ANALYSIS AND MANAGEMENT OF PROJECT RISKS: A SURVEY OF INDIGENOUS CONTRACTORS IN NIGERIAN CONSTRUCTION INDUSTRY.

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Abstract

Construction projects are capital intensive and risk laden; and contractors only make use of intuition or guess work in allocating contingencies for the presumed project risks. Hence this paper identifies the risk associated with construction projects with a view to assess the means of analysing and managing the inherent risks adopted by indigenous contractors in Nigeria. The paper adopted questionnaire survey on the targeted population of indigenous contractors operating in Lagos State under the umbrella of FOCI using simple random sampling technique. The questionnaire was structured to obtain information on category of risks associated with construction project, the techniques adopted for risk analysis and the measure of controlling or managing the inherent risks. The data collected were analysed using weighted mean, mean interval score (MIS), and multiple regression analysis. The hypothesis was analysed using regression model. The analysed data shows that financial and economic risk, delay risk and contractual and legal risk were prominent among the major risks associated with construction project. The techniques adopted by indigenous contractors in analysing project risks are Delphi Method, Influencing diagram and Portfolio theory while the mechanism of risk managing measures are Prediction, Specialization and Control measures. The regression model indicated a significant and positive relationship between risk managing measures and risk analytical techniques with coefficient ranging from 0.425 to 0.775. The paper concluded that indigenous contractors should adopt Monte-Carlo simulation and Latin-Hyper-Cube sampling that is mathematical oriented to analyse project risks rather than delegating the assessment to third party who are not conversant with the various variables of risk factors on construction projects and recommend that the combination of three measures of managing risks should be adopted in order to pre-empt the unpredictable nature of construction business environment in Nigeria.

Keywords: Construction project; Analytical techniques; Risk management; Managing measures

1.0 Introduction

Construction projects are prone to risk from inception to completion. These projects with high capital outlay and long period of execution experience risk depending on the degree of complexity and type of projects. This view was corroborated by Nieto-Morote and Ruz-Vila (2011) that the increasing complexity and dynamism of construction projects have imposed substantial uncertainties and subjectivities in the risk analysis and management process.

Literature has define risk in a number of ways (Brush, 2005; Chia, 2006 etc.); but Baloi and Price (2003) noted that the concept of risk varies according to viewpoint, attitudes and experience. Although risk has been defined in various ways, Nieto-Morote and Ruz-Vila (2011) identified some common characteristics as: a future event; uncertainty and conditionality of occurrence; probability of future occurrence and unexpected and unplanned impact or consequences of occurrence.

Risk is inherent in all project undertakings, as such it can never be fully eliminated, although can be effectively managed to mitigate the impacts on the achievement of project's objectives. Typically, construction firms are engaged as contractors and subcontractors in the construction industry. Therefore, the contractors are continually faced with a variety of situations involving many unknown, unexpected, undesirable and often unpredictable risk factors. These factors are conveniently lumped together as the category of risk. In Nigeria, contracts are usually awarded through conditions of contract and other contract documents. This contract documents allocate risks in term of liabilities and responsibilities to each contracting party in linguistic terms only and does not reflect the reality. Raftery *et al* (2001) noted that inappropriate and unclear risk allocation among the contracting parties generates avoidable construction claims and disputes.

However, contract document phrases are insufficient to quantify risk allocation between the contracting parties. Therefore, this paper assesses the techniques of risk analysis and management adopted by Nigerian contractors and considers its effects on project delivery.

2.0 Literature Review

Construction projects are complex in nature and have many inherent uncertainties refer to as risks. These risks are not only from the unique nature of the project but from the diversity of resources supply and activities/operations of the project (Rahman and Kumaraswamy, 2002). Also, external factors (risks) have very significant effects on the outcome of a project. Summarily, project risks can affect the success of a project's objective in terms of the schedule (time duration), the budget (contract sum) and quality.

Nasir *et al*, (2003) noted that contractors only make use of guess-work in allocating contingencies for the presumed project risks while Warszawaski and Sachs, (2004) opined that in order to bid low, contractors in Nigeria usually play down these risk factors when involved in competitive bidding. In this circumstance, it is difficult for a contractor to make reasonable analysis of the project risk which would have been adequately provided for in the bid estimates in order to maximize the chance of successful bid.

There are many different sources of project risks and some approaches have been suggested in the literature for classifying them. Some classification focus on the risk nature and magnitude (John and Peter, 1997); some on the risk origin (Zhou, *et al*, 2008) while others on hierarchical structure of risks (Tah *et al*, 1993). Summarily, Zhou, *et al*, (2008) identify nine categories of risks involved in project as: financial & economic risk; contractual risk; subcontractor risk; operational risk; safety and social risk; design risk; force majeure risk; physical risk and delay risk. Also, the study identified six measures of risk control as: consolidation; specialization; control; prediction; diffusion and selection. However, the increasing size and complexity of construction projects have added risks to project execution. With the need for improved

performance in construction project and increasing contractual obligations, the requirement of an effective risk management approach has never been more necessary than now. Some of the approaches to risk management suggested in the literature are: project risk analysis and management (PRAM; Chapman, 1997); risk analysis and management for projects (Institute of Civil Engineers, 2002); risk management standard (Institute of Risk Management, 2002) and project management body of knowledge (Project Management Institute, 2008). Figuratively, John and Peter (1997) illustrate the process of risk management as shown in figure 2.1

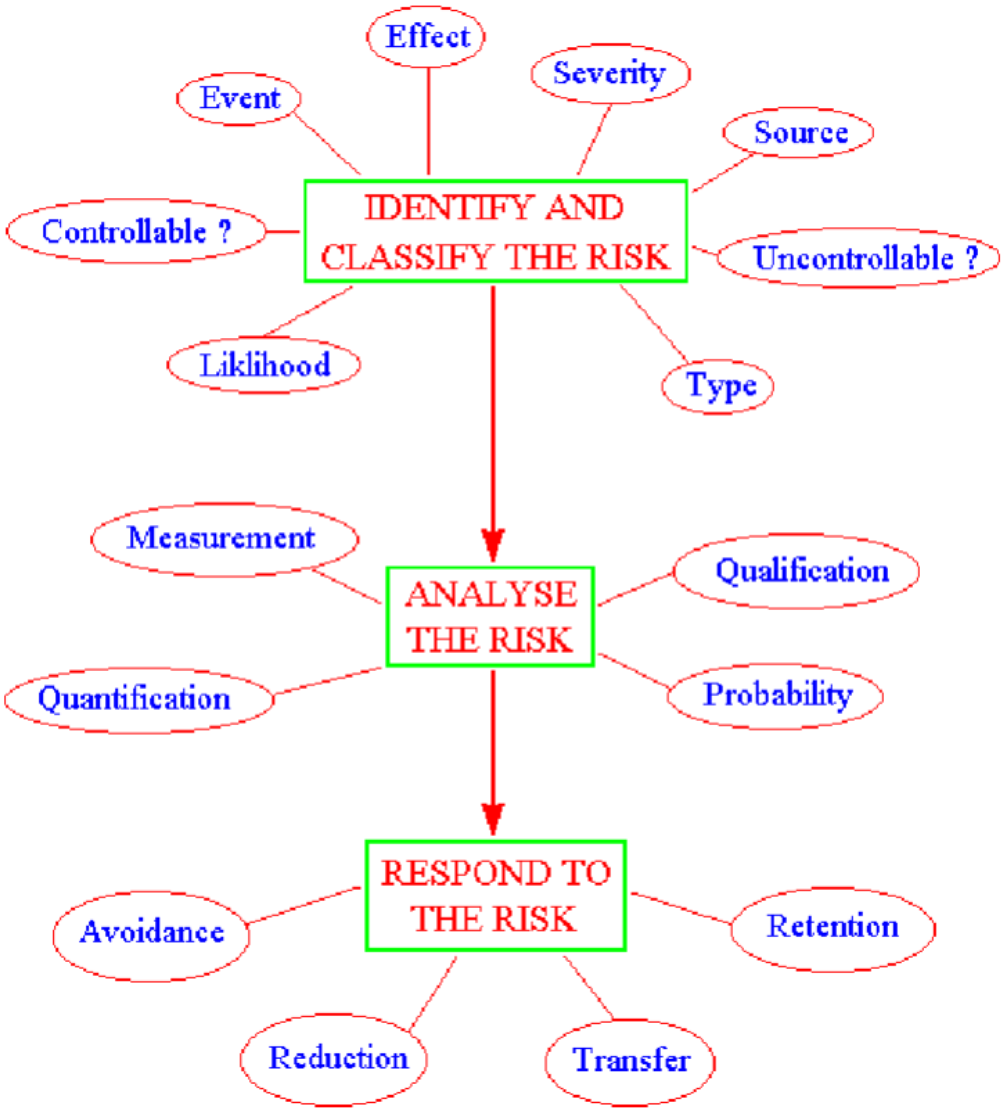

Figure 2.1. Stages of Risk Management: (Source: John and Peter, 1997)

All these approaches have similar framework with differences in the established steps in order to get the risks control.

Also, research studies have been focus on means of assessing project risks; notably among them are Odeyinka and Lowe (2002) proposed a factor approach to the analysis of risks while Dikmen *et al* (2007) proposed a model using influence diagram. Others are Wang and Elhag (2007) used

Delphi method to evaluate risk factors in terms of likelihood and consequences while Nieto-Morote and Ruz-Vila (2011) proposed a fuzzy approach to project risk assessment. Conclusively, literature has identify eight technique of risk analysis as: sensitivity analysis; probabilistic analysis; Monte-Carlo Simulation; decision tree analysis; Latin-hype-cube sampling; Portfolio theory; Delphi method and Influencing diagram. However, this paper assesses the approach usually adopted by indigenous contractors in Nigeria to analyze and manage project risks.

3.0 Research methodology

The study adopted questionnaire survey on the targeted population of indigenous contractors operating in Lagos State being the commercial nerve in terms of construction firm's location and project activities; under the umbrella of Federation of Construction Industry (FOCI) using simple random sampling technique. The participation of only indigenous contracting firms removed the problem of "imposed etic" by foreign firms which would disturb the uniformity in the responses for analysis (Koh and Low, 2008). The questionnaire was structured to obtain information on category of risks associated with construction project, the techniques usually adopted for risk analysis and the measure of controlling or managing project risk using a Likert scale of 5 (major) to 1 (minor). The firms involved in the survey have been classified into three groups based on the turnover of the firm as a measure of size grouping as depicted in Table 3.1. Tables 3.2 and 3.3 show the designation and construction experience of the respondents respectively. The respondents are mainly at the senior management level with an average construction experience of above 10 years. Also, Kline (1994) submitted that samples must not only be representative but sufficient size to produce reliable results, where this is not the case, the results are not meaningful. The study suggested a sample with ratio 2:1; and the rule that the bigger the ratio, the better. In this paper, an achieved ratio of 76:10 (i.e. 8:1) is considered adequate. This background information regarding the respondents indicated that responses provided by them could be relied upon for this study.

Table 3.1: Size of Construction Firms by Annual Turnover

Amount (₦)	Frequency	Percent	Cumulative
< 1	11	14.5	14.5
1-49M	10	13.2	27.6
50-99M	14	18.4	46.1
100-149M	5	6.6	52.6
150-199M	4	5.3	57.9
200M and Above	32	42.1	100.0
Total	76	100.0	

Table 3.2: Designation of Respondents

Position	Frequency	Percent	Cumulative
Managing Directors	16	21.05	21.05
Directors	33	43.42	64.47
Senior Managers	20	26.32	90.79
Managers	7	9.21	100.00
Total	76	100.00	

Table 3.3: Respondents' Experience

Years	Mid-Point	Frequency	Percentage
1-5	3	20	26.3
6-10	8	25	32.9
11-15	13	10	13.2
16-20	18	7	9.2
Above 20	20	14	18.4
Mean	**10.47**		
Total		76	100.0

4.0 Data Analysis and Discussion of Findings

4.1 Data Analysis

Table 4.1: Major Risks Associated with Construction Projects

S / N	Category of risk	Weighted mean	Rank
(i)	Financial and economic risk	3.59	1
(ii)	Delay risk	2.87	2
(iii)	Contractual risk	2.86	3
(iv)	Safety and legal risk	2.78	4
(v)	Sub-contractor related risk	2.77	5
(vi)	Physical risk	2.67	6
(vii)	Design risk	2.55	7
(viii)	Operational risk	2.47	8
(ix)	Force majeure risk	2.15	9
(x)	Other risks	1.23	10

Table 4.1 shows the weighted mean score of major risk factors associated with construction projects. Financial and economic risk; delay risk and contractual risk with weighted mean value of 3.59; 2.87 and 2.86 respectively were prominent among the major risk factors that affect construction projects while force majeure and other uncategorized risks with weighted mean value of 2.15 and 1.23 were ranked least among the risk factors that affect construction projects. This reflect the unpredictability nature of financial and economic situation that is characterized by galloping inflation in which contractors undertake construction business followed by the bureaucracy of award of contract that normally delay projects with the ambiguous and unclear contractual clauses contained in the contract documents.

Table 4.2 Risk Analytical Techniques usually Adopted

S / N	Analytical techniques	Mean score	Rank
(i)	Delphi method	3.68	1
(ii)	Influence diagram	3.58	2
(iii)	Portfolio theory	3.57	3
(iv)	Probability theory	3.47	4
(v)	Sensitivity analysis	3.29	5
(vi)	Decision tree analysis	3.01	6
(vii)	Latin-Hyper-Cube test	2.92	7
(viii)	Monte-Carlo simulation	2.82	8

Table 4.2 shows the frequency of techniques adopted in analyzing project risks. Delphi Method, influencing diagram and portfolio theory with mean score of 3.68, 3.58 and 3.57 respectively were prominent among the analytical techniques on construction projects. However, Monte

Carlo Simulation and Latin-Hyper-Cube with mean score of 2.82 and 2.92 respectively were the least from the rear. This implied that the use of Delphi method which is an expert opinion was done as conditional contractual requirements to obtain bond and insurance cover for the project and not with the intention of assessing risks involved; believing that if the risk eventually occur, the contractor will only beckon on the insurance company. The second in the rank (Influencing diagram) implied that contractors usually categorized the possible sources and effects of project risks on the basis of pessimistic and optimistic chance of occurrence while the third one (Portfolio theory) are normally regarded in business term as the higher the risks involved, the higher the profit.

Table 4.3 Risk Managing Measures in Use

S / N	Managing measures	Mean score	Rank
(i)	Prediction	2.78	1
(ii)	Specialization	2.68	2
(iii)	Control	2.59	3
(iv)	Diffusion	2.48	4
(v)	Consolidation	2.29	5
(vi)	Selection	2.16	6

Table 4.3 shows the rate of use of risk managing measures to minimize the possible effects on construction projects. Prediction, Specialization and Control with mean score of 2.78, 2.68 and 2.59 respectively were prominent. This implied that managing risks on construction projects depend on individual contractor's ability to evaluate and predict the chance of risk occurring in order to ameliorate the harmful effects (Prediction) while those risks that have been predicted are usually transfer to insurance company to assume the responsibility of handling the risks (Specialization) and those that are not transfer are assumed by the contractors to avert the risk occurring and reducing the harmful effects of the risks by implementing safety precaution measures on site.

4.2 TEST OF HYPOTHESIS.

Hypothesis was formulated to test if there is any relationship between risk analytical techniques and managing measures. The hypothesis was tested using regression method at 0.05 level of significance.

Hypothesis Set Up

Ho: There is no significant relationship between risk analytical techniques and risk managing measures.

H1: There is significant relationship between risk analytical techniques and risk managing measures.

Table 4.4: Regression Analysis of Risk Analytical Techniques and Risk Managing Measures.

Risk

Managing Measures.	R	R^2	$\overline{R}^2$	F	Sig. F
Diffusion	0.775	0.600	0.574	22.691	0.000
Selection	0.711	0.506	0.473	15.451	0.000
Prediction	0.649	0.421	0.382	10.970	0.000
Specialization	0.552	0.304	0.258	6.609	0.000
Consolidation	0.530	0.281	0.234	5.912	0.000
Control	0.425	0.181	0.127	3.338	0.001

Table 4.4 presents the relationship between risk managing measures and risk analytical techniques. The result revealed that there is significant and positive relationship between risk managing measures and analytical techniques with coefficient ranging from 0.425 to 0.775. The coefficient of determination r^2 varies between 0.181 to 0.600. In order words, all the identified risk analytical techniques jointly explained the percentage of the total variance. The remaining un-explained variation in each of the elements of analytical techniques can be attributed to variation in other parameters other than the ones identified, otherwise included in the stochastic error term.

4.3 Discussion of Findings

Financial and economic risk; delay risk and contractual and legal risk were prominent among the major risk associated with construction projects in Nigeria and the techniques adopted by indigenous contractors in analysing project risks are Delphi Method, Influencing diagram and Portfolio theory. The mechanism of risk managing measures adopted to minimize the possible effects of risks on construction projects are Prediction, Specialization and Control measures while the regression analysis indicate that that there is significant and positive relationship between risk managing measures and analytical techniques.

5.0 Conclusion and Recommendation

Studies have shown that risks on construction projects cannot be eliminated but managed or controlled. Hence, it is better that indigenous contractors adopt Monte-Carlo simulation and Latin-Hyper-Cube sampling that is mathematical oriented to analyze project risks rather than delegating the assessment to third party who are not conversant with the various variables of risk factors on construction projects and recommend that the combination of three measures of managing risks should be adopted in order to pre-empt the unpredictable nature of construction business environment in Nigeria.

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