10	58.8
North-central	19	10	52.6
South-east	31	20	64.5
South-west	89	59	66.3
South-south	38	21	55.3
Total	211	130	61.6

The research instrument used for the survey was structured questionnaire. The instrument was administered on project leaders who could be a project manager or an architect. Data were collected on the procurement system used to procure the projects. Data were also collected on the levels of use of 14 project documents that represented different forms of planning. The documents which are stated in the variables of the study were classified into three project stages namely: inception, design and construction. Respondents were requested to indicate whether each of the plans was prepared or not prepared during the delivery of the projects. Their responses were weighted as follows: prepared = 1; not prepared = 0. Data were also collected on both subjective and objective parameters of project outcome. Data collected on objective parameters of project outcome were initial and final contract periods and sums of the projects used for the study. Subjective parameters of project outcome were measured using three ranks namely: low, moderate and high. These ranks were weighted as follows: low = 1, moderate = 2 and high = 3. Respondents were requested to indicate their assessment of the duration, cost and quality of their projects based on the ranks provided. In the analysis, the levels of use of the selected project plans were calculated as the number of projects in which a plan was prepared

divided by the number of respondents. The levels of project inception, design and construction planning was calculated as the number of plans prepared divided by the number of plans selected in each project stage while the level of overall planning was calculated as the total number of plans prepared in the three project stages divided by the total number of plans (14) selected. Mean was used to rank the levels of inception, design, construction and overall planning and project outcome among the projects procured by the two procurement methods while t-test was used to test for differences in the levels of conception, design, construction and overall planning and project outcome between projects procured by the two methods.

7. Results

The results of the analysis of data collected are presented as follows.

7.1. Characteristics of projects sampled

The characteristics of the projects sampled were analysed as a background to the results of the study. The results of the analysis are presented in Table 2.

On client type, the results in Table 2 shows that the percentage of projects sampled that were owned by governments and their agencies (69.2) is higher than that of projects owned by private organisations (30.8). On project type, Table 2 shows that the percentage of building projects (79.2) covered by the study is higher than that of road projects (20.8). New construction (73.6%) is discovered to constitute majority of the projects sampled while renovation and maintenance works (26.4%) constituted minority. On project duration, Table 2 shows that the percentage of projects sampled of 1–6 months duration (40.8) is the highest, that of projects of above 12 months duration (32.3) is second highest while that of projects of 7–12 months duration (26.9) is the lowest. On project value, the percentage of projects of N50–99 million value sampled (41.6) is the highest, that of projects of N1–49 million value (32) is second highest, those of projects of N100–499 million value (14.4) and above N1 billion value (8) are the third and fourth highest respectively while that of projects of N500–999 million value (4) is the lowest.

7.2. Levels of use of selected project plans in DL and DBB projects

The first step taking to compare the level of planning done in projects procured by DL and DBB methods is to investigate the levels of use of selected project plans in projects procured by the two methods. For this purpose, fourteen project plans stated in the variables of the study were used. Respondents were requested to indicate whether or not the plans selected were prepared in the projects sampled for the study. The levels of use of the plans were evaluated as the number of projects in which each of the plans was prepared to the number of projects sampled or respondents. The level of use of each of the plans in projects procured by DL and DBB methods were ranked. The results are presented in Table 3.

On plans prepared at the project inception stage, the results in Table 3 show that the levels of use of project brief (92.6%) and project life-cycle chart (61.1%) in projects procured by DBB method rank first while the levels of use of project brief (92.1%) and project life-cycle chart (39.4%) in projects procured by DL method rank second. However, the level of use of feasibility and viability study in projects procured by DL method (85.7%) ranks first while that of projects procured by DBB method (74.4%) ranks second. These results indicate that the level of use of life-cycle chart is higher in projects procured by DBB method while the level of use of feasibility and viability study is higher in projects procured by DL method. However, the level of use of project brief in projects procured by the DL method compares with that of projects procured by DBB method.

On plans prepared at the project design stage, Table 3 shows that the level of use of project specifications in projects procured by DBB and DL methods are 91.4% and they both rank first. The result implies that the level of use of project specifications is the same when projects are procured by the two methods. The levels of use of architectural drawings (91.4%), structural drawings (91.5%), electrical drawings (89.7%), mechanical drawings (84.4%) and bill of quantities (96.5%) in projects procured by DBB method rank first while the levels of use of architectural drawings (67.5%), structural drawings (71.4%), electrical drawings (57.6%), mechanical drawings (51.5%) and bill of quantities (89.5%) in projects procured by DL method

Table 2. Descriptive results of the characteristics of projects used for the study

Characteristics	N	%	Characteristics	N	%
Client type			Project duration		
Public	90	69.2	1–6 months	53	40.8
Private	40	30.8	7–12 months	35	26.9
Total	130	100	Above 12 months	42	32.3
Project type			Total	130	100
Buildings	103	79.2	Project value		
Roads	27	20.8	N1–49 million	40	32.0
Total	130	100	N50–99 million	52	41.6
Construction type			N100–499 million	18	14.4
New construction	95	73.6	N500–999 million#	5	4.0
Renovation/maintenance	34	26.4	Above N1 billion	10	8.0
Total	129	100	Total	125	100

N = Number, N = Naira (Nigerian official currency)

Table 3. Percentage of projects in which selected project plans were prepared

Project plan	R	N	%	Rank	Project plan	R	N	%	Rank		
Conception plans					Bill of quantities	DBB	85	82	96.5	1	
Project brief	DBB	81	75	92.6	1	DL	38	34	89.5	2	
	DL	38	35	92.1	2	Total	123	116	94.3		
	Total	119	110	92.4							
Feasibility & viability studies	DL	35	30	85.7	1	Project specs	DBB	81	74	91.4	1
	DBB	78	58	74.4	2	DL	35	32	91.4	1	
	Total	113	88	77.9		Total	116	106	91.4		
Life-cycle chart	DBB	72	44	61.1	1	Contract plans					
	DL	33	13	39.4	2	Programme of work	DL	39	35	89.7	1
	Total	105	57	54.3		DBB	85	76	89.4	2	
Design plans Architectural drawings	DBB	81	74	91.4	1	Total	124	111	89.5		
	DL	40	27	67.5	2	Cash-flow chart	DL	32	21	65.6	1
	Total	121	101	83.5		DBB	67	32	47.8	2	
Structural drawings	DBB	82	75	91.5	1	Total	99	53	53.5		
	DL	35	25	71.4	2	Labour schedule	DL	39	31	79.5	1
	Total	117	100	85.5		DBB	71	39	54.9	2	
Electrical drawings	DBB	78	70	89.7	1	Total	110	70	63.5		
	DL	33	19	57.6	2	Plant schedule	DL	35	22	62.9	1
	Total	111	89	80.2		DBB	70	35	50.0	2	
Mechanical drawings	DBB	77	65	84.4	1	Total	105	57	54.3		
	DL	33	17	51.5	2	Material schedule	DL	40	33	82.5	1
	Total	110	82	74.5		DBB	77	52	67.5	2	
					Total	117	87	74.4			

R = Number of respondents, N = Number of projects in which project plan was prepared, % = Percentage of N to R.

rank second. The results indicate that the levels of use of all the plans prepared at the design stage except project specifications are higher in projects procured by design-bid-build method. This result implies that all the plans prepared at the design stage are more used in projects procured by DBB method than in projects procured by DL method.

On plans prepared at the construction stage, the results in Table 3 show that the levels of use of programme of work (89.7%), contractor’s cash-flow chart (65.6%), labour schedule (79.5%), plant schedule (62.9%) and material schedule (82.5%) in projects procured by DL method rank first while the levels of use of programme of work (89.4%), contractor’s cash-flow chart (47.8%), labour schedule (54.9%), plant schedule (50%) and material schedule (67.5%) in projects procured by DBB method rank second. The results indicate that the levels of use of cash-flow chart, labour, plant and material schedules in projects procured by DL method are higher than those of projects procured by DBB method. However, the level of use of programme of work in projects procured by DBB method compares with that of projects procured by DL method.

8. Comparing the priorities accorded selected project plans in projects procured by DL and DBB methods

Another objective of the study is to compare the priority accorded selected project plans when the two procurement methods are adopted. Such a comparison will make stakeholders to know the importance of project plans that are prepared when projects are procured by the two systems and to relate them to the outcome of projects procured by them. For the purpose of this comparison, the levels of use (percentages of projects in which each plan was prepared to the total number of projects used for the study) of each of the selected project plans in projects procured by DL and DBB systems derived above were ranked. The results are presented as follows.

8.1. Priorities accorded project inception stage plans in projects procured by DL and DBB methods

The priorities accorded project inception plans were determined by ranking the levels of use of the three selected project inception plans in projects procured by the two methods. The results are presented in Table 4.

Table 4. Ranking of the levels of use of selected inception stage plans in DBB and DB projects

Plan	R	Used (N)	%	Rank	R	Used (N)	%	Rank	
Design-bid-build					Direct labour				
Project brief	81	75	92.6	1	38	35	92.1	1	
Feasibility & viability report	78	58	74.4	2	35	30	85.7	2	
Life-cycle chart	72	44	61.1	3	33	13	39.4	3	

R = Number of respondents, N = Number of projects in which plan is prepared, % = Percentage of N to R.

Table 5. Ranking of the levels of use of selected design stage plans in projects procured by DL and DBB methods

Plan	R	Used (N)	%	Rank	R	Used (N)	%	Rank	
Design-bid-build					Direct labour				
Project specifications	81	74	91.4	3	35	30	91.4	1	
Bill of quantities	85	82	96.5	1	38	34	89.5	2	
Structural drawings	82	75	91.5	2	35	25	71.4	3	
Architectural drawings	81	74	91.4	3	40	27	67.5	4	
Electrical drawings	78	70	89.7	5	33	19	57.6	5	
Mechanical drawings	77	65	84.4	6	33	17	51.5	6	

R = Number of respondents, N = Number of projects in which plan is prepared, % = Percentage of N to R.

Table 6. Ranking of the levels of use of selected construction stage plans in DBB and DB projects

Plan	R	Used (N)	%	Rank	R	Used (N)	%	Rank	
Design-bid-build					Direct labour				
Programme of work	85	76	89.4	1	39	35	89.7	1	
Material schedule	77	52	67.5	2	40	33	82.5	2	
Labour schedule	71	39	54.9	3	39	31	79.5	3	
Contr. cash-flow chart	67	32	47.8	5	32	21	65.6	4	
Plant schedule	70	35	50.0	4	35	22	62.9	5	

R = Number of respondents, N = Number of projects in which plan was prepared, % = Percentage of N to R, Contr. = Contractor.

On the priorities accorded project inception stage plans in projects procured by design-bid-build method, the results in Table 4 show that the level of use of statement of project brief (92.6%) ranks first, while those of feasibility and viability report (74.4%) and project life-cycle chart (61.1%) rank second and third respectively. On the priorities accorded the inception stage plans in projects procured by direct labour method, Table 4 shows that the level of use of statement of project brief (92.1%) also ranks first, while the levels of use of feasibility and viability report (85.7%) and project life-cycle chart (39.4%) rank second and third respectively. The results indicate that the priorities accorded the three selected project inception stage plans are the same when projects are procured by the two methods. The preparation of the statement of project brief is accorded the highest priority while the preparation of feasibility and viability report and project life-cycle chart is accorded the second highest and the lowest priority respectively in projects procured by the two methods.

8.2. Priorities accorded project design stage plans in projects procured by DL and DBB methods

The priorities accorded project design plans were determined by ranking the levels of use of the six selected project design plans in projects procured by the two methods. The results are presented in Table 5.

On the priorities accorded project design stage plans in projects procured by design-bid-build method, the results in Table 5 show that the priority accorded the preparation of bill of quantities (96.5%) ranks first while that of structural drawings (91.5%) ranks second. the priority accorded the preparation of architectural drawings (91.4%) and project specifications (91.4%) rank third while those of electrical drawings (89.7%) and mechanical drawings (84.4%) ranks fifth and sixth respectively. On the priorities accorded project design stage plans in projects procured by direct labour method, Ta-

ble 5 shows that the priority accorded the preparation of project specifications (91.4%) ranks first while that of bill of quantities (89.5%) ranks second. the priority accorded the preparation of structural drawings (71.4%) ranks third while those of architectural drawings (67.5%) and electrical drawings (57.6%) rank fourth and fifth respectively. Table 5 shows that the priority accorded the preparation of mechanical drawings (51.5%) in projects procured by direct labour method ranks sixth. The above results indicate that the priorities accorded the six selected project design stage plans in projects procured by design-bid-build method differ from those of projects procured by direct labour method. While the preparation of bill of quantities is accorded the highest priority in projects procured by design-bid-build method, it is accorded the second highest priority in projects procured by direct labour method. The preparation of structural drawings is accorded the second highest priority in projects procured by design-bid-build method but it is accorded the third highest priority in projects procured by direct labour method. The preparation of project specifications is accorded the third highest priority in projects procured by design-bid-build method but it is accorded the highest priority in projects procured by direct labour method. The preparation of architectural drawings is accorded the third highest priority in projects procured by design-bid-build method but it is accorded the fourth highest priority in projects procured by direct labour method. The preparation of electrical and mechanical drawings is accorded the same priorities (5th and 6th respectively) in projects procured by the two methods.

8.3. Priorities accorded construction stage plans in projects procured by DL and DBB methods

The priorities accorded construction plans were determined by ranking the levels of use of the five selected construction plans in projects procured by the two methods. The results are presented in Table 6.

On the priorities accorded construction stage plans in projects procured by design-bid-build method, the results in Table 6 show that the priority accorded the preparation of programme of work (89.4%) ranks first. The priorities accorded the preparation of material schedule (67.5%) and labour schedule (54.9%) rank second and third respectively while the priorities accorded the preparation of plant schedule (50%) and contractor's cash-flow chart (47.8%) rank fourth and fifth respectively. On the priorities accorded construction stage plans in projects procured by direct labour method, Table 6 shows that the priority accorded the preparation of programme of work (89.7%) ranks first. The priorities accorded the preparation of material schedule (82.5%) and labour schedule (79.5%) rank second and third respectively while the priorities accorded the preparation of contractor's cash-flow chart (65.6%) and plant schedule (62.9%) rank fourth and fifth respectively. The results indicate that the priorities accorded the preparation of programme of work (1st), material schedule (2nd) and labour schedule (3rd) are the same in projects procured by the two methods. However, the priorities accorded the preparation of contractor's cash-flow chart and plant schedule in projects procured by design-bid-build method differ from those of projects procured by direct labour method. While that of plant schedule ranks fourth and that of contractor's cash-flow chart ranks fifth in projects procured by design-bid-build method, that of the former ranks fifth while that of the latter ranks fourth in projects procured by direct labour method.

9. Comparing the level of project stage and overall planning in projects procured by DL and DBB methods

The results in Tables 1–4 have revealed that the levels of use and the priorities accorded the selected plans differ among projects procured by DL and DBB methods. The study further attempted to determine whether or not these differences could bring about differences in the levels of planning at the three project stages in projects procured by the two methods. To do this, the study compares the levels of planning done at each of three main project stages in the development of construction projects name-

ly: inception, design and construction stages and overall project planning. The level of planning done at each project stage was defined as the number of the selected plans prepared at each project stage to the total number of plans selected. The level of overall project planning was calculated as the number of project inception, design and construction plans selected that is prepared in each project to the total selected plans in the three project stages. The ranking of the levels of project stage planning and overall project planning done in projects procured by the two procurement systems was thereafter determined. The results are presented in Table 7.

The results in Table 7 show that the level of project inception planning ($\bar{X} = 0.703$), project design planning ($\bar{X} = 0.862$) and overall planning ($\bar{X} = 0.707$) in projects procured by design-bid-build method rank first while the level of project inception planning ($\bar{X} = 0.659$), project design planning ($\bar{X} = 0.626$) and overall planning ($\bar{X} = 0.633$) in projects procured by direct labour method rank second. However, the level of construction stage planning ($\bar{X} = 0.676$) in projects procured by direct labour method ranks first while that of projects procured by design-bid-build method ($\bar{X} = 0.546$) ranks second. These results imply that the levels of project inception stage, design stage and overall planning in projects procured by design-bid-build method are higher than those of projects procured by direct labour method. However, the level of construction stage planning in projects procured by direct labour method is higher than that of projects procured by design-bid-build method. In other words, the numbers of project plans prepared at the inception and design stages when projects are procured by design-bid-build method are higher than those prepared when projects are procured by direct labour method. Furthermore, the total number of project plans prepared when construction projects are procured by design-bid-build method is higher than the total number of project plans prepared when projects are procured by direct labour method. However, the number of project plans prepared at the construction stage is higher when projects are procured by direct labour method than when projects are procured by design-bid-build method.

Table 7. Ranking of the levels of project inception, design, construction and overall planning in projects procured by design-bid-build and direct labour methods

Project stage	Proc method	R	Mean	Rank	t-value	Df	p-value	Decision
Inception	DBB	84	0.703	1	-0.801	121	0.425	Fail to reject
	DL	39	0.659	2				
Design	DBB	85	0.862	1	-4.768	123	0.001	Reject
	DL	40	0.626	2				
Construction	DL	42	0.676	1	2.034	125	0.044	Reject
	DBB	85	0.546	2				
Overall	DBB	86	0.707	1	-1.768	126	0.079	Fail to reject
	DL	42	0.633	2				

R = Number of respondents, Df = Degree of freedom, DBB = Design-bid-build, DL = Direct labour.

The results in Table 7 show that the levels of planning done at inception, design and construction stages and the level of overall project planning done when projects are procured by design-bid-build method differ from the levels done when projects are procured by direct labour method. The question raised by these results is whether these differences are significant or not. The attempt to provide an answer to this question involves the test of the first research hypothesis of the study. The hypothesis states that the levels of project inception, design, construction and overall project planning done when projects are procured by design-bid-build and direct labour methods are not significantly different. The levels of project stage and overall project planning were measured as explained above. The hypothesis was tested using the t-test with $p \leq 0.05$. The rule for the acceptance or rejection of the hypothesis is that when the p-value > 0.05 , the hypothesis is not rejected but when the p-value ≤ 0.05 , the hypothesis is rejected. The results of the test are presented in Table 7.

The results in Table 7 reveal that the t-values for the test of difference in project inception planning (-0.801) and overall project planning (-1.768) between projects procured by design-bid-build and direct labour methods are low and their respective p-values (0.425) and (0.079) are greater than the critical p-value (0.05) therefore, the test fails to reject the hypothesis. The result implies that the differences in the levels of project inception and overall planning done when projects are procured by design-bid-build and direct labour methods are not significant. However, the t-values for the test of difference in project design planning (-4.768) and construction planning (2.034) between projects procured by design-bid-build and direct labour methods are high and their respective p-values (0.001) and (0.044) are less than the critical p-value (0.05) therefore, the hypothesis is rejected. The result indicates that the differences in the levels of design and construction planning done when projects are procured by the two methods are significant. The results implies that the levels of project design stage and construction stage planning done in projects procured by design-bid-build method differ from those done in projects procured by direct labour method.

10. Comparing the outcome of projects procured by DBB and DL methods

The results of the study have shown that the levels of use of the project plans selected differ between projects procured by the two procurement methods. It further discovered that the level of design planning done when projects are procured by design-bid-build method is higher than when projects are procured by direct labour method but the level of construction planning done when projects are procured by direct labour method is higher than when projects are procured by design-bid-build method. The question posed by these results is "do these differences in the level of project planning done in the two procurement methods affect the outcome of the projects procured by them?" In the attempt to provide an answer to this ques-

tion, the study investigated the outcome of projects procured by two methods that were used for the study. For this purpose, three indicators of subjective project outcome and four indicators of objective project outcome stated in the variables of the study were used. Subjective project outcome indicators were measured using three ranks namely: low, moderate and high. The ranks were scored as follows: low = 1, moderate = 2 and high = 3. Project time-overrun was derived from data collected on initial and actual contract periods as the difference between the two and it was calculated in weeks. Project cost-overrun was derived as the difference between initial and final contract sums of projects used for the study and it was calculated in Naira (Nigerian currency). The percentage time-overrun to initial contract period and the percentage of cost-overrun to initial contract sum were further derived from the data on contract durations and sums collected. The rankings of the outcome of projects procured by the two procurement methods are presented in Table 8.

The results in Table 8 reveal that clients' satisfaction with the duration of projects procured by direct labour method ($\bar{X} = 2.39$) ranks first while that of projects procured by design-bid-build method ($\bar{X} = 2.26$) ranks second. Clients' satisfaction with the cost ($\bar{X} = 2.29$) and quality ($\bar{X} = 2.56$) of projects procured by design-bid-build method rank first while that of the cost ($\bar{X} = 2.02$) and quality ($\bar{X} = 2.50$) of projects procured by direct labour method rank second. The results tend to imply that clients are slightly more satisfied with the delivery time of projects procured by direct labour method than projects procured by design-bid-build method however; they are more satisfied with the cost and quality of projects procured by design-bid-build method than projects procured by direct labour method.

Table 8 also reveals that the time-overrun ($\bar{X} = 5.36$ weeks) and cost-overrun ($\bar{X} = \text{N}77.11$ million) recorded in projects procured by design-bid-build method rank first while the time-overrun ($\bar{X} = 0.82$ weeks) and cost-overrun ($\bar{X} = \text{N}17.97$ million) recorded in projects procured by direct labour method rank second. The results indicate that the overruns in project time and cost are higher in projects procured by design-bid-build method than in projects procured by direct labour method.

The percentage pre-construction period to planned project delivery period ($\bar{X} = 28.73$), percentage of time-overrun to initial contract period ($\bar{X} = 25.40$) and percentage of cost-overrun to initial to contract sum ($\bar{X} = 14.33$) of projects procured by design-bid-build method rank first while the pre-construction period to planned project delivery period ($\bar{X} = 25.61$), percentage of time-overrun to initial contract period ($\bar{X} = 7.76$) and percentage of cost-overrun to initial to contract sum ($\bar{X} = 9.04$) of projects procured by direct labour method rank second. The results indicate that the percentage of pre-construction period to planned project delivery period, percentage of time-overrun to initial contract period and percentage of cost-overrun to initial contract sum are higher in projects

Table 8. Results of t-test for differences in the outcome of projects procured by traditional contract and design-build methods

Parameter	Method	N	Mean	Rank	t-value	Df	p-value	Decision
Clients' assess. with project duration	DL	44	2.39	1	0.993	127	0.323	Fail to reject
	DBB	85	2.26	2				
	Total	129	2.30					
Clients' assess. of project cost	DBB	86	2.29	1	2.211	128	0.029	Reject
	DL	44	2.02	2				
	Total	130	2.20					
Clients' assess. of project quality	DBB	86	2.56	1	0.482	128	0.631	Fail to reject
	DL	44	2.50	2				
	Total	130	2.54					
Project time-overrun	DBB	58	5.36	1	2.644	89	0.010	Reject
	DL	33	0.82	2				
	Total	91	3.71					
Project cost-overrun	DBB	55	N77.11m	1	0.736	85	0.464	Fail to reject
	DL	32	N17.97m	2				
	Total	87	N55.36m					
% time-overrun/initial contract period	DBB	62	25.40	1	2.239	93	0.028	Reject
	DL	33	7.76	2				
	Total	95	19.27					
% cost-overrun/initial contract sum	DBB	55	14.33	1	1.001	77	0.320	Fail to reject
	DL	24	9.04	2				
	Total	79	12.72					

N = Number of respondents, Df = Degree of freedom, DBB = Design-bid-build, DL = Direct labour, N = Naira (Nigerian currency), m = million.

procured by design-bid-build method than in projects procured by direct labour method. These results confirm the results above that the overruns in project time and cost are higher in projects procured by design-bid-build method than in projects procured by direct labour method.

11. Test of difference in the outcome of projects procured by DL and DBB methods

The results in Table 8 have shown that there are differences in the outcome of projects procured by the two methods. The study shows that clients are more satisfied with the cost and quality of projects procured by design-bid-build method than those procured by direct labour method but projects procured by direct labour method performed better than those procured by design-bid-build method in other six parameters of project outcome. The question posed by these results is whether or not these differences in project outcome between projects procured by the two methods are significant. The attempt to provide an answer to the question prompted the second hypothesis of this study which states that the differences in the outcome of projects procured by design-bid-build and direct labour methods are not significant. The hypothesis was tested using the t-test with $p \leq 0.05$. The rule for the rejection of the hypothesis is that when the p-value > 0.05 , the test fails to reject the hypothesis but when the p-value ≤ 0.05 , the hypothesis is rejected. The results of the test are presented in Table 8.

The results in Table 8 show that the p-values for the test of difference in respondents' assessment of project duration (0.323) and quality (0.631), project cost-overrun (0.464) and percentage of cost-overrun to initial contract sum (0.320) between projects procured by design-bid-build and direct labour methods are greater than the critical p-value (0.05) therefore; the test fails to reject the

hypothesis. This result implies that the differences in respondents' assessment of the duration and quality of projects procured by the two methods are not significant. Also, the differences in cost-overrun and the percentage of cost-overrun to initial contract sum of projects procured by the two methods are not significant. However, the p-values for the test of difference in respondents' assessment of project cost (0.029), project time-overrun (0.010) and percentage of time-overrun to initial contract period (0.028) between projects procured by design-bid-build and direct labour methods are less than the critical p-value (0.05) therefore, the hypothesis is rejected. These results indicate that clients' satisfaction with the cost of projects procured by design-bid-build method differs from that of projects procured by direct labour method. Also, the time-overrun and percentage time-overrun to initial contract period of projects procured by design-bid-build method differ from those of projects procured by direct labour method.

12. Discussion of results

The results of the study have shown that the levels of use of project brief and life-cycle charts are higher in projects procured by design-bid-build method than in projects procured by direct labour method while the level of use of feasibility and viability study is higher in projects procured by direct labour method than in projects procured by design-bid-build method. These differences imply that the use of the selected project inception plans differs between projects procured by the two methods. However, further evaluation reveals that the levels of project inception planning in projects procured by the two methods are significantly the same. These results imply that the levels of use of inception plans in projects procured by the two methods are the same.

The study discovers that the levels of use of all the selected plans prepared at the design stage in projects procured by design-bid-build method are higher than those of projects procured by direct labour method. Further evaluation shows that the level of design stage planning done in projects procured by design-bid-build method is significantly different from that of projects procured by direct labour method. These results imply that the number of project plans prepared at the design stage in projects procured by design-bid-build method differs from that of projects procured by direct labour method. This difference is not unconnected with the procurement procedure of design-bid-build method which requires that design be fully completed before tendering and eventual construction of a project.

The study also discovers that the levels of use of the six selected construction plans are higher in projects procured by direct labour method than in projects procured by design-bid-build method. These results imply that more planning is done at the construction stage of projects procured by direct labour method than projects procured by design-bid-build method. What can be deduced from these results is that clients' management staff that are responsible for the management of projects procured by direct labour method carry out more planning at the construction stage than contractors' management staff that are responsible for the planning of projects procured by design-bid-build method.

The evaluation of the overall planning done at the inception, design and construction stages reveals that the levels of overall planning in projects procured by the two methods are significantly the same. What can be deduced from this finding is that the total number of plans prepared when projects are procured by design-bid-build method is significantly the same with the total number of plans prepared when projects are procured by direct labour method. The reason for this similarity in overall project planning is connected with the results of the levels of project inception, design and construction planning in projects procured by the two methods. The study has established that the level of inception planning is the same in projects procured by the two methods. While more effort is applied in planning projects procured by design-bid-build method at the design stage, more effort is applied in planning projects procured by direct labour method at the construction stage. The finding of the study therefore suggests that the differences in the effort applied in planning at the design and construction stages result to equal effort in overall planning in projects procured by the two methods.

The question posed by the differences in planning when projects are procured by the two methods is "what is the effect of this difference on the outcome of projects procured by the two methods?". The results of the outcome of projects procured by the two methods show that clients' satisfaction with the time and quality, the cost-overrun and the percentage of cost-overrun to initial contract sum of projects procured by the two methods are the same. The study also discovers that clients' satisfaction with the cost of projects procured by the two methods

differs so also is the overrun in the delivery time of projects procured by the methods. Although the study has not established the effect of the three stages of planning on project outcome however, the claim in research studies that planning contributes to project outcome suggests that the differences in the outcome of projects procured by the two methods can be linked to the differences in the levels of planning in particular design and construction stage of the projects.

High level of planning at the design stage is no doubt an effective tool for the control of the duration, cost and quality of projects at the construction stage however; design plans should be effectively implemented for these objectives to be achieved. The higher time-overrun and percentage time-overrun to initial contract period recorded in projects procured by design-bid-build method and even the results of insignificant difference in the cost-overrun of projects procured by the two methods in the face of higher level of project design planning in design-bid-build projects suggest the need for effective implementation of design plans at the construction stage of projects procured by design-bid-build method. The results of insignificant difference between the cost-overrun and the percentage of cost-overrun to initial contract sum of projects procured by the two methods suggest that the higher level of construction planning in direct labour projects should be complemented with adequate planning at the design stage.

13. Conclusions

The study has established the strengths and weaknesses of the two procurement options that are favoured by Nigerian clients. The choice of the procurement method to adopt is often based on several competing factors inclusive of project planning and some of these factors may override planning. When this is the case, Nigerian clients should minimise what will be forgone in selecting an option by ensuring that adequate planning commensurate with what will obtain when the alternative procurement option is adopted is done. Specifically, the study has established that the mean level of planning done at the design stage in projects procured by design-bid-build method is higher than that of projects procured by direct labour method. This invariably suggests that more planning needs to be done at the design stage when direct labour option is adopted in order for projects procured by the method to compare with those procured by design-bid-build method. In the same vein, the mean level of planning done at the construction stage in projects procured by direct labour method is higher than that of projects procured by design-bid-build method. This result equally suggests that more planning needs to be done at the construction stage when design-bid-build is adopted in order for projects procured by the method to compare with those procured by direct labour option. Clients should insist on the preparation of required construction plans by prospective contractors even when such contractors do not see the need for them.

14. Suggestion for further studies

The study has compared the levels of project planning at the inception, design and construction stages of projects procured by direct labour and design-bid-build methods. Specifically, it has established the differences in the level of planning at the three project delivery stages and the outcome of projects procured by the methods. Since project planning is known to have influence on project outcome, it is expected that the differences in the levels of planning discovered in the study will have effect on project outcome. This effect is not discovered because the relationship between the level of planning and the outcome of projects procured by the two methods is not investigated. For this reason, further investigation of the influence of the level of planning on the outcome of projects procured by direct labour and design-bid-build methods is suggested to complement the findings of the study.

Furthermore, there are several other available procurement options apart from direct labour and design-bid-build methods. Like the two methods, the plans investigated in this study are also used in other procurement options and the level of planning will equally have the same influence on these other procurement options. However, the scope of this study was restricted to direct labour and design-bid-build options therefore, the investigation carried out in this study could not be extended to other available options. For this reason, further study that will also compare the level of planning and performance of construction projects procured by other available procurement options and the relationship between them is therefore suggested.

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PLANAVIMO IR VEIKLOS EFEKTYVUMO PALYGINIMAS, NIGERIJOS STATYBŲ PROJEKTUOSE NAUDOJANT TIESIOGINĮ DARBĄ IR TAIKANT TRADICINĮ PIRKIMŲ METODĄ

G. I. Idoro

Santrauka

Šiame darbe lyginami planavimo lygiai ir projektų rezultatai, kai naudojamas tiesioginis darbas ir taikomas tradicinis pirkimų metodas (projektavimas–konkursas–statyba; angl. *Design-Bid-Build*, D-B-B). Palyginimui atlikta 130 projektų apklausa. Duomenys surinkti naudojant tam tikros struktūros anketas ir išanalizuoti pagal procentus, vidurkius ir *t* testą. Atliekant tyrimą nustatyta, kad abiem paslaugų pirkimo atvejais projektų sumanymo etapas ir bendras planavimas yra vienodo lygio, tačiau tradicinį pirkimų metodą pasirinkusiuose projektuose projektavimo ir statybų planavimo etapų lygis skiriasi nuo tiesioginį darbą pasirinkusių projektų etapų lygio. Atliekant tyrimą paaiškėjo, kad abiem atvejais laikas viršijimas skirtingai, tačiau sąnaudos viršijamos vienodai. Daroma išvada, kad projektams taikant skirtingus pirkimo būdus (tradicinį metodą arba tiesioginio darbo variantą) skiriasi planavimas ir vėlavimas; taip pat siūloma, kaip pagerinti projektavimo etapo planavimą, kai naudojamas tiesioginio darbo variantas, ir kaip pagerinti statybų etapo planavimą, kai taikomas tradicinis metodas.

Reikšminiai žodžiai: tradicinis pirkimų metodas (projektavimas–konkursas–statyba), tiesioginis darbas, Nigerija, projekto planavimas ir projekto efektyvumas.

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