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AN ASSESSMENT OF RISK FACTORS AT THE DESIGN STATE OF CONSTRUCTION PROJECTS IN KADUNA STATE

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ABSTRACT
The effectiveness of the design stage in construction has a great influence on the success of subsequent processes in the construction of projects. Despite its importance, relatively little attention has been paid to risks at the design when compared to construction and hence the resulting problems of Poor communication, lack of adequate documentation, unbalanced resource allocation, lack of coordination between disciplines. This study assessed risks at the design phase of construction projects. A structured self-administered questionnaire was administered to 328 consultants in Kaduna state. 203 (56.7%) were completed returned and analyzed. SPSS 22 was used to analyze the data collected. Factor analysis was carried out and the risks were classified into four components: Technical Risks, Management Risks, Clients Risks and financial Risks. The results of the descriptive statistics show that Management Risks ranked the highest with a grand mean of 4.06 while financial risks ranked the lowest with a grand mean of 3.88. Risks exist at the design stage of construction at various degrees and management risks are high. The study recommends that All stakeholders involved in managing the design process should be made to understand in details their roles and responsibilities in the bid to increase the transparency and improve the communication between the actors.

Keywords: *Consultants, Design Stage, Risks, Risk Management*

INTRODUCTION
Construction industry is unique compared to other industries and the main characteristics of a construction project is that it very complex and one of a kind (Oyewobi, Ibrahim & Ganiyu, 2013). Each project has a different nature

of work, located at different workplace, employ different personnel and produce different types of products. These interrelated factors are sufficient to cause the existence risks in the course of the project (Nworuh & Nwachuku, 2014. The design stage of any construction is an important aspect of any construction where necessary decisions are taken. The complexities of construction activities and the nature of working environment which constantly change contribute to greater and constant risk occurring at construction site all times (Khutyz, 2018). This scenario has made most people to view construction industry as a high-risk working environment as compared to others. The construction industry is particularly plagued by risk (Wood, Flangan and Norman, 2013). But often this risk is not dealt with adequately resulting in poor performance with increased cost and time delays (Thompson and Perry 2012). Construction projects are becoming increasingly complex and dynamic in their nature and the introduction of new procurement methods means that many contractors have been forced to rethink their approach to the way that risks are treated within their projects and organizations. Risk in construction can be described as exposure of construction activities to economic loss due to unforeseen events or foreseeing events for which uncertainty was not properly accommodated (Oyewale & Ayotunde, 2017). Adeyileka & Odewale, (2016) explain that risks are inherent in construction from the design stage to the completion of the project. To effectively manage these risks, the integration of risk management techniques at the design stage of construction projects becomes necessary to curb cost overrun. Risks not properly managed at the design stage makes it difficult to find a project in which the initial contract sum is not exceeded at the completion time. Inherent of risk at the design stage may likely result in uncertainty as to the final cost. Aksyonva, (2018) observed that design risk in construction is a variable in the construction process whose variation results in uncertainty to the final cost, duration and quality of the project. Vareshahin, (2016) observed risks at the design stage are often ignored by most owners and contractors, this may result in unnecessary long and disruptive delays turn on otherwise profitable project into a financially ruinous undertaking (Glukhova, 2018). As a managerial process, design is traditionally regarded as one of the stages of a project in the building industry. In fact, it is one of the most important processes in building projects, since it defines the product to

be built and has many interfaces with several other processes, such as production planning, material supply, sales, and building operations (Kachalov, 2012). The breakdown of the design process into stages varies considerably across studies both in terms of content and the names given to each stage. The design stage therefore needs to be planned and controlled more effectively, in order to minimize the effects of complexity and uncertainty (Kopylova, Redkina & Khnykina, (2019). Lack of adequate planning at the design stage results in insufficient information being made available to complete design tasks and inconsistencies within construction documents. Poor communication, lack of adequate documentation, unbalanced resource allocation, lack of coordination between disciplines, and erratic decision making have been pointed out as the main problems at the design stage (Palunin, 2019). Despite its importance, relatively little attention has been paid to the design when compared to production and hence the resulting problems (Fademiro et al, 2016). This study assessed the inherent risks at the design stage of Construction projects in Kaduna state.

Risks in Construction

Every human endeavor involves risk and the success or failure of any venture depends crucially on how we deal with these risks.(Ogunsani Salako & Ajayi, 2011) Risk occurs in every facet of human life and such construction project are not exempted from this as they are characterized by activities that are predisposed to different types of risk ranging from political risk to construction risk. Risk has different meanings to different people; the concept of risk varies according to view point, attitudes and experience (Malyshko, Klyaus, Kulikova, . Engineers, designers and contractors view risk from the technological perspective (Baloi and Price, 2003). According to Odeyinka (2006) risk in construction can be described as a variation that results in uncertainty in the final cost, duration and quality of the project. Risks generally recognized within the construction industry are continually faced with a variety of situations involving many unknown, unexpected, frequently undesirable, and often unpredictable factors that include timing schedule slippage of the project tasks, technological issues, people-oriented issues, finance, managerial and political issues. Palunin, Chursin & Yudin, (2019) placed the responsibility of an adequate and proper evaluation of this risk on

both the client and design advises. The initial contract sum comprises of site labour cost, material cost and contractor cost, plant and establishments charges (Romanova &Krutova, 2019). Initial and final contract sum are not or never the same due to inherent risk factor such as fluctuation, variation, re-measurement of provisional quantities, adjustment of provisional and prime cost and some other risk factors.

Risk Management in Construction

The underlying reason for risk management is to ensure a well-grounded and unbiased decision making (Paulini et al). Risk management process should be implemented at the early project phases, when there is still a possibility for fundamental changes. The project should be carefully analyzed as to which kind of methods to use, which project phases and a process needs to be customized according to all project's characteristics. According to Nworuh and Nwachukwu (2014) they define risk management as a systematic approach which evaluates the propensity of risk occurrence in construction system, especially its direct impact on time and cost commitment in terms of their negative effects to properly safeguard initial project strategy, thus reducing failures in the performance of parameters (Romanova et al). Also, their research leads credence to the imperatives of risk management approach in overall construction project, planning, controlling process, implementation and delivery. Odeyinka and Iyagba (2000) also, defines risks management as the act of the planning, organizing, directing, and controlling an organization assets and activities to minimize the adverse operational and financial effects of accidental losses upon that organization and as a system that aim to identify and quantify all risks to which the business or project is exposed to, so that a conscious decision can be taken on how to manage the risks (Malyshoko et al, 2019). According to them, the system includes the identification and assessment of risks together with the development of strategies to minimize them, and when they occur, to mitigate them, any adverse effects or take advantage of the beneficial ones. Khizhnyak & Shoshpanova, (2016) concluded that risk management is a process comprising of the following main steps, they are as follows risk management planning, risk identification risk assessment, risk analysis, risk response, risk monitoring, and risk communication, in order to evolve sound and effective

strategies that will assist risk management and control on building projects, numerous studies have been made by various researchers.

Risks at the Design stage of Construction

The following sources of risk are predominant at the design stage of construction projects: Newman and Hundermann, (2018) listed No sufficient details, Site location, The total number of bidders, Insufficient site information (soil test & survey report), Variation by the client and Variation of construction programme. Brown and Lee (2017) identified Project complexity, Delay in funding and Payment condition attach to project. Others identified by Wang and Zou (2017) include Fluctuation & non-fluctuation. Shehu and Abubakar (2018) identified Availability of materials, Types of client, Client financial capability. Ellis & Keel (2015) Changes in design, Organizational structure, Overhead and profits of the company and Occurrence of dispute. Shen and Liu (2013) stated No QC system in place and Lack of planning. Tamarin & Tsigu (2015) identified Errors in design, Lack of coordination, Available skills and Innovative design. Robbin and Umer, (2014) identified Lack of effective communication and Condition of contract. Ngete, (2015) identified Design variation. Lub and Kendra (2013) identified Labor productivity basis, The weather condition and Profile of other competitors. Hsiao and Kim (2011) identified Unsuitable construction programme planning, The technical manpower & equipment, General safety accident occurrence. The responsibility of an adequate and proper evaluation of these risks is placed on both the client and the design teams.

Methodology

The study considered theories and collect data hence the deductive approach was the most suitable. The data collection process points towards the deductive approach therefore the survey was appropriate for the research process. The survey design allows collection of quantitative data which can be analyzed using descriptive and inferential statistics. The survey method has been applied in research examining aspects of risk Managemnt (Menz, 2012), This study seeks to assess risks inherent at the design stage of construction This study focused on Consultants in Kaduna State. The target respondents of this survey members of the design team (Architects, Quantity Surveyors,

Engineers and Builders) with business addresses in Kaduna state. The total number is unknown. 358 sample size is sufficient when the sample size is unknown at 90% confident level, 0.5 standard of deviation and at +/- 5% margin of error (Smith, 2016). Thus, a total number of 358 questionnaires were administered by the researcher and 203 (56.7%) were retrieved and analyzed. The survey instrument (questionnaire) was developed based on literature review, the identified variables were used to construct appropriate measures.

Analysis and Results

Likert scale was used for each item measured 5 Points representing Strongly Agree and 1 point Strongly Disagree. The descriptive analysis of the data collected were analyzed using SPSS version 22 . The study identified 32 risks inherent at the design stage of construction project. Cronbach alpha test was conducted to confirm the reliability of the data collected, the Kaise-Mayer-Olkin(KMO) and Berletts test of sphericity were used to establish the validity of the instrument by assessing the sample adequacy and multivariate normality of the identified variables. The least Cronbach's alpha coefficient was 0.73 while the highest value was 0.87. The KMO test, which is a measure of sampling adequacy that compares the magnitudes of the partial correlation coefficients of measuring variables, is 0.700, while Barlett's test of sphericity, which tests the correlation matrix is significant since the p-value is less than 0.05

Table 1: KMO and Bartletts Test.

Kaiser-Meyer-olkin Measure of Sampling Adequacy		**.700**
Bartletts' Test of Spericity	Approximate Chi-Suare	8431.239
Risks	Df	210
	Sig	.000

The extraction of the components of the identified risks was based on the total variance explained which indicated eigenvalues of 1 and above. Thus, the four components explain a total variance of 70.0%.

Table 2: Rotated component matrix

		COMP 1	COMP 2	COMP 3	COMP 4
CR1	No sufficient details	0.784			
CR2	Site location	0.819			

CR3	The total number of bidders	0.715			
CR4	Insufficient site information (soil test & survey report)	0.789			
CR5	Variation by the client	0.623			
CR6	Variation of construction programme	0.674			
CR7	Project complexity	0.711			
FR1	Delay in funding		0.819		
FR2	Payment condition attach to project		0.833		
FR3	Fluctuation & non-fluctuation		0.859		
FR4	Availability of materials		0.717		
MR1	Types of client			0.632	
MR2	Client financial capability			0.718	
MR3	Changes in design			0.709	
MR4	Organizational structure			0.699	
MR5	Over head and profits of the company			0.754	
MR6	Occurrence of dispute			0.699	
MR7	No QC system in place			0.837	
MR8	Lack of planning			0.901	
TR1	Errors in design				0.633
TR2	Lack of coordination				0.724
TR3	Available skills				0.845
TR4	Innovative design				0.637
TR5	Lack of effective communication				0.611
TR6	Condition of contract				0.609
TR7	Design variation				0.713
TR8	Labour productivity basis				0.819
TR9	The weather condition				0.912
TR10	Profile of other competitors				0.705

TR11	Unsuitable construction programme planning				0.852
TR12	The technical manpower & equipment				0.652
TR13	General safety accident occurrence				0.702

Source: Field Survey (2019)

Table 2 shows the rotated component matrix of the risks. The extraction method used is the principal component analysis, the varimax with Kaiser Normalization and the rotation converged in 5 iterations. The loading of each of the variables is presented in Table 2. Instrument reliability was used to satisfactorily measure the variables of this research. The Cronbach's Alpha values were used to examine the internal consistency of the interrelated multiple scale items. The cornbach alpha results are above 0.70 this indicates that the results are highly significant since according to Enegbuma et al. (2015), the values obtained must be higher than the recommended minimum value of 0.60. The risks were classified into four groups Management Risks (MR), Financial Risk (FR), Technical Risks (TR) and Clients risks (CR)

Table 3. Mean scores of design risks

CODE	RISK FACTORS	MEAN
Clients Risks		
CR1	No sufficient details	4.10
CR2	Site location	3.76
CR3	The total number of bidders	3.96
CR4	Insufficient site information (soil test & survey report)	3.70
CR5	Variation by the client	3.85
CR6	Variation of construction programme	4.23
CR7	Project complexity	3.94
Grand Mean		**3.93**
Financial Risks		
FR1	Delay in funding	3.72
FR2	Payment condition attach to project	3.87
FR3	Fluctuation & non-fluctuation	3.79

FR4	Availability of materials	4.15
Grand Mean		**3.88**
Management Risks		
MR1	Types of client	3.93
MR2	Client financial capability	4.11
MR3	Changes in design	3.52
MR4	Organizational structure	3.94
MR5	Overhead and profits of the company	4.19
MR6	Occurrence of dispute	4.42
MR7	No QC system in place	4.36
MR8	Lack of planning	3.99
Grand Mean		**4.06**
Technical Risks		
TR1	Errors in design	4.33
TR2	Lack of coordination	3.68
TR3	Available skills	4.28
TR4	Innovative design	3.96
TR5	Lack of effective communication	3.89
TR6	Condition of contract	4.11
TR7	Design variation	3.81
TR8	Labor productivity basis	3.76
TR9	The weather condition	3.57
TR10	Profile of other competitors	4.32
TR11	Unsuitable construction programme planning	4.21
TR12	The technical manpower & equipment	4.09
TR13	General safety accident occurrence	4.15
Grand Mean		**4.01**

Source: Field Study (2019)

Table 3 shows the results of the mean scores of the risks based on their components. The risks were classified into four components: Technical Risks, Client Risks, Financial Risks and Management Risks. The results show that Management risks ranked the highest with a grand mean of 4.06, followed by Technical risks with a grand mean of 4.01. the result further shows that clients

risk ranked next with a grand mean of 3.93 while the financial risks ranked the lowest with a grand mean of 3.88

DISCUSSION OF FINDINGS

The findings show that risk exists at the design stage of a project at various degrees. The four components established exists at the design stage of construction projects. The study established that Management risk ranked the highest this corroborates the findings of (Brown e al, 2017; Wang and Zou, 2017). Their findings identified management risk as the highes ranking list. Management of any process is vital to the success of any venture. Occurrence of dispute raked high among the management risks. This implies that disputes should be minimized to achieve success in the design process. Consultants must work together as a team to minimize the occurrence of disputes. As managers of the design process. Communication is vital. Clients risk ranked the lowest, this finding is in line with the findings of (Ellis et al, 2015). The findings show that client related risk ranked the lowest. Clients are mostly not responsible for issues in the design process (Lub et al, 2013). Basically, the client is responsible for brief description and approves major decisions taken (Tamarin & Tsigu, 2015)

CONCLUSIONS

This study assessed the risks inherent at the design stage of construction projects. It points out that risks exist at the design stage of construction projects. The study grouped the identified risks into four components: Technical Risks, Client risks, Financial Risks and Management risks. The risks exist at various degrees in Construction projects. Management risks ranked the highest and should be given attention at the design stage of construction. Design process and management of sustainable building are essential components of the management of the urban environment, especially in developing countries.

RECOMMENDATIONS

1. All stakeholders involved in managing the design process should be made to understand in details their roles and responsibilities in the bid to increase the transparency and improve the communication between the actors.

2. The information needed to perform all the necessary activities in the different stages have been formerly established and should be enforced and made effective.

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