International Journal of Business and Management Invention (IJBMI)
ISSN (Online): 2319-8028, ISSN (Print):2319-801X
www.ijbmi.org || Volume 9 Issue 6 Ser. IV || June 2020 || PP 55-62

Evaluation of Project Risk Assessment Strategies

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***ABSTRACT*:** *The risk involved in the construction works is relatively higher than the other works. The biggest challenge is to reduce the risks involved. Risk assessments include identifying risks, analyzing risk and controlling risk qualitatively by various methods. In this study, the Questionnaire checklist method is used to identifying the risk in the construction work, at the Federal Ministry of Works and Housing, Nigeria. Based on this, risk assessment is made to control the risk. There are various factors which affects the occurrence of these risks. All these risk occur during the project life cycle will results in financial loss and even in the stoppage of a particular project. Hence in order to prevent this, proper risk assessment is very important. The purpose of this research is to evaluate various risks factors that could hinder the implementation of projects and the determining the influence of risk avoidance, according to the perception of the employees of the Federal Ministry of Works and Housing. For that, a questionnaire of five point scale was prepared. The study adopted a descriptive survey design and collected data through questionnaires from 212 employees of the Federal Ministry works and Housing through stratified random sampling. Data was analyzed using both descriptive statistics with the help of IBM SPSS Statistics for Windows, Version 25.0.In conclusion, the results indicated that the staff of the Federal Ministry of Works and Housinghad very high opinion with regards to the implementation of risk avoidance strategy and its impact on project implementation (mean = 0.152; std. dev. = 0.33).*

KEYWORDS: *Risk, Project, Risk assessment, Risk identification, Project Implementation and Construction works*

Date of Submission: 13-06-2020 Date of Acceptance: 29-06-2020

I. INTRODUCTION

This study examines the Federal Ministry of Works and Housing employees' perception of the degree of occurrence and impact of the risk factors on project implementation in medium and large enterprises within the Nigerian construction industry. In Nigeria, risks are dealt with in a completely arbitrary way by adding 10% contingency onto the estimated cost of the project. According to Mills (2001), risk contingencies are a result of past experiences concealed within the bid process. He added that contingency protects the contractor's interest in the event of a risk occurrence. Is that enough to cater for risks on a project? Diallo and Thuillier (2004) pointed out that most international assistance provided to developing countries is managed by projects. They added that projects are financed by multilateral development agencies such as the World Bank, the European Union and the United Nations Development Program amongst others. The World Bank (2003 cited in Tuuli*et al*., 2007) argued that despite the important role the industry plays in the nation, the industry is still largely inefficient, especially regarding contract management, as characterized by lengthy payment delays, cost and time overruns and poor project implementation. Other studies have linked the relationship between the construction industry and the nation economy (Rameezdeen and Ramachandra, 2008).

The term risk is defined in many ways. A comprehensive risk that incorporates the two aspects (threat and opportunity) is the project risk. Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives such as scope, schedule, cost, and quality (Project Management Institute, 2013). According to Greeshma and Minu (2016), a risk is considered as the combination of probability of an event and its impacts on project objectives. Risk is a sure factor for every business organization. So, construction projects carry lot of risks because of the involvement of a large number of parties such as owners, designers, supervision consultants, contractors, subcontractors, suppliers, manufacturers, governments etc. According to Doner (2010), risk assessment and management has moved to another level of importance due to the increased complexity and unpredictability in the development environment, and above all after the commencement of the global financial crisis; hence the need to apply robust and sophisticated risk management techniques in property development projects. Some of the major causes of risk in construction include design error, estimating error, competitive tendering risk, financial risk and changes in political and

economic climate among others. Whilst these risk factors are not unknown to the Nigerian building and construction industry, the relative likelihood of occurrence, impacts and assessment of project risks has not been extensively investigated. Furthermore, the current economic downturn and challenges in a highly competitive Nigeria's building and construction sector require contractors to manage risks by themselves.

According to Tah and Carr (2000), the building and construction industry are subject to more risks compared with many other industries due to the unique features of construction activities, such as long period, complicated processes, abominable environment, financial intensity and dynamic organization structures. Hence it is important to implement proper risk management in every construction project. Risk management is not a simple process. It involves various complex steps. Santoso*et al*. (2003) concluded that risk can be identified based on the frequency of occurrence and level of impact based on research work on assessment of risk in high rise building construction in Jakarta. Indonesia, like Nigeria is a developing country with Oil and Gas as the major exports. Santoso*et al*. (2003) identified 130 risk events which were further classified into sub-categories and grouped under low, medium and high risk.

Furthermore, researchers have classified risk into two categories of internal and external with the internal risk being further sub-classified into local and global comprising eight sub-categories in total whereas external risk was further sub-divided into economic, physical, political and technological change.

Consequently, Sloman (1995) explained that risk and uncertainty are two common terms in the field of risk management. These two terminologies have been extensively defined, and these depend on the setting in which they are examined. Attempts have been made to distinguish them. Also, the researcher defined uncertainty and risk as follows:

- Uncertainty – when an outcome may or may not occur and its probability of occurring is not known.
- Risk – when an outcome may or may not occur, but its probability of occurring is known.

This study purposes to better understand the risk assessment process and other risk processes. It has been already recognized that the Federal Government of Nigeria, under the auspices of the Federal Ministry of Works and Housing is ready to improve risk assessment and management. Therefore, the objective of this learning is to evaluate the various project risk assessment strategies in the Federal Ministry of Works and Housing and promote strategies that can be utilized towards actualizing successful project executions/performance.

II. STATEMENT OF THE PROBLEM

The Federal Ministry of Works and Housing, which is the formal governmental implementing agency of public sector projects, is considered the arm responsible for the implementation of the government's building and construction programs. The Ministry undertakes the construction and development of the network of roads as well as the construction of buildings and government constructions, and the development of the housing sector, in addition to the development of work in the construction sector. One of the main challenges that face the Ministry in its quest to realize their vision and strategic plans is how to apply the project risk assessment principles, effectively in its activities. So, in this study, an attempt has been made to provide some aspects of the answers, to the evaluation of project risk assessment strategies, embodied in the question:

"What can be done to develop and evaluate project risk assessment practices in the public sector, in Nigeria and enhance project performance?"

III. OBJECTIVES OF THE STUDY

To obtain a high level of efficiency of implementation of public projects, the study aids better understanding of the risk assessment processes, thereby building a clear and well-defined system that could be institutionalized. Therefore, this study attempts to highlight and evaluate project risk assessment strategies in the public sector, as follows:

i. To review literatures on the application of project risk assessment strategies in the Federal Ministry of Works and Housing,
ii. To identify the risks in building and construction projects through questionnaire surveys,
iii. To identify various methods of risk assessment.

IV. RESEARCH HYPOTHESES

To achieve the objectives of this study, the following two null hypotheses were formulated for testing.

H_1: The deficiency in the application of project risk strategies significantly increases the risk in projects executed by the Federal Ministry of Works and Housing.

H_2: The application of project risk strategies has no significant impact on the probability of risk occurrence.

H_3: Assessing the Impact of Risk is not a tool for categorizing risks according to ranks.

V. LITERATURE REVIEW

5.1 Conceptual Framework

Enever and Isaac (2002) mentioned that "in statistics, risk relates to a situation where a probability or weight can be assigned to a possible outcome arising from a decision, while uncertainty is the situation when the likelihoods of the outcome are unknown, and hence no measure of probability can be made." In other words, risk concerns situations with considerable data and well-defined boundaries for its use; while uncertainty, is synonymous with lack of knowledge and poor/imperfect information (SRA, 2015). However, Adair and Hutchison (2005) stated that in property development, the difference between risk and uncertainty is widely acknowledged, and are used interchangeably. Also, studies within the African context have also examined the impact of risk on project performance (Aje*et al*., 2009) causes of delay on construction projects (Frimpong*et al*., 2003).

The study by Dada and Jagboro (2007) of professions in Nigerian construction industry placed the relative importance on risk factors and identified finance and political influence as main risk factors. Still within the Nigerian context, Aje*et al*. (2009) identified contractors' management capability had significant impact on cost and time of building projects.An investigation is also applied to show that it was necessary and important to understand the interdependences between projects and their risks for project portfolio success (Teller and Kock, 2013). In addition, there are approaches quantitatively assessing risk interdependences, which can be mainly classified into the following categories: The Monte Carlo simulation approach, the nature language assessment approach, the matrix-based approach and the Delphi-based approach. The Monte Carlo simulation approach is mainly used to establish interdependence among different project risks (Rao and Grobler, 1995).

5.2. Empirical Review

The following studies have investigated the application of risk management techniques in the construction and real estate industries. Akintoye and MacLeod (1997) conducted a study on risk analysis and management using a sample of 100 top firms in UK construction industry. The study achieved 43% response rate comprising 30 general contractors and 13 project management practitioners. Findings showed that 77% of contractors and 100% of project management practices used intuition/judgment/experience in risk analysis. This is followed by sensitivity analysis, where 53% and 38% of contractors and project management practices applied the technique respectively.

Lyon and Skitmore (2004) conducted a survey on the usage of risk management techniques by Queensland engineering construction industry with a sample of 200 organizations comprising; owners, property developers, consultants (project managers, quantity surveyors and engineers) and contractors. A response of 6 developers, 10 owners, 11 consultants and 17 contractors were achieved. Findings indicate that risk identification and risk analysis are the most often used risk management components ahead of risk response and risk document. The most frequently used risk identification techniques are brainstorming, the case-based approach and checklists. Among the risk assessment techniques available, intuition, experience and judgement are the most frequently used, followed by sensitivity analysis and risk premium; while the least used are Monte Carlo simulation, decision analysis techniques and expected monetary value (EMV) method.

Otegbulu et al. (2012), surveyed risk assessment techniques applied in property development project in Abuja, Nigeria. The study investigated 80 estate surveying and valuation firms. A total of 69 firms responded comprising 23 project managers, 20 developers, 14 feasibility consultants and 12 that engage in the above three functions. The study disclosed that economic, political and social risks are the most predominant risks encountered in property development project. The most often used risk analysis techniques by the firms are qualitative description and scenario/sensitivity analysis. The study by Nnamani (2016), investigated the "Application of quantitative risk analysis techniques in the investment appraisal of residential properties in Enugu Urban, Nigeria." The study surveyed the frequency of risk analysis techniques used by estate surveying and valuation firms in the appraisal residential property investment. The study investigated 44 estate surveying and valuation firms in Enugu Urban, with a response rate of 84.09 %. The results show that the rate of application of subjective assessment is 88%, sensitivity analysis (60%) and risk-adjusted discount rate (36%). No firm use probabilistic methods for risk analysis. Also, lack of familiarity, degree of sophistication, non-availability of sound data/information, lack of expertise, and lack of local software packages are the key factors limiting the application of quantitative risk analysis techniques by the firms. These studies mainly focused on risk identification and risk analysis/assessment by mainly estate surveying and valuation firms, ignoring other aspects of risk management process; while others covered risk management on building construction without considering other aspects of the property development process (e.g., Odimabo and Oduoza, 2013).

From an extensive literature survey, it was revealed that a large number of researchers have shown remarkable contribution towards project risk identification and assessment in the construction industry. However, only few comparisons have been made between various methods of project risk assessment. Therefore, this study intends to fill the lacuna, by establishing a comparison between the probability of risk

occurrence and impact of project risks. This will help to predict the importance of each project risk, according to their probability and impact.

VI. METHODOLOGY

The Federal Ministry of Works and Housing is the Ministry saddled with the responsibility of overseeing building and construction projects of the Federal Government of Nigeria.Survey research design, as a research design will be used in this study. This research design has been preferred over other types of research designs, primarily because it is concerned with describing the actual situation and establishing the relationship existing among variables. It is believed that survey design will lead to the realization of the objectives of this study as it primarily seeks to describe, explain or interpret existing conditions, prevailing circumstances or practices so as to build some benchmarks. A simple size of 212 was obtained from the population of 450 at 5% error tolerance and 95% degree of freedom using Yamane's statistical formula 212(100%) of the questionnaires distributed and all were returned. The questionnaire was designed in Likert scale format. More so, a pre-test on the questionnaire was carried out to ensure the validity of the instrument. Simple linear regression test and Pearson product moment correlation coefficient were used to test the hypotheses.

VII. RESULTS OF FREQUENCY ANALYSIS

7.1 Probability of Risk Occurrence

Further analysis was carried out to highlight the probability of risk occurrence in the building and construction projects of the Federal Ministry of Works and Housing by the respondents. From the findings, as expressed in Figure 1, 124(58.2%) respondents, which are the majority, opined that the probability of risk occurrence was moderate; 62(29.1%) and 26(12.2%) respondents suggested that the probability of risk occurrence were high and low, respectively. However, Henry and Adebayo (2004) reported that the likelihood of occurrence of risk in the building and construction industry is very high.

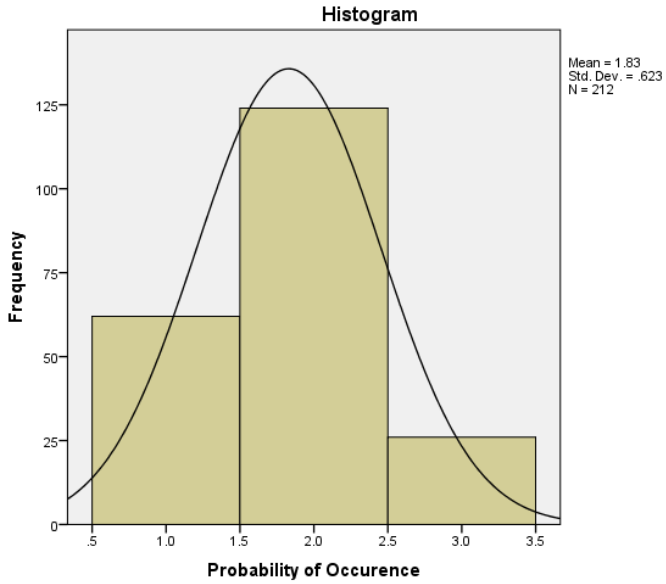

Figure 1. Histogram Showing the Probability of Risk Occurrence

The graph shows that the mean and standard deviation are 1.83 and 0.623, respectively

7.2 Ranking of Risks by Respondents

Table I:Ranking of Risks

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Financial Risk	87	40.8	41.0	41.0
	Construction Risk	47	22.1	22.2	63.2
	Environmental Risk	70	32.9	33.0	96.2
	Design Risk	8	3.8	3.8	100.0
	Total	212	99.5	100.0	
Missing	System	1	.5		
Total		213	100.0		

Source: Field Study (2020)

The response according to Table 1 shows that 87(40.8%) opined that financial risk is the highest ranked risk amongst the four common risks observed in most projects of the Federal Ministry of Works and Housing. While environmental, construction and design risks were considered second, third and fourth, respectively. Report by Greeshma and Minu (2016) supported this finding by stating that financial risk has first rank in probability of occurrence.

This study therefore implies that strategies to manage financial risks and the others must be improved upon and adopted for better project execution.

7.3. Descriptive Analysis on Risk Avoidance

Table II: Descriptive Analysis on Risk Avoidance and Project Implementation

Statements	Mean	Standard Deviation
The Ministry encourages use of contingency/alternative plans in order to avoid any situation that may affect the schedule, cost and quality of project implementation.	0.09	0.286
The Ministry encourages use of detailed work plans so as to limit occurrence of anything that may affect the schedule, cost and quality of project implementation.	0.07	0.249
The Ministry has put in place protection and safety systems against any event that may affect schedule, cost and quality of project implementation.	0.13	0.339
The Ministry uses regular inspections to ensure no issue arises that may affect schedule, cost and quality of project implementation.	0.09	0.293
The Ministry has a programme on training of employees on how to ensure the proper implantation and evaluation of project risk strategies.	0.38	0.486
Average	0.152	0.33

Source: Field Study (2020)

The result indicates an average mean score of 0.152 and a percentage agreement of approximately 84.42% for the various statements of risk avoidance, signifying approval towards the statements. This shows that the respondents' opinion was very high with regards to the implementation of risk avoidance strategy and the influence the strategy had on project implementation at the Federal Ministry of Works and Housing.This was emphasized by Mambo et al., (2019), who recommended that the Government should emphasize on the preparation of detailed risk assessment plans and adhere to the plans in order to avoid the occurrence of events.

VIII. TEST OF HYPOTHESES

The two hypotheses were tested with various test statistics aided by computer applied Statistical Package for Social Sciences (SPSS: 21.00s version) of Microsoft environment. Specifically, Pearson product moment correlation coefficient test was used to test hypotheses one and, hypothesis two was tested using simple linear regression.

Test of hypothesis one

H_{01}. The deficiency in the application of project risk strategies significantly increases the risk in projects executed by the Federal Ministry of Works and Housing.

Table III: Association between Risk Avoidance and Project Implementation

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	156.622[a]	4	.000
Likelihood Ratio	140.012	4	.000
Linear-by-Linear Association	31.202	1	.000
N of Valid Cases	212		

Source: Extraction from SPSS Result

Based on the results in Table 3, the study tested the hypothesis on the association between risk avoidance strategy and project implementation at the Federal Ministry of Works and Housing. At the level of significance = 95% (alpha = 0.05), all the test scores yielded p values less than the alpha value ($p < 0.05$). Therefore, the null hypothesis was rejected and it was concluded that there is a significant association between risk avoidance and project implementation at the Federal Ministry of Works and Housing.

Test of hypothesis two

H_2. The application of project risk strategies has no significant impact on the probability of risk occurrence.

Table IV:Model Summary

Equation 1	Multiple R	.385
	R Square	.148
	Adjusted R Square	.144
	Std. Error of the Estimate	.367

Source: Extraction from SPSS Result

Table V:ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Equation 1	Regression	4.922	1	4.922	36.443	.000
	Residual	28.361	210	.135		
	Total	33.283	211			

Source: Extraction from SPSS Result

Table VI:Coefficients

		Unstandardized Coefficients		Beta	t	Sig.
		B	Std. Error			
Equation 1	(Constant)	1.335	.078		17.014	.000
	Probability of Risk Occurrence	-.245	.041	-.385	-6.037	.000

Source: Extraction from SPSS Result.

The results from Table 4 revealed that there is no significant relationship between project risk strategies and probability of risk occurrence, as indicated by the R square value; 14.8% i.e. (R Square= 0.148) and an adjusted R square value of 0.144. The ANOVA table 5 shows that the Fcal is 36.443. The implication is that adoption of project risk strategies has effect on probability of risk occurrence.

The coefficient table 6 shows the simple model that expresses the effect of significant relationship between project risk strategies and probability of risk occurrence. The model is shown mathematically as follows:

$Y= a + bx$

Where 'y' is project risk strategy and 'x' is probability of risk occurrence; 'a' is a constant factor and b is the value of coefficient. From this table therefore, Project Risk Strategy (PRS) = -0.245+ 1.335. This suggests that increase in the value of coefficient leads to the increase of the dependent variable.

Test of hypothesis three

H_3. Assessing the Impact of Risk is not a tool for categorizing risks according to ranks

Table VII: Model Summary

Equation 1	Multiple R	.116
	R Square	.014
	Adjusted R Square	.009
	Std. Error of the Estimate	.750

Source: Extraction from SPSS Result

Table VIII: ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Equation 1	Regression	1.625	1	1.625	2.887	.091
	Residual	118.205	210	.563		
	Total	119.830	211			

Source: Extraction from SPSS Result

Table IX: Coefficients

		Unstandardized Coefficients		Beta	t	Sig.
		B	Std. Error			
Equation 1	(Constant)	.878	.076		11.600	.000
	Ranking of Risks	.048	.028	.116	1.699	.091

Source: Extraction from SPSS Result

The results from the Table 7 above revealed that there is no significant relationship between project risk assessment impact and the ranking of risks, as indicated by the R square value; 0.014 and an adjusted R square value of 0.009. The ANOVA table (4.11) shows that the Fcal is 2.887. The implication is that project risk assessment has effect on the categorization of ranking risks.

The coefficient Table 8 shows the simple model that expresses the effect of significant relationship between project risk strategies and probability of risk occurrence. The model is shown mathematically as follows:

$Y = a + bx$

Where 'y' is ranking of risks and 'x' is risk assessment; 'a' is a constant factor and b is the value of coefficient. From this table therefore, Ranking of Risks (RR) = 0.048+ 0.878. This suggests that increase in the value of coefficient leads to the increase of the dependent variable.

Discussion of Findings

Decision on Hypothesis 1

H_1. The deficiency in the application of project risk strategies significantly increases the risk in projects executed by the Federal Ministry of Works and Housing.At the level of significance = 95% (alpha = 0.05), all the test scores yielded p values less than the alpha value ($p < 0.05$). Therefore, the decision would be to reject the null hypothesis and accept the alternative hypothesis (H_1).

Decision on Hypothesis 2

H_2. The application of project risk strategies has no significant impact on the probability of risk occurrence.The significance level is below 0.01, which implies a statistical confidence of above 99%. This suggests that the application project risk strategies affects probability of risk occurrence. Therefore, the decision would be to reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1).

Decision on Hypothesis 3

H_3. Assessing the Impact of Risk is not a tool for categorizing risks according to ranks. The significance level is below 0.01, which implies a statistical confidence of above 99%. This suggests that assessment of impact of risk is a tool for ranking risks in the building and construction industry. Therefore, the decision would be to reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1).

IX. CONCLUSION

The following are the conclusions from the study:

Construction industry is considered to be one of the most risky business sectors. Since construction process involves a large number of activities the chance for the occurrence of risks are very high in construction industry.

Risk may results in serious financial loss, disputes, delays, and even in the stoppage of work. Risks are of various types. Depending up on the type of risks, its impact also varies. Hence it is important to access risk strategies during construction.

The financial risk has the high probability of risk occurrence.The probability of risk occurrence does not depend on the impact of risk.

Also, it is found that in order to reduce the impact of risk proper management should be implemented.There are various management techniques to reduce the impact of risk. Among them the most suitable suggestion is the risk management through risk avoidance technique.

X. RECOMMENDATION

The following are study recommendations:

i. In view of the findings on the influence of risk avoidance on project implementation at the Federal Ministry of Works and Housing, this study recommends that the government should emphasize on preparation of detailed risk management plans and strict adherence to the plans in order to avoid the occurrence of events that may affect the schedule, cost and quality of project delivery.

ii. The Ministry should also conduct operation reviews and regular inspections of projects, to ascertain the progress and act accordingly to minimize the severity of any existing risks.

iii. The Ministry should train project staff on project risk strategies. This would ensure the adoption of relevant risk strategies according to best global practices.

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HauwaMujaddadi. "Evaluation of Project Risk Assessment Strategies." *International Journal of Business and Management Invention (IJBMI)*, vol. 09(06), 2020, pp. 55-62. Journal DOI-10.35629/8028