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# Analysis of Risk Management in Civil Engineering Projects

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***Abstract:*** *The results from a questionnaire survey of risk management in the different phases of a construction project at Akwa Ibom State Nigeria are presented. The participants of the study were clients, contractors and consultants working in this state.They evaluated the participation of these stakeholders in the stages of the project, in specific, their roles in the system of risk management and their impact on risk management. It has been shown that a construction project's planning and manufacturing stages are the most important for risk management, where risk identification, evaluation and reaction occurs. However, collaboration in terms of risk management between the key players is most intensive in these phases.Compared to other stakeholders, contractors engage more actively in the risk management process and have the greatest impact on project risk management. Despite the recognized significance of the project's early stages, this study demonstrates a very low level of risk management activity in the program stage and promotes thorough risk analysis to overcome pushbacks and abandonment of projects to has potentials of enhancing economic growth and development.*

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## I. Introduction

Being a fast developing country with numerous infrastructural project, construction industry is one of the largest industry in Nigerian economy. It provides employment teeming population and contribute about 700,000 Million Naira to the country's GDP (NBS, 2015). As the standard of the buildings and infrastructure has a direct impact on the level of life of populace, a well-functioning construction industry is a paramount factor for the development of the nation. Nigerian construction industry has been criticized for increasing costs, low productivity, low quality, project delay and negligence of safety measures and processes. Particularly, the risk management process is argued to play an important role in project and construction management and, as a result, has to be further developed in order to achieve further efficiency improvement in the industry.

Risk management is meant to be an integral part of construction management (Olsson, 2007; Del Caño and de la Cruz, 2002), where one of the most difficult activities is indentifying the project's risks and how should they be optimized (Anderson, 2009). This is a key process which is very important for good project management (Baloi and Price, 2003; Perera and Holsomback, 2005; Alali and Pinto, 2009). Generally, risk management is defined as the process of identifying and assessing risk, and to apply methods to reduce it to an acceptable extent (Tohidi *et al*., 2011). The aim of project's risk management is to identify, evaluate, and control the risk for project successful and timely project delivery. Overall, risk management procudure involves the following majorsteps: Risk planning; Risk identification; Risk assessment ( both qualitative and quantitative); (4) Risk analysis; Risk response; Risk monitoring, and Recording the risk management process (ISO 31.000, 2009; Baloi and Price, 2003).

In the last four decades the risk management studies have grown considerably in the construction industry (Forbes *et al*, 2008) because construction projects are exposed to risk at the time of their coming into existence (Schieg, 2006; El-Sayegh, 2008). Project risk are analyzed from two different point of view. First, we have the project owner(Bryde and Volm, 2009), and on the other side we have contractors (Baloi and Price, 2003). The systems used for project risk management is centered on quantitative risk analysis, however this techniques do not capture lessons learned from previous projects, which may be necessary for consideration in a new one. Forbes *et al* (2008) indicate that with time, the construction industry used only a limited number of risk management techniques reason being not all techniques are appropriate for every situation (Skitmore, 2004).The overall aim of this research is to analyze risk in the different phases of construction project.The specific objective through which the major objective would be achieved are:to analyse how risks are shared and managed in various procurement options and to develop recommendations, which contribute to more effective risk management in construction projects especially in Nigeria.

## II. Methodology

### 2.1 Research design

Types of research are instrumental, descriptive, exploratory, explanatory and interpretive. The research presented in this thesis is of a descriptive type. Descriptive research aims at identifying and recording a phenomenon, process or system and may be conducted using surveys (Fellows and Liu 2003). Thus survey technique was chosen for data collection.

### 3.2 Data Collection

#### 3.2.1 Choice and Description of the Projects

A total of 22 projects were considered for this research which included 10 federal projects and 12 state projects. A total of 9 were ongoing, 10 have been completed while 3 were abandoned.

#### 3.2.2 Questionnaire Survey

Survey is a suitable method of data collection for descriptive purposes (Robson 2002). As one of the study's objectives was to analyse how risk management worked in the projects, a questionnaire survey was chosen as one of the methods of data collection.

### 3.3 Method of analysis

When the completed questionnaires had been collected, the data was entered into the Statistical Package for Social Science (SPSS). All questions and sub-questions were tranlated into variables. Each answer alternative was coded using value labels. In total, 32 variables were entered and used for the analysis.

Simple SPSS tools such as descriptive statistics and custom tables were used. With their integrated features frequencies, means, distributions and rankings were obtained. In order to illustrate statistical data, graphs were drawn in Microsoft Excel.

No particular analytic technique was used to process the data. Instead, we tried to find patterns, and understand the respondents' perceptions, opinions, and views of the study area

## III. Results and discussions

A total of 60 questionnaires were sent and 46 answers were obtained, leading in a reaction rate of 77% from the answers obtained. Figure 1 shows the sample structure aggregated according to the positions of the performers in the project.

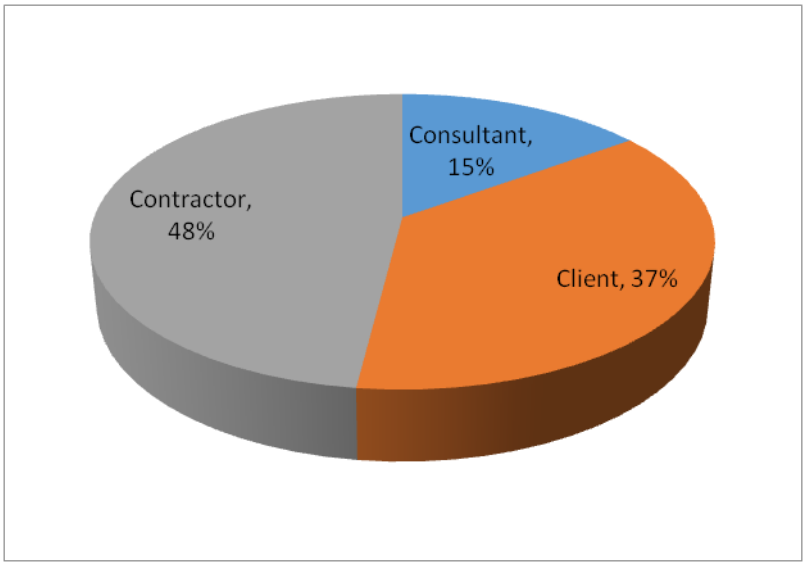


**Figure 1:** Sample composition

### 4.2 Respondents

Gender allocation analysis confirms the traditional male-dominated sector of the Nigerian building industry. There are 39 males in the study and 7 females in the study. The distribution of age indicates that 80% is over 40 years of age. Most participants (72%) have over 10 years of experience in the building sector, and 64% have over 20 years of experience.71% of survey respondents have a university degree in construction, 21% have completed high school and only 8% have vocational training. In their organizations or during university studies, 13 percent of respondents took part in risk management courses.

Despite a relatively high level of education and extensive experience, most respondents (65%) estimate their risk management knowledge to be fair. The knowledge of risk management within each group of actors is summarized in Table 1.

**Table 1:** Knowledge of risk management

| | Role in the project | | | Total |
|---|---|---|---|---|
| | **Client** | **Contractor** | **Consultant** | |
| Low | 4 | 0 | 0 | 4 |
| Fair | 9 | 16 | 5 | 30 |
| Advanced | 4 | 6 | 2 | 12 |

### 4.3 Risk Management In The Different Phases Of The Project

Figure 2 demonstrates that most participants (46) were involved in the stage of manufacturing. It is quite natural for contractors because they are always engaged in the stage of manufacturing and very rarely in the stage of the programme. Consequently, the involvement of contractors improves as the project progresses: none of the contractors participated in the stage of the program and 20 in the stage of manufacturing. Civil engineering projects often do not have a program phase. Therefore, most of this group's participants replied that they did not engage in that stage. The planning stage was attended by six advisors and four of them in the manufacturing stage.

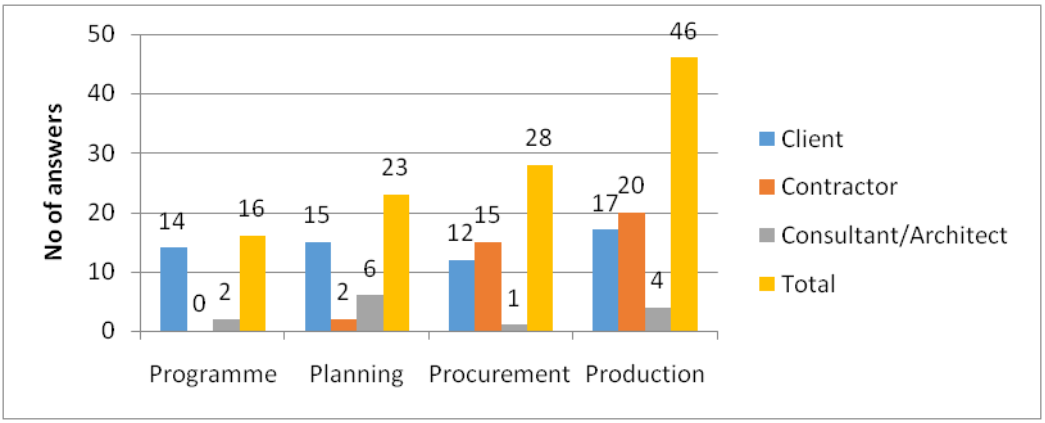


**Figure 2:** Participation in the project phases

When asked to assess the significance of risk management in each project stage (Figure 3), the estimates were comparable in both client and contractor organizations. The stages of manufacturing and planning have been recognized as the most important for risk management. Then follow the stages of the procurement and the program.The estimates of consultants vary from those of customers and contractors. Overall, compared to the other performers, we note that they underestimate the significance of all stages. Consultants, however, identify the planning and manufacturing stages as the most important. We can conclude from this allocation that many actors link hazards to the stage of manufacturing.

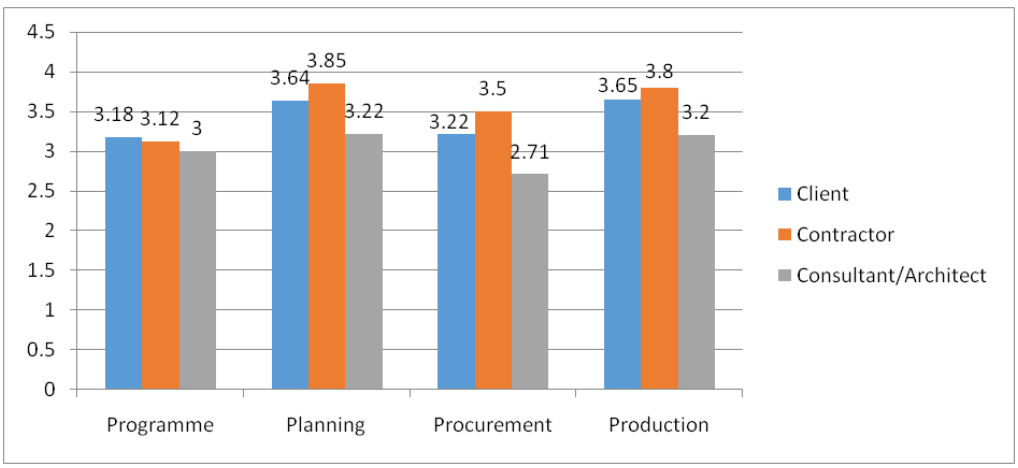


**Figure3:** Importance of risk management in the different phases

Figure 4 shows how many actors systematically perform procedures of risk management in their projects. The most active group is contractors, where all participants systematically identified and evaluated project risks and 64 percent responded to risk. 56% recognized hazards in the customer group, 47% evaluated them, and only 37% reacted systematically to project hazards.The low risk response rate may be explained by customers allowing other actors in the value chain to address recognized hazards. Only 23 percent of advisors recognized hazards and reacted systematically,and none evaluated project hazards just as Yin (2004) discovered.

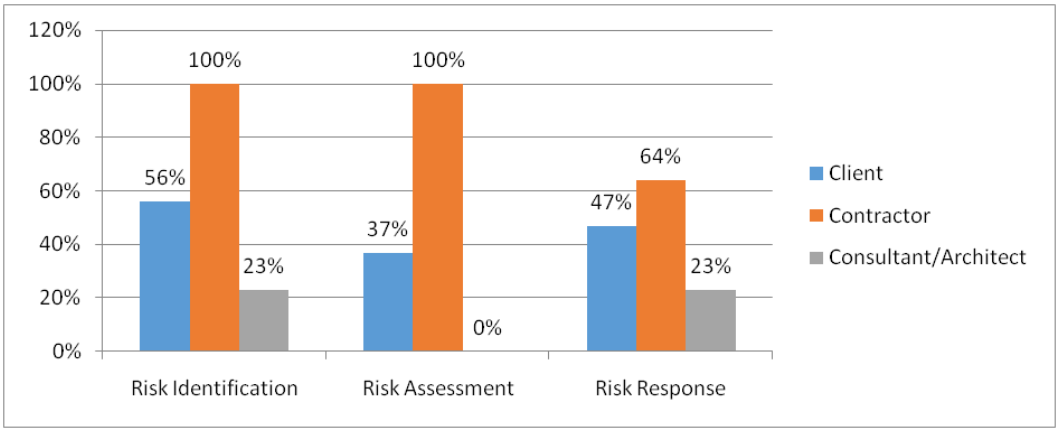


**Figure 4:** The risk management systematically processes performed in the project

### 4.3.1 Risk Identification Process

Risk identification (Figure 5) was carried out mostly during planning and manufacturing stages. The previous hazards are recognized, the less likely they will happen. Despite this, only 17 participants replied that in the program stage risk identification was conducted. Most of the clients stated that risk identification was carried out in the planning phase, whereas contractors mostly identify risks in the production phase.

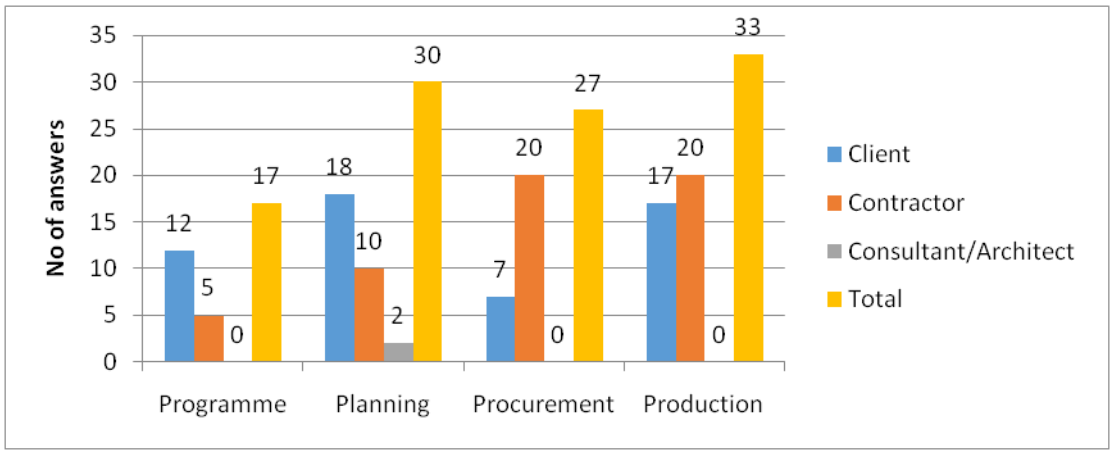


**Figure 5:** Risk identification in the different phases

Sixty-four percent of participants replied that the client recognized hazards in the program stage. In the scheduling stage, 29 percent replied that all actors jointly conducted risk identification and 15 percent replied that the client and the advisor conducted the identification. The contractor plays the most significant role in risk identification during the acquisition stage (50 percent). In the manufacturing phase, risks were identified by the contractor (31%) or jointly by all actors (31%).

### 4.3.2 Risk Assessment Process

Figure 6 demonstrates that risk assessment has a comparable inclination to the method of risk identification: it is performed in the manufacturing stage by most participants. However, for the risk assessment process, the procurement stage is more crucial than for risk identification and risk reaction. This is because the risk premium is computed in the procurement phase and therefore it is important to assess earlier identified risks.

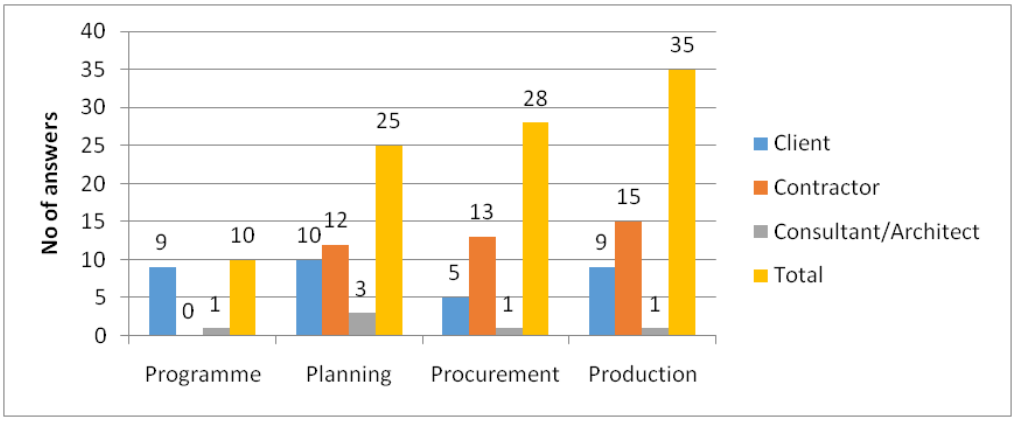


**Figure 6:** Risk assessment in the different phases

Similar to the process of risk identification, risk evaluation in the program stage is carried out mostly by the customer, collectively by all actors in the planning stage, or by the customer and consultants. However, the contractor's involvement in the risk assessment was higher in the scheduling phase than in the risk identification. The stages of procurement and manufacturing do not vary greatly from the method of risk identification: the contractor plays the most significant part in both stages.

### 4.3.3 Risk Response Process

Also connected with the manufacturing stage is the risk reaction (Figure 7). In this stage, both customers and contractors mostly handle hazards. This is due to the traditional strategy in the building sector: contractors are not putting enough effort into avoiding and solving issues as they appear in the project.

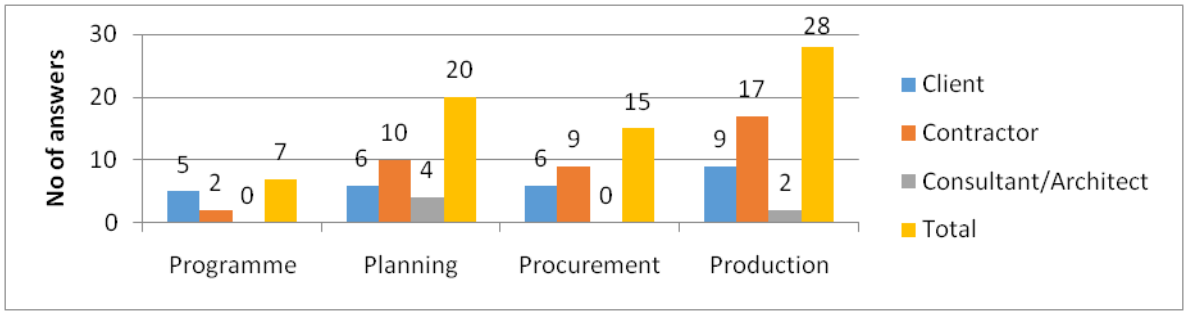


**Figure 7:** Risk response in the different phases

Risk reaction is conducted by the clients in the program stage, similar to the procedures of risk identification and evaluation. The client and the consultants reacted to the project hazards in the scheduling stage. Risk reaction in the procurement stage is carried out primarily by the contractor.In the production phase the role of the contractor is large and the degree of joint risk management is high.

## 4.4 Collaboration In Managing Risk And Actors' Influence On The Risk Management Process

The term collaboration is defined in the questionnaire as joint work in the risk management process. In the project, nearly all respondents worked with other actors in risk management: 12 clients, 18 contractors and 6 consultants.Seven respondents (5 clients, 4 contractors and one consultant) replied that there was no risk management collaboration in the project. Collaboration assessments (Table 2) vary from "fairly good" to "very good."

**Table 2:** Evaluation of collaboration in risk management

| Role in Project | Evaluation |
|---|---|
| Client | 3.50 |
| Contractor | 3.35 |
| Consultant/Architect | 3.31 |

The degrees of communication between actors in the procurement stage of recognized hazards and possibilities are provided in Table 3 Overall assessments are not high and differ between "small details" and

"relatively comprehensive." The contractors responded that recognized hazards were transmitted moderately by the customer (2.06).On the contrary, the clients opined that their communication of known risks is higher (2.73).

**Table 3:** Degree of communication of known risks and opportunities between actors in the procurement phase

| | **Client's Communication** | **Contractors Communication** |
|---|---|---|
| Client | 2.52 | 2.70 |
| Contractor | 2.05 | 2.20 |
| Consultant/Architect | 3.05 | 2.95 |

Figure 8 provides their own and other actors judgment of the participants influencing the project's risk management. The findings indicate that from the view of all performers, the contractor has the greatest impact on risk management. Interestingly, even the client estimate the impact of the contractors to be greater than their own.The influence of the consultant is surprisingly low despite that the planning phase is considered to be very important by all actors.

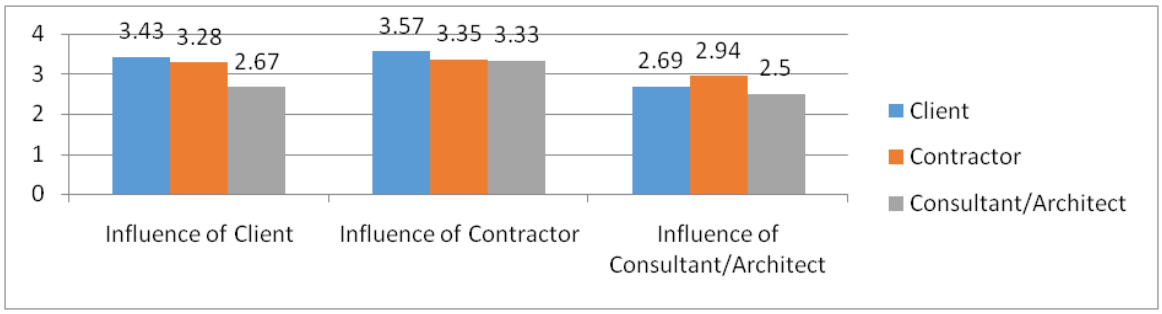


**Figure 8:** Influence of the actors on the risk management process in the project

Figure 9 shows the presence of cooperation in risk detection, risk evaluation and risk reaction. Risk identification (RI) is the method where, according to most performers, cooperation existed: 71 percent of customers, 77 percent of contractors and 61 percent of advisors responded that they collaborated to identify the hazards of the project.Clients and contractors collaborated with each other during the risk assessment phase (RA), while only 33 percent of advisors responded that cooperation existed. According to the contractors, the risk reaction method (RR) has a reduced degree of cooperation: 62 percent of them worked together to take care of the hazards. The result is similar to that of Ospiva (2008)

## IV. Conclusion and recommendations

**Conclusion**

All actors have identified the planning and manufacturing stages as the most important for risk management. Identification of danger, risk assessment and risk reaction were mostly performed in these stages. The actor's involvement in all stages of the building phase contributes to more comprehensive risk management through more extensive exchange of data and expertise and previous identificationand assessment of potential project risks.The results of the survey proves that the roles of the actors in risk management processes are strongly connected to their being part of the project's phases.

All actors rated collaboration in risk management high and was most intensive in the manufacturing phase. There are low assessments of the communication of known risks by actors in the procurement phase. In the processes of risk identification and risk assessment, collaboration between actors has been very strong.In the risk response process the extent of collaboration decreases significantly judging by contractors' opinion.This is an indication that the actors of the project safeguard their own interests and attempt to transfer the hazards recognized to other actors. Study findings indicate that contractors were most systematically involved in the project in performing risk identification, evaluation and reaction. Consultants had very low influence on project risk management. They were far less familiar with risk identification, risk assessment and risk response.

However, it is difficult to extrapolate the results because the consultant group is very small in the sample. We suggest that the consultants should be involved more in risk management because design is a very significant risk source in a construction project.

### 4.2 Recommendations

Considering the effects of quality and price risk management on a project's goals, it should be an open and aware approach throughout all project phases. Most risk processes are performed at this point and contractors tend to be the most active group with a significant effect on the method of risk management. Some

results from past research are verified by these results. Despite the acknowledged significance of the stage of the program, this research showed that this stage does not play a significant part in the process of risk management.

We thereby recommend that consultant should incorporate risk identification and assessment into their design. The consultants should make sure that their recommendations in line with the risk identification and assessment is judiciously followed and implemented by consultants during production phase. Government bodies and agencies such as Federal Ministry of Work, Standard Organization of Nigeria (SON), Federal Roads Maintenance Agency, Council for Regulation of Engineering in Nigeria (COREN), Council of Registered Builders of Nigeria (CORBON) etc should make sure that proper risk analysis is done and its proposition followed to the later, during all stages of projects especially during planning (design) stage and production (construction) stage. The will minimize to the barest minimum the manifestations of improper risk analysis such abandonment, structural failure, injuries and the resulting litigations.

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