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ASSESSMENT OF RISK ANALYSIS PROCESSES IN THE NIGERIAN CONSTRUCTION INDUSTRY: CONTRACTORS'AND PROJECT MANAGERS' VIEWS

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ABSTRACT

The construction industry is big and obligatorily requires input from various stakeholders. Inadvertently, these inputs are full of risks that the Project manager and project team must overcome during the project life cycle. These risks the Project manager and the project team must identify, analyse, treat, monitor and control before the risks contribute negatively to the success of the project. Risk analysis in the industry is to ascertain the likelihood and impact of the risks on the project so that the risk effects on the main objectives of the project are minimal. The respondents are local and foreign construction firms and project managers with over twenty years working experience. The result of the analysis suggests that local contractors use more of qualitative risk analysis than quantitative risk analysis while the foreign contractors and project managers moderately use qualitative analysis than quantitative analysis. The result also suggests that local contractors barely have projects that require quantitative analysis in projects executed. In conclusion, synergizing is crucial in the industry as each stakeholder gain more than contributed. Engaging professionals on risk analysis processes is vital to the success the construction industry and the project stakeholders. In addition, the Project managers' need to make the clients understand the importance of risk analysis in construction projects.

Keywords: local contractors, foreign contractors, risk analysis, construction industry, Project manager.

INTRODUCTION

The incidence of risk management is new in the Nigerian construction industry, as risk management practice is still at infancy according to [14] Cost, time and quality are the most affected when risk issues come to life especially where project management practice is green and not yet legislated. Project risk management is a useful element of project management as it increases the worth of other project management processes; hence, these processes encourage harmonious mode with existing organizational practice and policies [11]. Risk management procedure assist planners and managers to consistently identify risks and create steps to address those risks and related consequences. The aim of this process is to proffer a more dependable planning, greater certainty about the financial and management results and ameliorate decision making [11]. [18], defined risk as the possibility that there is no outcome of the expected achievement or is reinstated by another or that an unanticipated circumstances occurs. The gross view of risk according to [18], includes both certainty due to the future event and the effects of limited knowledge, information or experience it measures in terms of consequences and likelihood. [1], claimed that people's conviction, condition of mind, opinion and sentiment influence risk recognition. [1], submission is very accurate, but there is a need to established these impacts on the project types, project stakeholders and clients.

With the current spate of development and swift changes [14], claimed that project plan, proper monitoring and controlling are not enough to have a successful project plan. Thus, organisations must have project risks fully analysed and deal with identified risk accordingly. Risk analysis is generic in all projects irrespective of size, location, client, and any other compelling factors that abound in all construction industry. However, risk analysis in the Nigerian construction industry has call for concern looking at current spate of building collapses. The major cause of unanalysed risk according to [7], is inadequate information at the inception of construction projects, which results in a high grade of risks related to cost, time and quality. The current issue of building collapses in the country is one indicator that lacks risk analysis is the basic reason for this development. Furthermore, inadequate information dissemination among relevant stakeholders in the industry is a major factor. Hence, inadequate information from the client to the Project manager from the Architect to other consultants like Electrical Engineer, Structural Engineer, Mechanical Engineer, Quantity Surveyor and the constructor. The Project manager and the team are to identify, analyse, monitor and control risks and these role as good as it is the extent of engagement of Project manager and project team has call for concern. According to [10], clients engage other consultants before the project managers in 39% and project managers before other consultants in 23% on most projects. Thus, the inadequate involvement of Project managers is one of the factors militating against the analysis of risks before the commencement of the project.

The concern is that risk analysis needs knowledgeable professionals to analyse the potential risks, monitor and control the risks from the project inception to the project closeout. It is obligatory at this stage of development to look into the extent and the frequency of use of risk analyses techniques as applicable to the Nigerian construction industry. Hence, the intended objectives of this study are: 1. to confirm the extent of use of qualitative and quantitative risk analyse techniques by foreign and local contractors, and Project managers. 2. To confirm the benefits of qualitative and quantitative risk techniques in construction projects. In the light of this development, the awareness of risk analysis will be increased amongst the Project managers, project team members and concerned stakeholders. Furthermore, the yearning of the academia and the policy makers will be met in relation to the study's findings and recommendations.

LITERATURE REVIEW

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[14], define risk as the possibility of not achieving the expected outcome or by reinstating another or that an unanticipated event occurs. This broad view of risk according to [14] includes both certainty due to the future event and the result of limited knowledge, information or experience it measures in terms of consequences and likelihood.

[16], mentioned the following five techniques: 1. Estimating technique (applied to probability and impact) 2. Root causes Analysis. 3. Post project review/lesson learned/historical information. 4. Probability and impact matrix and 5. Analytical hierarchal process. [16], also proposed that performing and broad assessments of risk in business practice it is crucial to use both qualitative and quantitative methods for risk analysis in construction projects. "The knowledge of methodology in those areas should be a prerequisite for accurate risk evaluation" [16]. The combined uses of both qualitative and quantitative methods are the more accurate risk estimation.'' Nonetheless, the intensity and impact of risk is also crucial at this stage [16]. Risk analysis relates with the application of useful information to estimate the probability and impact of the risk to the project objectives and the stakeholders. Risk analysis contains the following steps, definition of scope, danger, identification, estimation of probability of occurrences, assessment of the liability of the elements at risk.

Project risk management includes the processes regarding the conduct of risk management planning, identification, analysis, responses and monitoring and control of the project according to [12], [12], further explained that the target of Project risk management are to increase the probability and impact of positive events, and abate the likelihood and impact of negative events in the project. Risk is an integral part of every aspect of managing every phase of the project. Hence, risk application to projects is important to successful project management as it is part of project plans and operational documents according to [11]. The broad view of risk according to [18] includes both certainty due to the future event and the result of confined knowledge, information or experience it measures in terms of result and likelihood. [1], risk level may decrease as the project progresses. Thus, when the risk is being accomplished as project progresses, the level of certainty increase and level of risks reduces unless secondary risk evolves.

[22], explained the importance of project scope and other cardinal facets of project management during the analysis of projects risks and the description of a particular project execution approach. Therefore, the project manager and the project team implicit judgment that determines the use of relevant techniques required as high-risk projects need more refined techniques and resources compared to small, low-risk projects [22]. [4], proposed the use of automated tools in the application of risk analysis techniques as this allow for searching, gathering and managing the essential data for several project risk management phases. [4], concluded that complex projects need advance risk analysis techniques, and simple projects require less sophisticated techniques in project risk analysis. Hence, sophisticated techniques are costly and labour intensive analysis using simulation will be of an advantage only when the project is complex, unusual and rare. [4]. In short, the summary is that simple project risk analysis should be solved by qualitative analysis while complex projects' risk analysis should be solved by quantitative analysis [4]

Risk analysis includes the qualitative and quantitative valuation of the identified risks the project managers and the team have to calculate the likelihood of an incidence of the risk factors and the risk's probable impact. [21], concluded that risk quantification model assist in gauging the likely result in terms of costs, schedule and quality, hence provides motivator to the project team to amend these weaknesses. [21], further stressed the advantage of the model as it furnish efficient plan toward quantification of risks.

USING QUALITATIVE RISK ANALYSIS

Qualitative risk analysis examines and prioritizes risk based on the likelihood of occurrence and the effect on the project that happens unexpectedly. Thus, proposes that mental suggestions to organising and prioritizing risks are the basis of qualitative risk analysis. [12], and [4], It is an extensive approach to ranking risks by priority, which then guides the risk reaction process. And also end result of quantitative risk analysis or move directly into risk response planning. Preparing for qualitative risk analysis needs the risk management plan as the first input which directs the process, the methodologies in use and the scoring model for identified risks. Qualitative methods create a list of risks, and risk ranking in order to prioritize risks for further analysis by evaluating and searching thoroughly the risks probability of occurrence and impact [4]. [12], established that project type have some relevant relationship with the process especially when a new project has little or no historical background. Some of the qualitative techniques are: brainstorming, causes and effect diagram or Ishikawa diagram and checklists. Others are Delphi; Event and tree Analysis, risk Breakdown Matrix and risk quality assessment according to [4]. In qualitative analysis the following processes are achieved: 1. the analysis of the risk probability 2. Determine the risk impact on the project objectives; 3. The identification of root causes of the risks. 4. The confirmation of the risk's importance. 5. Provision of prioritized risks according to [11]

USING QUANTITATIVE RISK ANALYSIS

Quantitative technique is a numerical process of assessing the probability and impact of identified risks on the project. Hence, it makes an all-encompassing risk score for the project according to [12], and [4] Quantitative risk technique calculates the likelihood that bears on the project and quantifying the degree of impact on the project cost, schedule, quality and other objectives [4]. [5], stated that there is no ambiguous set of criteria for determining when to use quantitative techniques, but it cannot be carried out before qualitative and semi-quantitative analyses. Quantitative risk analysis is more grounded than qualitative risk analysis as accomplishment of the project goals depends on use of many tools [19]. Quantitative basic tools are sensitivity analysis; decision tree and Monte Carlo analysis are used to create an overall risk score for the project. Although, quantitative risk analysis is more time-consuming and expensive to run the advantages overweigh the shortcomings [19]. Some of the important quantitative techniques are: decision tree analysis; expected monetary value. Others are expert judgment; Fault tree analysis; fuzzy logic; probability distribution and sensitivity analysis according to [4], and [19]. In quantitative risk analysis the following processes are carried out: 1. Creation of numerical models. 2. Achievement of combined results. 3. Determine the confidence level on the project. 4. Carry out sensitivity analysis. 5. Update the prioritized risk lists.[11], Monte Carlo simulations and system dynamics application use computer-based tools as such they are considered derivative concept of quantitative techniques because of the elongated use of numerical past data for such analysis.

Planning for risk response involves options and actions, which focuses on how to reduce the possibility of risks affecting the project's objective contrarily and increase the probability of positive risk to the advantage of the project. Reaction to the identified risks must balance with the risk and time and money invested in a risk compensated for by the gains from reducing the risk's impact and probability. [3], explained that trying to eliminate risks in projects is not achievable; however, there is a need to formalise risk management process in order to manage all risks. Project successes rely on proper risk management, and response strategies used in mitigating risks. [3], proposed the following risk benefits achieved when risks are analysed. 1. Identification of formidable alternative options [3]; 2. Increased confidence in achieving project objectives [3]; 3.Improved chances of success [3]; 4."Reduced surprises" [3]; 5.More precise estimates (through reduced uncertainty) [3]; and 6. Abate duplication of efforts (through team awareness of risk control action) [3].

METHODOLOGY

Data collection was through a survey administered to local contractors and foreign contractors who have been involved in the construction of buildings and facilities in the country for over twenty years. The survey was sent to 115 randomly selected company's executives of both indigenous and foreign construction firms. A total of 32 executives of the local firms returned the completed questionnaire while only 15 executives of the foreign firms returned the questionnaires.

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The third group is the consultant project managers, whose role has been mainly consultancy services on major projects. The project manager's response to the risk management requirements is crucial in the development of the practice in developing countries like Nigeria.

The questionnaires are from reviewed researches that are very relevant to the intended aim and objectives of the study. The questionnaires were inferentially and relationally analysed to bring out the information supplied by the respondents to the general public and the learned environment. The questionnaire consists section A, which is brief demographic information about the respondents like the respondents working experience and professional qualifications. The section B of the questionnaire consists of part A; this was used to determine the extent to which the respondents use qualitative and quantitative risk techniques. Part B consists the different types of benefits derived when the respondents use available risk techniques. The arrangements of the answers to the questions are in Likert scale of one to five, in which the 1 represents never, and 5 represent always.

Spearman rank correlation coefficient was used to decide the relationship between opinion of local contractors and foreign contractors on the issue of risk identification factors. Secondly, the opinion of the project managers and that of the local and foreign contractors were also determined.

1. $r_s=1-6\sum d^2/(n^2-n)$
2. t-test at 95% confidence level of the null (H_0) and alternative (H_1) was used to test the rank correlation coefficient.
3. $t=r_s \sqrt{n-2/1-r^2}$

The determinant was on whether the t calculated was greater or lesser than the critical value of t for (n-2) degree of freedom.

The hypotheses are

1. H_0: There is no statistically significant relationship between local contractors' and foreign contractors' opinions on qualitative risk analysis techniques in the Nigerian construction industry.
2. H_0: There is no statistically significant relationship between foreign contractors' and Project managers' opinions on qualitative risk analysis techniques in the Nigerian construction industry
3. H_0: There is no statistically significant relationship between local contractors' and Project managers' opinions on qualitative risk analysis techniques in the Nigerian construction industry.
4. H_0: There is no statistically significant relationship between local contractors' and foreign contractors' opinions on quantitative risk analysis techniques in the Nigerian construction industry.
5. H_0: There is no statistically significant relationship between foreign contractors' and Project managers' opinion on quantitative risk analysis techniques in the Nigerian construction industry.
6. H_0: There is no statistically significant relationship between local contractors' and Project managers' opinion on quantitative risk analysis techniques in the Nigerian construction industry.

RESULT OF FINDINGS ON QUALITATIVE METHODS

The local contractors mostly use checklists, causes and effect diagram, event and fault tree, probability and impact matrix and data accuracy ranking for risk analysis. The foreign contractors almost have the same factors as those of local contractors except on cause and effect diagram where it is the second on the local contractors and third on foreign contractors. In the event and fault tree the local contractors' response is third and second on the foreign contractors. The project manager's response is quite different from that of local and foreign contractors as cause and effect diagram is mostly used than others. Others in descending order are checklist, probability impact tables and data precision analysis. The mostly used qualitative risk analysis as the result indicate in the weighted average are checklist, event and fault trees, cause and effect diagram, probability-impact table and probability and impact matrix.

Table 1. Qualitative Risk Analysis Techniques

Qualitative techniques	Indigenous contractor Mean Rank	Foreign contractors Mean Rank	Project managers Mean Rank	Weighted Av. Mean Rank
Probability and impact matrix: this technique identifies for each risk a union of probability and impact to give a clear and definite overall risk rating and advance decision on the detailed risk response plan based on the statue clarification. [13]	0.650 4	0.824 4	0.400 8	0.672 5
Assumption Analysis: this is a project management exercise that planners use in ascertaining all assumption made for risk reduction. Each assumption is analysed to decide its accuracy and ascertain all potential risks if the assumptions if later found to be inaccurate. Explore the validity of the assumptions that were identified and documented during the project planning process. It is used to further identify risks by primarily testing against the following two factors. 1. The validity or strength of the assumption. 2. The consequences on the project if the assumption turns to be false. [13]	0.200 9	0.240 9	0.333 9	0.271 9
Checklist: consist of a list of items that are marked as "yes" or "no", and could be used by an individual project team member, a group or an interview. [6]	0.988 1	0.968 1	0.858 3	0.942 1
Probability-impact tables: project assumption testing, identified assumptions must be tested against two criteria; assumption stability and the consequences on the project if the assumptions is false, alternative assumptions that may be true should be identified and their consequences on the project objectives and their consequences on the project objectives tested in the qualitative risk analysis [25]	0.238 6	0.704 6	0.840 4	0.710 4
Data precision ranking: this is a qualitative risk analysis technique that requires precise and unprejudiced data, this technique evaluates the degree to data that emerged from risk identification is useful for risk management; it involves magnitude of knowledge about the risk; available data; quality of data available and reliability and integrity of the date. {12]	0.275 5	0.728 5	0.733 5	0.658 6
Flow charts: this is a graphical process document succession of steps contained in a situation in order to understand and bring forth any fundamental issue or problems [17]	0.213 8	0.328 7	0.622 6	0.465 8
Influence diagrams: this is a consolidated graphical and mathematical representation of a decision situation. It involves modelling and solving both probabilistic inference problems and decision making problems as in Bayesian network. [25]	0.219 7	0.29 8	0.520 7	0.392 7
Cause-and-effect diagram: is also called Ishikawa or fishbone diagram used primarily in root cause analysis. It is crucial visual aid to assist in establishing the root cause of quality issues or other pending issues and relationship between different variables**. [17]**	0.913 2	0.872 3	0.902 2	0.896 3
Event and fault trees: this is a graphical representation of the logic model that ascertain and quantifies the possible result. It determines the limits of the particular analyses by defining the initiating event and the possible results for each succession of events. It				

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defines success, and partial and/or complete system/subsystem failure scenarios. (AVES) and [18]	0.869	3	0.928	2	0.920	1	0.907	2

CONSIDERATION OF LOCAL CONTRACTORS AND FOREIGN CONTRACTORS ON QUALITATIVE RISK ANALYSIS FACTORS

$Rho=p= 1-6\sum d^2/n\ (n^2-1)$

=0.967 suggest that the correlation is positive and very strong as it is close to 1.0. It shows that the local construction firms' opinions and foreign contractors on the use of qualitative risk analysis factors in most of their construction projects are related.

H_0: There is no statistically significant relationship between local contractors' and foreign contractors' opinions on qualitative risk analysis techniques in the Nigerian construction industry.

Student's t distribution with degree of freedom n-2 were used

$t= r_s\sqrt{n-2/1-r^2}$

t-calculated is 10.04, which is lower than t-tabulated 2.365. The observation suggests that the relationship between the opinions local contractors' opinion and that of foreign contractors is significant on qualitative risk analysis techniques in the Nigerian construction industry. Therefore, we reject the null hypothesis.

CONSIDERATION OF FOREIGN CONTRACTORS' AND PROJECT MANAGERS' OPINIONS' ON QUALITATIVE RISK ANALYSIS TECHNIQUES

$Rho=p= 1-6\sum d^2/n\ (n^2-1)$

=0.733 suggest that the correlation is positive and very strong as it is above average. It shows that the foreign construction firms' opinions and that of project managers on the use of risk identification factors in most of their construction projects are related.

H_0: There is no statistically significant relationship between foreign contractors' and Project managers' opinions on qualitative risk analysis techniques in the Nigerian construction industry.

Student's t distribution with degree of freedom n-2 were used

$t= r_s\sqrt{n-2/1-r^2}$

t-calculated is 2.85, which is higher than t-tabulated 2.365 . The observation suggests that the relationship between the opinions of foreign contractors' and Project managers' is significant on qualitative risk analysis techniques in the Nigerian construction industry. Therefore, we reject the null hypothesis.

CONSIDERATION OF LOCAL CONTRACTORS' AND PROJECT MANAGERS' OPINIONS ON QUALITATIVE RISK ANALYSIS TECHNIQUES.

$Rho=p= 1-6\sum d^2/n\ (n^2-1)$

=0.418 suggest that the correlation is positive and very strong as it is above average. It shows that the local construction firms' opinions and that of project managers on the use of quantitative risk analysis factors in most of their construction projects are related.

H_0: There is no statistically significant relationship between local contractors' and Project Managers' opinions on qualitative risk analysis techniques in the Nigerian construction industry.

Student's t distribution with degree of freedom n-2 were used

$t= r_s\sqrt{n-2/1-r^2}$

t-calculated is 1.22, which is lower than t-tabulated 2.31. The observation suggests that the relationship between the opinions local contractors' opinion and that of Project managers' is significant on qualitative risk analysis techniques in the Nigerian construction industry. Therefore, we accept the null hypothesis.

Table 2. Test of Hypothesis on Qualitative risk techniques

parameters	**r_s**	**t-cal**	**t-tab**	**p-value**	**Reject H_0**
Local contractors and foreign contractors	0.967	10.04	2.36	0.05	Yes
Foreign contractors and project managers	0.733	2.85	2.36	0.05	Yes
Local contractors and project managers	0.418	1.22	2.36	0.05	No

RESULTS OF FINDINGS ON QUANTITATIVE RISK ANALISIS

The local contractors' responses show that they mostly use Monte Carlo simulation, event tree faults, fuzzy logic, process simulation and expected monetary value analysis. The foreign contractors use Monte Carlo simulation more than the following: expected monetary value analysis, decision tree analysis, event and fault trees and probabilistic sums. The project managers' response is, however not different from those of local contractors and foreign contractors as the mostly used qualitative method is Monte Carlo followed by expected monetary value analysis. Others are decision tree analysis; event and fault trees and fuzzy logic. Furthermore, the weighted average shows that Monte Carlo simulation is mostly used followed by expected monetary value analysis; event and fault trees; decision tree analysis and process simulation.

Table 3. Quantitative Risk Analysis Techniques

Quantitative techniques	Indigenous contractor Mean	Rank	Foreign contractor Mean	Rank	Project Managers Mean	Rank	Weighted Average Mean	Rank
Sensitivity Analysis: this technique is used to ascertain how distinct values of an independent variable will impact a particular dependent variable under a given set of conjectures. It is a method of predicting the result of a decision if a condition turns out to be different compared to the key presage. [26], [18] and [9]	0.325	9	0.288	9	0.222	9	0.284	10
Probabilistic Sums: in theory it expresses the probability of the union of independent events. It is also the standard semantic for strong disjunction in such extension of product fuzzy logic in which it is definable. [25]	0.400	7	0.325	5	0.240	8	0.323	9
Monte Carlo and LHC stimulation:A problem solving technique used to approximate the probability of certain outcomes by running multiple trial runs, called simulation, using random variables [8]	0.944	1	0.963	1	0.969	1	0.958	1
Expected monetary value analysis:this technique weigh the probability of each potential result and determine the average worth of all outcomes. [11]	0.500	5	0.888	2	0.933	2	0.823	2

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Decision trees analysis: A schematic tree-shaped diagram used to determine a course of action or show a statistical probability, each of the decision tree represent a possible decision or occurrence. The tree structure shows how one choice leads to the next and the use of branches indicate s that each option is mutually exclusive. It is used to clarify and find answer to a complex problem.. The furthest branches on the represent possible end results. [11]	0.225	10	0.800	3	0.880	3	0.770	4
Event and fault trees: this is a fault tree analysis employed to calculate the probability rate of occurrence of an unwanted event in a technical system. Qualitative techniques are first used before subsequent analysis that depends on accurate quantitative data analysis. [20]	0.850	2	0.763	4	0.800	4	0.805	3
Multi-criteria MCDA: this is a sub-discipline of operations research that explicitly examines multiple standards in decision making environment. This technique structures intricate problems tolerably and consider multiple tests specifically to be informed and make a better decision. [23]	0.363	8	0.300	6	0.410	6	0.364	7
Fuzzy logic: this is a mode of many-valued logic; it deals with reasoning that is nearly accurate rather than fixed and exact. Fuzzy logic variables may have truth value that ranges in degree between 0 and 1. (Wikipedia, Fuzzy logic- Wikipedia. the free encyclopedia, 2014)	0.800	3	.238	10	0.413	5	0.442	6
Process simulation: this technique uses a model that interpret the uncertainty specified indicated at a detailed condition into their possible impact on objectives at the level of the total project. [23]	0.725	4	0.263	8	0.333	7	0.534	5
System dynamics: this is a methodology and mathematical pattern and framing, discerning, and debating complex issues and problems. This is achieved by attempting to discern the conduct of intricate system overtime. It relates with internal feedback circuit and time delays that involve the behaviour of the entire system. [24]	0.475	6	0.275	7	0.213	10	0.360	8

CONSIDERATION OF LOCAL CONTRACTORS AND FOREIGN CONTRACTORS ON QUANTITATIVE RISK ANALYSIS FACTORS

Rho=p= $1-6\sum d^2/n\,(n^2-1)$

=0.176 suggest that the correlation is positive and very weak as it is far below average. It shows that the local construction firms' opinions and foreign contractors on the use of qualitative risk analysis factors in most of their construction projects are related.

H_0: There is no statistically significant relationship between local contractors' and foreign contractors' opinions on quantitative risk analysis techniques in the Nigerian construction industry.

Student's t distribution with degree of freedom n-2 were used

$t= r_s\sqrt{n-2}/1-r^2$

t-calculated is 0.51, which is lower than t-tabulated 2.31. The observation suggests that the relationship between the opinions local contractors' opinion and that of foreign contractors' is not significant on qualitative risk analysis techniques in the Nigerian construction industry. Therefore, we accept the null hypothesis.

CONSIDERATION OF FOREIGN CONTRACTORS AND PROJECT MANAGERS ON QUANTITATIVE RISK ANALYSIS FACTORS

Rho=p= $1-6\sum d^2/n\,(n^2-1)$

=0.733 suggest that the correlation is positive and very strong as it is above average. It shows that the foreign construction firms' opinions and that of project managers on the use of risk identification factors in most of their construction projects are related.

H_0: There is no statistically significant relationship between foreign contractors' and Project managers' opinions on quantitative risk analysis techniques in the Nigerian construction industry.

Student's t distribution with degree of freedom n-2 were used

$t= r_s\sqrt{n-2}/1-r^2$

t-calculated is 3.05, which is higher than t-tabulated 2.31. The observation suggests that the relationship between the opinions foreign contractors' opinion and that of Project managers' is significant on qualitative risk analysis techniques in the Nigerian construction industry. Therefore, we reject the null hypothesis.

CONSIDERATION OF LOCAL CONTRACTORS AND PROJECT MANAGERS ON QUANTITATIVE RISK ANALYSIS FACTORS

Rho=p= $1-6\sum d^2/n\,(n^2-1)$

=0.418 suggest that the correlation is positive and moderate as it is not far from average. It shows that the local construction firms' opinions and that of project managers on the use of quantitative risk analysis factors in most of their construction projects are related.

H_0: There is no statistically significant relationship between local contractors' and Project managers' opinions on quantitative risk analysis techniques in the Nigerian construction industry.

Student's t distribution with degree of freedom n-2 were used

$t= r_s\sqrt{n-2}/1-r^2$

t-calculated is 1.43, which is lower than t-tabulated 2.31. The observation suggests that the relationship between the opinions local contractors' opinion and that of Project managers' is not significant on qualitative risk analysis techniques in the Nigerian construction industry. Therefore, we accept the null hypothesis.

Table 4. Test of Hypothesis on Quantitative risk techniques

parameters	r_s	t-cal	t-tab	p-value	Reject H_0
Local contractors and foreign contractors	0.176	0.51	2.30	0.05	No
Foreign contractors and project managers	0.733	3.05	2.30	0.05	Yes
Local contractors and project managers	0.418	1.43	2.30	0.05	No

FINDINGS ON RISKS ANALYSIS BENEFITS TO THE CONTRACTORS AND PROJECT MANAGERS.

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The result on table 3 indicates that the use of project risk analysis benefits the contractors and project managers on the weighted average. The result shows frequent achievement of precise estimate through reduced uncertainty whenever qualitative and quantitative analyses are carried out. The responses of the foreign contractors indicate the most benefits while the one of local contractors and Project managers are second on each column. The second on the weighted average indicate that the use of risk analysis methods reduces duplication of endeavour through team awareness of risk control action. However, this is the first in cases of project managers and local contractors and fourth on the foreign construction firms. The improved chances of success are the third most favoured benefit on the weighted average, the Project managers, and it is second to the foreign contractors and fourth to the local contractors. The increased confidence in achieving project objectives is the fourth on the weighted average, but fifth on Project managers' and local contractors' response and third on foreign contractors. The risk analysis reduces surprises, and it identifies formidable alternative courses of action are the fifth and sixth respectively on the weighted average. However, on the local contractors response reduction of surprises is the third in the column and sixth for both Project managers and foreign contractors. The Project managers identify formidable alternative courses of action is the fourth on the column, which is also the fifth and sixth for the foreign contractors and local contractors respectively.

Table 5. Benefits of Risk Analysis Applications.

BENEFITS OF RISK ANALYSIS	Local contractors Mean	Rank	Foreign contractors Mean	Rank	Project managers Mean	Rank	Weighted Average Mean	Rank
Identification of formidable alternative courses of action.	0.713	6	0.547	5	0.837	4	0.708	6
Increased confidence in achieving project objectives.	0.719	5	0.920	3	0.832	5	0.832	4
Improved chances of success	0.838	4	0.947	2	0.842	3	0.878	3
More precise estimate (through reduced uncertainty.	0.919	2	0.973	1	0.905	2	0.933	1
Reduced surprises	0.869	3	0.520	6	0.816	6	0.767	5
Reduced duplication of effort (through team awareness of risk control action)	0.963	1	0.907	4	0.921	1	0.931	2

CONCLUSION AND RECOMMENDATIONS

The research establishes the state of risk analysis as adopted by the contractors and Project managers in the Nigerian construction industry. The result on the extent of use of the qualitative and quantitative techniques is not encouraging, and there is a need by partakers in the industry to understand the importance of risk analysis. The development of risk analysis is growing at a very low pace. However, the stakeholders' intention to be component of the global village in term of infrastructural development should move fast to have a share in the stake. Most of the local contractors are aware of qualitative risk analysis techniques, which show lack of knowledge base on quantitative techniques. However, the use of quantitative techniques depends on the complexity of the project as this is one of the factors that sets the limit for the usage. The foreign construction firms are familiar with both quantitative and qualitative techniques, but the percentage of use is still low compared to requirements of a developing nation. The Nigerian construction industry is not very familiar with risk management analysis in general. The need to develop risk analysis knowledge base and expertise through training is now a compelling factor that needs encouragement in the industry. The policy makers need to be interested in risk management to encourage other stakeholders in the development as it is happening in other developed countries. While the client's response to risk analysis is averse, it is imperative for the project managers to make the clients realise the importance of risk analysis in projects.

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