

Assessment of Risk Management Techniques for Construction Projects under Design Bid Build and Design & Build Procurement Methods in Abuja, Nigeria

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Abstract

The non-implementation of risk management techniques constitutes a lot to most of the project failures encountered nowadays. This leads to variations, incessant claims due to time loss by the contractor and loss of significant stakeholder's value. This study assessed risk management techniques for construction projects under Design Bid Build and Design and Build (DBB and DB) procurement methods in Abuja, with a view to enhancing the level of understanding and implementation of risk management in DBB and DB procurement methods. Data were collected from 150 respondents who are professionals registered with Federation of Construction Industry (FOCI). Tools used for data analysis were Relative Importance Index (RII), Mean Item Score (MIS) and Spearman Rank Correlation analysis. Findings from the study revealed the identified major risk management techniques on construction projects are often practiced (average RII = 0.71). The most effective Risk Management Techniques in construction projects are "Risk mitigation/Reduction" and "Risk Acceptance" (MIS = 3.94 and 3.60 respectively). Risk Management Techniques for the DBB Procurement

Method is therefore more effective than that of DB Procurement Method (Mean DBB = 3.4754; Mean DB = 3.0659). It was concluded that the assessment and management of risk for construction projects under the DBB (Design Bid Build) Procurement Method is more effective than when carried out under the DB (Design and Build) Procurement Method in Nigeria. It was therefore recommended that stakeholders should consider the use of DBB Procurement Method for procuring projects in order to more effectively manage risks in construction projects.

Introduction

Procurement selection criteria of cost, time, quality, project characteristics and external environmental factors have effects on project performance. In this respect, the attitude towards risk retention, previous experience and knowledge of the options all have a bearing on the final decision. In a nutshell, the selection of appropriate method of procurement can make or mar the success of the project and reduce the risk involved in construction projects. The presence of uncertainty in everyday life as well as in organisations has become an important issue at present and to achieve its appropriate management has become a challenge (Aven, 2011). Due to the dynamic and complex environment that exists around organisations, uncertainty becomes an important issue that must be taken into account for the realization of any project (Rohaninejad & Bagherpour, 2013).

Risk is a term that has been into rigorous study from different researches in different areas, Hilson (2013) defined risk as the certainty that can be measured, and uncertainty is a risk that cannot be measured. Construction projects have been described to be highly complex and executed under conditions of varying degrees of risks (Oladokun *et al.*, 2016). Risk cannot be avoided totally in construction project because of the nature and the environmental interference. But it can be minimised, managed, shared, accepted or transferred but cannot be totally ignored (Bahamid & Doh, 2017).

Procurement is a combination of different methods for purchasing construction projects and includes such variables as source of funding, partner selection

method, price basis, responsibility for design, responsibility for management, and amount of subcontracting (Murdoch & Hughes, 2008). The client's choice of procurement option, i.e. a combination of the above mentioned variables, implies different ranges of responsibilities and liabilities for the various actors, as well as different degrees of their collaboration in the project (Love *et al.*, 1998; Eriksson & Westerberg, 2011), may influence risk management (Osipova & Eriksson, 2011).

There are project delivery methods (i.e. who has design responsibility), form of payment (i.e. how contract price was formed and if incentives are used), and use of additional collaboration or partnering arrangements. From the perspective of design responsibility there are two major methods of project delivery: in general, contracts responsibility for design lies with client while in design-build contracts design responsibility lies with contractor. As design is considered to be a significant source of risk (Akintoye *et al.*, 1998), responsibility for design may influence actors' attitudes towards risk management. From the above facts, it is therefore evident that there is need for a study to assessing the effectiveness of risk management techniques in the construction industry with the aim of enhancing the level of understanding risk management techniques under Design Bid Build and Design and Build methods of procurement.

In a recent research work by Bahamid and Doh (2017), emphasis was laid on re-evaluating construction risk management process and facilitating the elimination of the existing gap between theory and practice of construction risk in developing countries of the world. But researchers do not extend the work to cover procurement methods as a means of managing or minimising risk in construction projects. The non-implementation of risk management techniques as can be found in journals and researches among others from theory to practice constitute a lot to most of the project failures encountered nowadays. This leads to variations, incessant claims due to time loss by the contractor and loss of significant stakeholder's value, among others.

In order to address the research problem, this study was set out to assess the risk management techniques for construction projects under Design Bid Build and Design and Build (DBB and DB) procurement methods in Abuja, Nigeria with a view to enhancing the level of understanding and implementation of risk management in DBB and DB procurement methods in Abuja. The following objectives were pursued in order to achieve the aim:

- i. To identify and examine the major risk management techniques practiced in managing risks in construction projects.
- ii. To evaluate how risks are shared and managed under DBB and DB procurement methods.
- iii. To examine strategies for enhancing the level of understanding of risk management under DBB and DB procurement methods.

LITERATURE REVIEW

In order to achieve the objectives of the study and to place the study in its proper context, this section reviewed issues related to the themes related to the study.

Techniques for managing risk in construction projects

Risk management means minimising, controlling and sharing risks rather than merely passing them on to another party (Iqbal *et al*, 2018). Risk management is an integral part of project management which when used effectively will result to successful construction project. Risk management can also be defined as the systematic process of analysing, identifying, and responding to projects risk. It consists of maximizing the chances and the impact of positive events while minimizing the probability and the impact of negative events, in other to meet the project objectives (Tipili & Ibrahim, 2015). Goh and Abdul-Rahman (2013) thought of risk management as a decision-making process, and it entails having a full understanding of a known risk and necessary actions to reduce the effect and chances of the event of such risks, in other to reduce its complications and increase the chances of success. There are three stages in the management of risk in construction industry as identified by Wang *et al*. (2004) and Zayed *et al* (2008) namely:

Stage 1: Risk identification and assessment

Stage 2: Risk analysis and evaluation

Stage 3: Risk response

Risk identification is defined as the process of identifying and keeping records of the associated risks. Risk assessment on the other hand, means to critically examine the identified risks, define the description of the risk, and making an estimate of their respective chances and effects on the project. There are four main techniques for identifying risk in construction projects (Iqbal *et al*, 2018). El-Sayegh and Mansour (2015) defined risk analysis as the procedure involving the critical evaluation of prospective risks, arranging them according to

importance, allowing the management team to select the important ones. The sole aim of the second stage is to evaluate risk by separating the unnecessary events, the chances of the unwanted event happening, and the size of such events (KarimiAzari *et al.*, 2011). The risk response refers to the identification, Selection, evaluation, and the action to implement the project. (Zhang & Fan, 2014). Wang *et al.*, (2004) stated that the aim of risk management process is to try as much as possible to remove the most crucial project risks by producing an organized framework that will make risk management efficient and effective.

Techniques for sharing risks in construction projects

Risk sharing is one of the risk response strategies, (risk transfer) involves shifting some or all risk responsibilities which are likely to face the building construction project to the party that is in better position in terms of resources and knowledge to manage them. (Oke, 2016). There are various forms of risk sharing for construction projects. Mikapagaro & Geremi (2018) identified insurance, bond, warranty, surety, subcontracting, subletting and joint venture. However, despite their existence, there are still a number of contractual claims in building projects. Olatunji *et al.* (2016). Singh & Goel (2006) advised that risks that occurred least often (such as those related to politics, labour strikes and natural hazards) which occur rarely and are beyond the control of project manager can be transferred to other parties through insurance policies.

According to Kordas (2015), in order to minimize contingency costs of building projects, there is a need for formation of risk sharing agreement between parties so as to attain the optimal risk sharing ratios. Risk sharing between parties in the building construction projects can be done in different forms. The choice of any form of risk sharing is therefore dependent on the strength of such particular form of risk sharing (Mudzookowa, 2017).

Strategies for enhancing level of understanding of risk management

The key drivers for change and implementing alternative procurement forms are committed leadership, the development of a customer focus strategy, project team integration, a focus on quality and a commitment to people (Egan, 1998). It has been suggested by Egan (1998) that committed clients should undertake demonstration projects to develop and illustrate alternative strategies and work practices. In Australia this occurred when the Federal Government used an alliancing contract for the procurement of the National Museum of Australia in

Canberra (Hauck *et al.* 2004). Such demonstration projects should become a movement for change and innovation but unfortunately this has not been the case in this instance. More demonstration projects are required so that the benefits of alternative procurement practices and the subsequent innovations that arise can be presented to the wider community.

The level of understanding and implementation of risk management in construction calls for critical evaluation. Miller *et al.* (2009) and The World Bank (2016) suggested the following for enhancing the level of understanding to make implementation easier and reducing the effect of risk on the project objectives.

- i. Critically studying the contract type and selection of the appropriate contract form.
- ii. Considering the market's capability.
- iii. Understanding the required price and costing mechanism.
- iv. Collaborative approach.
- v. Evaluation methods are concerned with establishing the process by which supplier bids and proposals are assessed.
- vi. The effective, efficient, and economic use of resources.
- vii. Looking at the procurement risk analysis undertaken.

RESEARCH METHODOLOGY

The study's population constitutes the construction firms registered with the Federation of Construction Industry (FOCI) with Abuja's business address with contract sum not less than #50,000,000.00. FOCI has 85 members as at the time of this research (2019), with 74 full members, 5 associate members, 5 information members and 1 ordinary member. The research work laid emphasis on completed construction projects from January 2014 to December 2018 where DBB and DB procurement methods were used. To ensure adequate representation of information, all the 25 members which are resident in Abuja were selected. All the professionals (Architects, Quantity Surveyors, Builders, and Engineers) in the construction industry were involved from the sampled firms because they have roles to play in the successful management of risk in construction projects. This gave a sample size of 150.

Data were collected using structured questionnaire. The questionnaire was administered to the sampled professionals in the selected construction firms. The questionnaire was divided into two parts; the background information of

the respondents; and information about risk management and procurement options in Nigeria. One hundred and Fifty (150) copies of questionnaire were distributed. A total of One hundred and twenty-five copies were returned giving a response rate of 83.33%. The analysis of data was done using both descriptive (Mean Item Score [MIS] and Relative Importance Index [RII]) and inferential (Independent Sample T – Test) methods of analysis. The decision rule adopted for the RII and MIS are summarized in Table 1.

Table 1: Decision Rule for Data Analysis

SCALE	RII (CUT-OFF POINT)	MIS (CUT-OFF POINT)	FREQUENCY OCCURRENCE	OF LEVEL OF EFFECTIVENESS
5	0.81 - 1.00	4.51 - 5.00	Very Often	Very Effective
4	0.61 - 0.80	3.51 - 4.50	Often	Effective
3	0.41 - 0.60	2.51 - 3.50	Fairly Often	Fairly Effective
2	0.21 - 0.40	1.51 - 2.50	Less Often	Less Effective
1	0.00 - 0.20	1.00 - 1.50	Rarely	Least Effective

Source: Adapted and Modified from Shittu et al. (2015)

RESULTS AND DISCUSSIONS

This section demonstrates data utilised for analysis and discussion of the results gotten from the analysis. The analysis of data and the result discussions were premised on the data obtained from primary source through questionnaire.

Major risk management techniques practiced in construction projects

The RII analysis results for the frequency of occurrence of the major risk management techniques practiced in construction projects is presented in Table 2.

Table 2: Major Risk Management Techniques Practiced on Construction Projects

S/NO	RISK MANAGEMENT TECHNIQUES	RII	RANK	DECISION
1	Risk exploit/Control	0.81	1st	Very Often
2	Risk mitigation/Reduction	0.78	2nd	Often
3	Risk Enhancement	0.70	3rd	Often
4	Risk Sharing	0.69	4th	Often
5	Contingency plan	0.66	5th	Often
6	Risk Avoidance	0.65	6th	Often

7	Risk exploit/Control	0.65	6th	Often
	<i>Average</i>	<i>0.71</i>		<i>Often</i>

Source: Researcher's Analysis of Data (2019)

Table 2 reveals seven (7) identified major risk management techniques practiced on construction projects. These techniques range between “Risk exploit/Control” and “Risk exploit/Control” (RII = 0.65 – 0.81). “Risk exploit/Control” is the technique which is practiced very often (RII = 0.81) while others are also often practiced. On the average, the identified major risk management techniques on construction projects are often practiced (average RII = 0.71).

Means of sharing and managing risks under DBB and DB procurement methods

RII analysis was carried out for the Forms of Risk Sharing and Management under each of the two (DBB and DB) Procurement methods. Thereafter Independent Sample T – Test was carried out to determine the statistical difference which occurs between the two procurement methods and hence the most effective method. The results of these analyses are summarised in Tables 7, 8 and 9. Table 3 presents the results of RII carried out for the Forms of Risk Sharing and Management Techniques under DBB Procurement method.

Table 3: Risk Sharing Techniques for DBB Procurement Method

S/NO	RISK SHARING METHODS (DBB)	RII	RANK	DECISION
1	Insurance	0.82	1st	Mostly Used
2	Warranty	0.77	2nd	Moderately Used
3	Sub-contracting	0.77	2nd	Moderately Used
4	Bond	0.74	4th	Moderately Used
5	Surety	0.71	5th	Moderately Used
6	Joint Venture	0.71	5th	Moderately Used
7	Sub-letting	0.69	7th	Moderately Used
8	Partnership	0.64	8th	Moderately Used
9	Alliancing	0.64	8th	Moderately Used
10	Relational Contracting	0.47	10th	Fairly Used
	<i>Average</i>	<i>0.70</i>		<i>Moderately Used</i>

Source: Researcher's Analysis of Data (2019)

It is revealed from Table 3 that “Insurance” is the mostly used Risk Sharing Technique for DBB Procurement Method with RII of 0.81. Eight (8) other Risk Sharing Techniques for DBB Procurement Method are moderately used (RII = 0.77 – 0.64). “Relational Contracting” is shown to be fairly used with RII of 0.47. On the average the identified Risk Sharing Techniques for DBB Procurement Method are moderately used in construction projects (average RII = 0.70). Table 4 presents the results of RII carried out for the Forms of Risk Sharing and Management Techniques under DB Procurement method.

Table 4: Risk Sharing Techniques for DB Procurement Method

S/NO	RISK SHARING METHODS (DB)	RII	RANK	DECISION
1	Warranty	0.71	1st	Moderately Used
2	Bond	0.66	2nd	Moderately Used
3	Surety	0.66	2nd	Moderately Used
4	Sub-letting	0.66	2nd	Moderately Used
5	Insurance	0.64	5th	Moderately Used
6	Joint Venture	0.64	5th	Moderately Used
7	Sub-contracting	0.63	7th	Moderately Used
8	Partnership	0.61	8th	Moderately Used
9	Alliancing	0.48	9th	Fairly Used
10	Relational Contracting	0.45	10th	Fairly Used
	<i>Average</i>	<i>0.61</i>		<i>Moderately Used</i>

Source: Researcher’s Analysis of Data (2019)

Eight (8) of the ten (10) identified Risk Sharing Techniques for DB Procurement Method are moderately used. These range between “Warranty” and “Partnership” (RII = 0.61 – 0.71) as shown in Table 4. “Alliancing” and “Relational Contracting” on the other hand, are fairly used with RII of 0.48 and 0.45 respectively. On the average the identified Risk Sharing Techniques for DB Procurement Method are moderately used in construction projects (average RII = 0.61). The results of the Independent Sample T – Test was carried out to determine the statistical difference which occurs between the two procurement methods are summarised in Table 5.

Table 5: T - Test of Difference of how Risks are Shared and Managed between DBB and DB Procurement Methods

S/N	VARIABLES		TYPE OF ANALYSIS	OBSERVATION			INFERENCE
	X1	X2		T-cal	T-tab	P value	
1	DBB Procurement Method (Mean = 3.4754)	DBB Procurement Method (Mean = 3.0659)	T-test	7.395	1.960	0.000	Statistically Significant

Source: Researcher's Analysis of Data (2019)

It is shown in Table 5 that there exists a significant difference in the level of effectiveness of how risks are shared and managed between DBB and DB Procurement Methods. The T calculated value observed was 7.395 which is greater than the tabulated T value from Statistics Table. The Probability (p) value observed was 0.000 which is less than the study's level of significance of 0.05. This implies that there is significant difference in the level of effectiveness of how risks are shared and managed between DBB and DB Procurement Methods at 95% confidence limit. The mean value observed for the DBB Procurement Method is 3.4754 while that of the DB Procurement Method is 3.0659. The Risk Management Techniques for the DBB Procurement Method is therefore more effective than that of DB Procurement Method.

Strategies for enhancing level of understanding of risk management under DBB and DB procurement methods

The MIS results on the Strategies for Enhancing the Level of Understanding of Risk Management is presented in Table 6.

Table 6: Strategies for Enhancing the Level of Understanding of Risk Management

S/NO	STRATEGIES	MIS	RANK	DECISION
1	Understanding the required price and costing mechanism.	4.11	1st	Effective
2	Collaboration between private party and government..	3.77	2nd	Effective
3	Establishing the process by which supplier bids and proposals are assessed.	3.37	3rd	Fairly Effective

4	Critically studying the contract type.	3.29	4th	Fairly Effective
5	Considering the market's capability.	3.25	5th	Fairly Effective
6	The effective, efficient, and economic use of resources.	2.84	6th	Fairly Effective
7	Looking at the procurement risk analysis undertaken.	2.62	7th	Fairly Effective
	<i>Average</i>	<i>3.32</i>		<i>Effective</i>

Source: Researcher's Analysis of Data (2019)

Table 6 revealed seven (7) strategies for enhancing the level of understanding of risk management. Only two (2) of the strategies are effective. These are “Understanding the required price and costing mechanism” and “Collaboration between private party and government” (MIS = 4.11 and 3.77 respectively). The other five strategies are fairly effective with MIS ranging from 2.62 – 3.37. Averagely all the strategies are fairly effective (average MIS = 3.32).

CONCLUSION AND RECOMMENDATIONS

It can be concluded that the identified major risk management techniques on construction projects are often practiced and are fairly effective. The Risk Sharing Techniques for DBB and DB Procurement Methods are moderately used in construction projects but the Risk Management Techniques for the DBB Procurement Method is more effective than that of DB Procurement Method. Therefore, the assessment and management of risk for construction projects under the DBB (Design Bid Build) Procurement Method is more effective than when carried out under the DB (Design and Build) Procurement Method in Nigeria.

Stakeholders especially clients and consultants should therefore consider the use of DBB Procurement Method for procuring projects in order to more effectively manage risks in construction projects. In order to better enhance the level of understanding of risk management in construction projects, stakeholders should use the strategies of “Understanding the required price and costing mechanism” and “Collaboration between private party and government”.

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