STRATEGIES FOR IMPLEMENTATION OF RISK MONITORING AND CONTROL MEASURES IN CONSTRUCTION PROJECTS

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ABSTRACT

Projects in the construction industry are fragmented, temporary and complex, this in itself exposes project to risk. Stakeholders within the industry must have access to information and knowledge in order to manage risks in a proper and systematic manner. Therefore, the implementation of effective risk management in relation to its associated project risk knowledge can facilitate the success of the construction project. The purpose of this study is to identify and assess the factors hindering the implementation of risk monitoring and control within the Nigeria construction industry and ultimately develop strategies for its implementation, with the emphasis on the perspective of Nigerian contractors. The study embraced related studies on risk management fundamentals, risk management process and some factors that hinder project risk implementation. Primary data were collected using questionnaires administered to randomly selected construction organizations whereas secondary data were collected from Real Estate Developers Association (REDAN). Analysis of data are based on a mixed method approach. The raw data as obtained from questionnaires were subjected to Likert Scale analysis. The results from this research show that in the Internal risk, contractor risk and subcontractor risk have highest rating factor, while in the External risk, social and cultural risks have the most occurrence and risk index of 4.1. The manner in which majority of construction organizations handle risks is by stoppage to work within budgeted cost. Among the qualitative analysis techniques employed in this, FUZZY Logic technique gives a highest weighted factor of 128. The results shows lack of coordination as the first among the identified factors hindering implementation of risk control in construction industry with a weighted score of 151. One of the strategies been developed in this study is that Professional bodies within construction organization e.g. NIQS, NIOB, NIA should setup a periodic training manual for registered contractors and sub-contractors. In conclusion, risk management, being a new concept in Nigerian construction organizations should be embraced as soon as possible by all stakeholders. It is therefore recommended that federal government should encourage contractors and subcontractors who reduce and mitigate risks in projects by way of incentives and tax waivers.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Project Management Institute (2013) defines risk management as one of the nine knowledge areas for project success. The integration of an effective risk management is considered a crucial element and essential for project delivery. The effect of risk cannot be underestimated in the construction industry at large, the industry has been characterized as the difficult, riskiest, and effective industry (Liu *et al.,* 2016; Hwang *et al.,* 2017; Sambasivan *et al.,* 2017). Risk in construction has different meanings and interpretations. Hertz and Thomas (1983) regarded risk as uncertainty and the result of uncertainty. Any exposure to the possibility of loss or damage to people, property or others interest has also been considered as risk.

Risk as a concept varies according to viewpoint, attitudes and experience. Engineers and contractors view risk from the technological perspective. Investors and developers tend to lean more to the economic and financial side of projects. Health professionals, environmentalists, chemical engineers consider risk in safety and environmental perspective. Although, risks vary from one country to another and from one project to another, yet project of multi organizational structure creates high risk business environment (Rasheed *et al*., 2015). Risk is therefore seen generally as an abstract concept whose measurement is very difficult. Further to that PMI (2013) pointed out that Risk Management (RM) is based on well-informed and consensual decision-making process in critical part of any industrial project. In the reports of (Loosemore *et al*., 2006; Wibowo and Taufik, 2017; Szymanski, 2017). Risk Management helps to achieve project's outcomes more economically and effectively. The country has failed to focus

more on risk management during construction and the inability to manage risks properly consequently led to an increase in project failure (Nnadi *et al*., 2018).

1.2 Statement of the Research Problem

Nigeria's underdevelopment in terms of infrastructure is as a result of unethical routine in the Nigerian construction industry which makes construction projects prone to risks (Oyewobi *et al.*, 2011). The industry is one of the most uncertain, vibrant, and demanding establishments (Xia *et al.*, 2018). Further to that (Themsen and Skærbæk, 2018; Wang *et al.*, 2019) views the industry to takes a pitiable position in handling risks, and therefore, several projects have failed to attain the stipulated time limit and cost levels. Also, Husein and Majdi (2020) revealed that risks in construction projects carried by many parties tend to change according to internal or external factors.

That notwithstanding, Zhou *et al.* (2020) presented a new method and system to assess and manage the risks during the construction process by coupling the risk management system and the quality management system and integrating jobsite monitoring data, design data, and environmental data for risk assessment and management of undersea tunnel construction. Similarly, the research of Hiyassat *et al.* (2020) focused on risk allocation for public construction projects using Jordan as a case study. Karamoozian *et al*. (2020) carried out risk assessment of building information modelling adoption in construction projects. It is clear that little or no research have been carried out on risk monitoring and control. Instead, most researchers have focused on risk assessment, identification, allocation, response, and analysis neglecting risk monitoring and control. In light of this, this current research will focus on the strategies for implementation of risk monitoring and control measures in construction projects. The Nigerian construction industry consists of a few very large multinational companies and a

multitude of companies that run the gauntlet from very small to fairly big in size. Most of the subcontracting firms fall into the category of very small to small firms. Small and Medium Enterprises (SMEs) in Nigeria are defined as any enterprise with a maximum asset base of Nl.5 billion (excluding land and working capital), and with no lower or upper limit of staff (Central Bank of Nigeria, 2009). While the activities of large firms impact significantly on the industry's financial turnover, income redistribution and construction innovation on a wide scale is carried out by medium size company. Problems that affect the medium level industry are thus important, and worthy of research.

1.3 Aim and Objectives of the Study

The aim of the study is to assess the strategies for implementation of risk monitoring and control measures in construction projects. The objective of the study are to;

(i) Identify the factors hindering the implementation of risk monitoring and controlling.

(ii) Assess the effect of implementing risk monitoring and control on construction projects.

(iii) Develop strategies for implementing the risk monitoring and controlling.

1.4 Research Questions

This research is carried out to provide an appropriate answer to the following questions:

(i) What are the factors hindering the implementation of risk monitoring and controlling in Nigerian construction industry?

(ii) What are the effect of implementing risk monitoring and control on construction projects?

(iii)What are the strategies for implementing the risk monitoring and controlling?

1.5 Justification for the Study

Construction projects are prone to various degree of risk as a result of project complexity, construction speed, location, weather variations, company size, labour and plant productivity, familiarity with work nature, and materials (Behzadi *et al*., 2018). Risk management should be emphasized and systemized in international or overseas projects, in order to improve the quality of difficult decisions that may arise while constructing and executing (Amirshenava and Osanloo, 2018; Wang *et al*., 2019).

Despite the significance of risk management as one of the most necessary elements of project management (Al Harthi, 2015; Lyons and Skitmore, 2004), most construction organizations in Nigeria have been observed to have little knowledge on how to measure risk or of reliable tactics that can be used to eradicate or alleviate risk. Most researchers have failed to focus on the monitoring and control process of risk management which has resulted to failure of many construction projects in Nigeria. Furthermore, it is observed that most construction projects only carry out the risk identification and analysis, process of risk management and failed to include the necessary framework for monitoring and controlling risks. The benefits that can be derived from risk monitoring and control cannot be underestimated, as it would provide up to date state of risk structure in the construction projects. This will enable clients and other project stakeholders make meaningful decision that will guarantee project successful completion.

Against this backdrop, this research has study the factors hindering the implementation of risk monitoring and control process of risk management in construction organizations with the aim to assess the current level of usage and why it is being neglected.

1.6 Scope of the Study

This research focused on construction organizations that engage actively in construction works and pay their tax timely to Federal Inland Revenue Service (FIRS) and registered estate developers in Abuja whose companies are listed in Real Estate Developer Association (REDAN) directory. The list of this construction companies was obtained from FIRS database as it would show they have a recent tax record. Abuja was selected as the desired location due to its fast growing in development. Furthermore, Abuja fairly stands as an open market of construction companies for all and sundry. Olaleye (2008) also revealed that 80% of the Nigerian locally owned construction contractors have their addresses in Lagos, Abuja and Port Harcourt.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of Risk Management

2.1.2 Uncertainty and risk

The distinction and relationship between uncertainty and risk may be described as the risk being measurable uncertainty whereas uncertainty is unmeasurable risk. It is the interaction of uncertainty on objectives that gives rise to risk, which means that only relevant uncertainties that have the potential to affect project objectives can become risks. In other words, a risk is an uncertainty that matters and the importance is defined in relation to the particular objectives in question. However, the term risk is used widely in variety of applications but the most common application of risk management is in projects, where project risks are defined as those uncertainties that could affect project objectives (Hillson and Murray-Webster, 2004).

2.2 Definition of Risk

Risk is always present when making decisions on the basis of assumptions, expectations and estimates of the future. It characterizes situations where the actual outcome for a specific event or activity is likely to deviate from the estimated value (Raftery, 1994). The definition of risk is diverse and can be assessed in terms of fatalities and injuries, sample of a population, in terms of probability and reliability or in terms of the likely effects on a project. One can distinguish uncertainty from risk by defining risk as being where the outcome of an event is possible to predict on the basis of statistical probability. This implies that there is knowledge about a risk as a combination of circumstances as opposed to the term uncertainty in which there is no knowledge (Smith

et al., 2006). Risk is often explained in terms of probabilities and consequences, or impact on various objectives. In order for a potential event to be considered a risk it must have a probability of between 0 and 1, which reveals a spectrum in which the event is either impossible or is certain to happen (Loosemore *et al*., 2006). Hence, the occurrence of risk is present when a decision is described in terms of a series of possible outcomes and when known probabilities can be attached to set outcomes (Smith *et al*., 2006).

Hillson and Murray Webster (2004) explain an interesting trend when examining various official published risk management standards. They state that the definition of risk had an exclusively negative connotation before 1997, hence risk equals threat, with the term being synonymous with hazard, danger and so on. Although, from 2000 onwards, the definition of risk presented in various publications in relation to risk management has changed, a clear majority of the official standards have unequivocally treated risk as including both opportunities and threats.

Nothing is certain in this world, whenever we try to achieve an objective; there is always the possibility of deviation from the plan. Every step in achieving our objective has uncertainty; every step has an element of risk which needs to be addressed. Therefore, risk means uncertainty with recognized probability distribution (Barkley, 2004). It is the probability of a future problem expected to arise, but does not give any assurance of existence of the problem (Holmes, 2002). It was also defined as the consequence of uncertainty on aims or objectives, either negative or positive (Augie and Kreiner, 2000). It is very important to know the distinction between risk and uncertainty (Carpenter and Frederickson, 2001).

Uncertainty is a state of being that involves a deficiency of information and leads to inadequate knowledge or understanding (Carpenter and Frederickson, 2001). But Perry and Hayes (1985), believed that while the distinction between risk and uncertainty is recognized, it is unhelpful to construction projects. Risk can be from financial market doubts or uncertainties, failures in projects, legal liabilities, loan risks, accidents, force majeure, and events of uncertainties or unpredictable root-cause (Akintoye and Macloed, 1997). Risk means the possibility of a problem in the future while management is the act of gathering people together in order to achieve set goals or objectives by the use of on hand resources efficiently.

2.3 Project Risk Classification

Risks can be divided into different types or classifications or categories, the important aspects of these are as follows:

(i) Known risks: these risk events are frequently occurring in all construction projects and are inevitable, thus including minor fluctuations in material costs and productivity (Smith *et al*., 2006). It is the cognitive condition of risk, where the identification of the risk source has been made and the probability of occurrence regarding the risk event has been assigned (Winch, 2010). Known unknowns, these risk events are somewhat predictable meaning there is some knowledge regarding either the probability of occurrence or their effect (Smith *et al*., 2006). It is the cognitive condition of uncertainty, where at least the risk source has been identified.

(ii) Unknown unknowns: it is the cognitive condition of uncertainty in which somebody might have knowledge about the risk source and probabilities but keeps the information private. The risk source is not identified and the risk event

can therefore not be known (Winch, 2010). Thus, these risk events are incidents whose effect and probabilities of occurrence are unforeseeable, even by the most knowledgeable and experienced members of a project (Smith *et al*., 2006).

In project risk management, events or risks with a low impact can be divided into the elements of trivial and expected as presented in Figure 2.1 the illustration compares the probability of occurrence of an event compared with its impact on the construction project. Hence, risks with both high impact and a high likelihood of occurring depend on risk management.

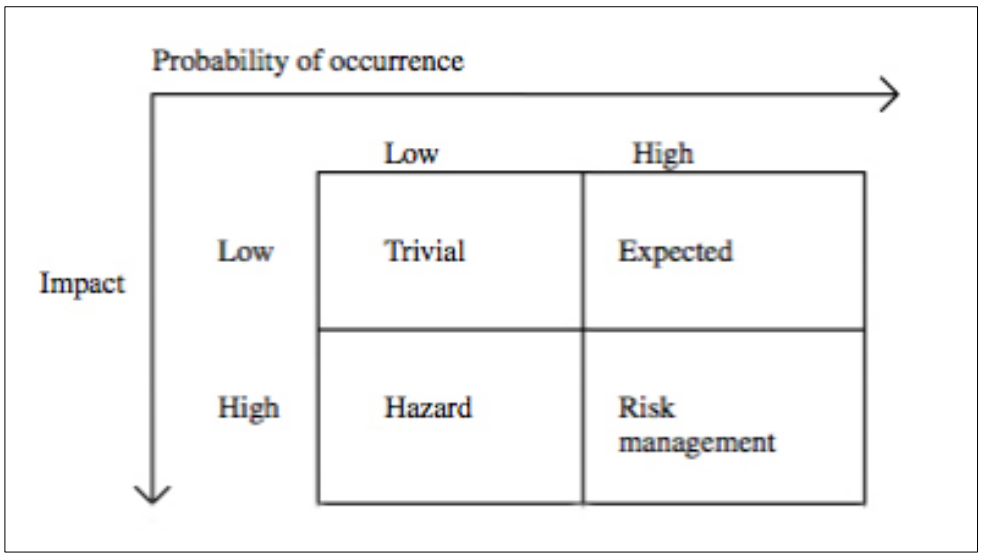

Figure 2.1: Risk classification in relation to probability and impact
Source: Smith *et al* (2006)

Smith *et al* (2006) gives an example of a hazard event with low probability and high impact, they state that these might arise but aren't considered since they are too remote in reality. For instance, parts from a satellite might someday crash on a building project but few buildings are designed with that event in mind. However, even though the probability may be low the event should not be ignored if it is a high impact risk in project management. Thus, arrangement of response plans should be covered for risk events even if the financial impact is too large to be managed.

2.4 Risk Management Process in the Construction Industry

Risk Management (RM) is greatly influenced by the uniqueness of the construction industry in a specific country, and it is also influenced by different project typologies (Baba, 2014). Traditionally risk in construction was either ignored or dealt with in an arbitrary way (Potts, 2008) but today risk management is an integral part of project management (Serpella *et al*., 2014). The current usage of RM techniques in construction industry have been studied by researchers to include; risk premium, risk adjusted discount rate, subjective probability, decision analysis, Monte Carlo simulation, stochastic dominance and intuition among others (Toakley and Ling, 1991; Raftery, 1994: Akintoye and Macleod, 1997).

According to Gibson (2009), risk management is the identification, analysis, assessment, managing and avoidance, elimination or reduction of unacceptable risks. It is a process of taking actions or measures against uncertainties. In risk management, we undergo a priority format in which the risk with higher loss and higher possibility of occurrence are managed first while the one with lower loss and less possibility of occurring is handled next in descending order. Evaluating total risks is difficult and balancing resources used in order to moderate between risk with more possibility of occurring and lower loss versus risk with greater loss and lower possibility of occurring can be misunderstood.

AlBahar and Crandall (1990) explained the risk managements as a formal and orderly process which involves a systematic way of identifying, analyzing, and responding to risk events throughout the life of a project to ensure optimum or acceptable degree of risk control. The PMBOK (2004) provided four (4) phases of the risk management process to include: risk identification, quantification, responses development and

control. It was later revised to include six (6) phase and they are: RM planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning and risk monitoring and control (PMBOK, 2004).

Risk management is a systematic approach that deals with risk (Edwards and Bowen, 2009). A risk management system should establish an appropriate context, set goals and objectives, identify and analyses risks, influence risk decision making and monitor and review risk response. Raz and Micheal (2001) brought forward a process consisting of two main phases which include; risk assessment and risk control. The assessment phases deal with the identification, analysis and prioritization while the risk control phase deals with the risk management planning, risk resolution and risk monitoring and response.

Simmons (2002) opined a definition for risk management as the sum of all proactive management directed activities, within a project or program that is intended to acceptably accommodate the possible failures in the elements of a project or program. The term acceptable is seen from two perspectives; the client's perspective which is in the final analysis and the firm's perspective which is in terms of the firm's inability to deliver in a professional manner or in a less adequate result. According to Goncalves (2003), risk management practices are developed around three (3) key elements namely; risk identification, risk analysis and risk prioritization. All of the above cited authors and researchers have identified the risk management processes which could be used most of which essentially have the same processes but expressed differently.

In other words, the essence of risk management is still captured by most of these studies that is to ensure a project is executed as planned without negative deviations. However, a more comprehensive risk management practices is that of PMI (2013) which includes; risk management planning, risk identification, qualitative risk analysis, quantitative risk

analysis, risk response planning and risk monitoring and controlling. Despite the importance of risk management practices, studies have reported that, practitioners prefer to use the informal risk management process (intuition and experience) rather than the formal risk management practices. Recent studies in Nigeria showed that not only is the adoption of risk management process low, they also lack the understanding of risk management process (Ojo, 2010; Augustine *et al*., 2013). In addition, Oyewobi *et al*. (2012) reported that identified risk are not rigorously examined and even when they have been assessed and remedial measures agreed upon, they are not generally communicated effectively. Thus, project participants do not have a shared understanding of the risks that threaten a project and, consequently, they are unable to implement effective early warning 15 measures and mitigating strategies to adequately deal with problems resulting from decisions that were taken elsewhere in the chain. Hence, the industry continues to suffer poor performance with many projects failing to meet time and cost targets.

2.4.1 Risk management model and process within the construction industry

There are many methodologies or models in regards to managing the risks in various projects but the core process of risk management is comprised into four stages in the construction industry. Identification and classification of the risk sources, risk assessment analysis, development of management responses to risk and to control and monitor them (Smith *et al*., 2006). The method of risk management helps to observe and determine all the risks to which the project is exposed in hopes of making an aware decision that is pursued with the coordinated and economical application of resources, in order to control and reduce the effect and overall probability of events considered undesirable (Dehdasht *et al*., 2015) Thus transparency increases through risk

management and the project can be prepared for unavoidable problems, also many problems can be averted from the outset through proactive measures (Schieg, 2006).

Loosemore *et al.* (2006) describes risk management as a proactive process of looking forward as opposed to indicating a reactive framework. They state that the distinction is often confused within the construction industry where managers might think they are practicing risk management, but in reality they often demonstrate a backward looking and reactive approach. Winch (2010) describes the model as being designed in a circular fashion to emphasize that risk management is a learning process through time, using the same four elements or stages as Smith *et al.* (2006) and Hillson and Murray-Webster (2004). A systematic implementation of the process throughout the lifecycle, from planning to completion, of any construction project is needed in order for the practice to be truly beneficial, thus the process needs to be iterative (Loosemore *et al*., 2006). PMBOK's model differs by incorporating risk assessment with qualitative and quantitative risk analysis. The importance of feedback within each phase is emphasized in ISO 31000, in which monitoring and review ensures that the organization monitors risk performance and learns from experience.

In a risk management process, identification of risk is the first step in order to characterize the threat of the risk. The next step is to evaluate the weakness of significant assets to certain threats and also determine the risk, which means determining the expected possibility of risk occurrence of certain assets. Methods or ways of reducing those risks are identified and prioritize measures are taken for risk reduction. When risks are not properly prioritized and assessed, it amounts to waste of time trying to tackle risks that will not occur. Risk management depends on organization or planning, early identification and risks evaluation, continuous tracking

of risk and re-evaluation, actualization of remedy actions, communication and coordination (Kremljak, 2010). There are many ways to structure risk management, but according to Kremljak (2010) it is structured into four parts: Planning, evaluation or assessment, handling or control and monitoring. Risk management involves both positive and negative risk aspect (Augier and Kreiner, 2000). A successful risk management process should be able to identify advantageous alternative courses of action, improve chances of success and increase confidence in achieving project objectives (Perry and Hayes, 1985). Figure 2.2 shows the risk processes of risk management.

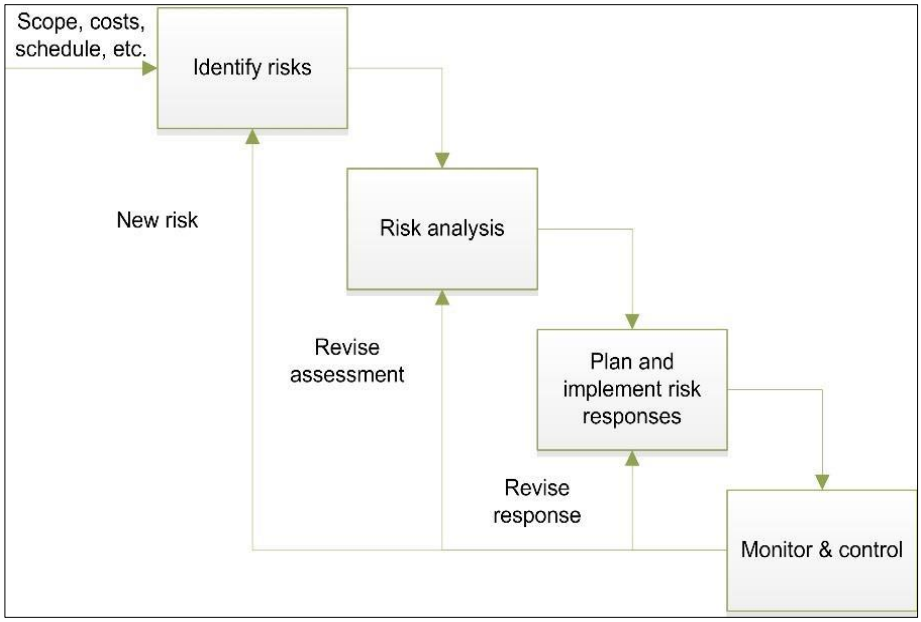

Figure 2.2: Basic Risk Management Process
Source: Nicholas and Steyn (2012)

Construction projects are from the start of their existence immediately exposed to risks (Schieg, 2006). Hence, the implementation of risk management from the early stages of a project is essential due to the fact that major decisions such as choice of alignment and selection of construction methods can be influenced during this stage (Eskesen *et al.* 2004). Other reasons for investigating risk events early in the project life is that useful

information about the risks might emerge enabling the implementation of a strategic approach to be defined and adopted as early as possible. This will in turn help clarify internal project goals and priorities as well as enabling an improved estimation of safety, budget and schedule (Reilly and Brown, 2004). By incorporating risk management into the planning phase one can facilitate the identification and reduction of potential risks for the project success (Schieg, 2006). The adoption of risk management ultimately can serve as an instrument to help facilitate the decision making process in order to prevent, eliminate and reduce the risks.

2.5 Risk Management Planning

Risk planning is a nonstop process of creating an organized detailed risk management approach. It includes procedures, practices, strategy development, setting of goals and objectives, planning assessment, control activities, resource identification, task and responsibilities etc. Planning describes how we intend to manage the risks and also describes the components management, the approach and resources to be used in managing the risk. The plan can be applied to products, processes and projects or to entire organization.

2.5.1 Risk identification

The identification of risk is arguably recognized as the most crucial step within the risk management process (Banaitene and Banaitis, 2012). The aim is not to obtain perfect predictions of future events, rather it is the recognition of potential risk sources with high impact on a particular project, and should they occur. It is impossible to identify all potential risks and the purpose should not be to do so (Smith *et al*., 2006). Thus, the intention of identifying and assessing the risks is to ensure that potential risks are

assessed and managed in a manner, which allows for the overall objectives to be achieved. Due to the constant changing nature of risks throughout a projects life cycle the management of risk must be an ongoing process (Potts, 2008). Before risks can be managed they must be identified, and knowledge from previous experiences might apply to the current project (Karimiazari *et al*., 2010).

The descriptions of most risk management processes emphasize the need to identify the risks early in the process. Chapman and Ward (2003) discusses the need to identify sources and associated possible responses as well as secondary sources that arise from these responses. The quality of the primary identification phase within the risk management process has a big impact on the success of later phases within the process (Chapman, 2001). The initial step at the early phase of the project should form the basis by which strategies, policies, uncertainties and risks are established when it comes to management and allocation (Potts, 2008). However, given that all risks are not completely recognizable before the start of a project and the fact that additional risks might arise during the implementation of the project, the identification of risk must be implemented in a manner that is in line with the progress of the project as well as being forward-looking (Schieg, 2006).

The different methodologies regarding risk source identification usually consist of checklists, brainstorming, workshops, expert interviews and analysis of different scenarios as well as analysis of historical data and project plans. The Delphi technique is a consensus developing technique; anonymous participation of project risk experts under a facilitator, who uses a questionnaire to implore ideas about the important project risks, takes place for identification of risky situations, and consensus on the main project risks is reached in a few rounds by circulating and commenting on the submitted

responses. Interviews of experienced project managers or subject matter experts are carried out for identifying project risks. Considered risks are then examined in the analysis of strengths, weaknesses, opportunities, and threats (SWOT). Checklists also serve for risk identification and are quick and easy-to-use. The assumptions analysis technique is employed for checking assumptions' validity. Graphical diagrams are also valid techniques to support the process of risk identification. The cause-and-effect diagram is used to identify causes of risks in a project and the resulting effects. System or process flow charts allow showing the interrelation and interplay of various elements of a system. Influence diagrams help representing causal influences, time ordering of events and other relationships among variables and outcomes Risks are events that cause problems when triggered and affect the achievement of objectives negatively (Moavenzadeh and Rossow, 1976). The first step after planning your risk management process is the identification of potential threats. This involves discovering, recognizing and outlining the risk that has effect on the achievement of organizational objectives. The source of the risk should be taken into account in addition to events or conditions that could affect organizational objectives. When the source of risk is identified or known, it is easier to investigate the consequences of that source or the problems it caused e.g. withdrawal of stakeholders from a project.

2.5.2 Risk assessment

Risk assignment may be defined as the process of identifying project risks and determining how they may be realistically shared by all of the parties in a construction project. The identification of risk is only the first phase, some of the identified risks may be considered more significant and need to be further analyzed. The next step is to determine their significance quantitatively, before the response management stage. According to the report of Association of General Contractors of America and

American Council of Engineering Companies. relived that assignment of construction risks to the construction parties through proper contractual arrangements has a significant impact on the total construction costs paid by owners, Construction projects usually strive to meet targets established for cost effectiveness, time efficiency and performance quality; the most important risks in construction are those that prevent attainment of these targets. Construction projects are complex in nature and have many inherent uncertainties arising from the diversity of resources and activities they require to bring them to fruition; this is the origin of construction risk.

Risk assessment evaluates the extent of risk effect i.e. damage or loss. This is an analysis of the risks in relation to the life cycle of the system. In this stage, making the best refined decisions is very important so as to be sure of implementation of the plan. The nature, source and causes of risks that have been identified should be properly understood and the level of risk should be estimated. Risk assessment involves developing a probability consequences scale, performing supporting analysis, determining probability and significance levels or ratings, documentation of results and also to prioritize the risk. The risk analysis result is compared with the criteria for risk so as to decide if a certain risk level is tolerable or not. The primary objective for this assessment is to estimate risk by identifying undesired events; the likelihood of occurrence of these events and the result in case of occurrence or consequences. The main problem in risk assessment or evaluation is to determine the possibility of occurrence due to the fact that there is no available statistical information for some past incidents.

2.5.3 Methods for conducting risk assessment and analysis

Bahar *et al*. (1991) describe the first step in risk analysis and evaluation process as the collection of relevant data to the risk exposure, which might be historical data collected through past project experience by the contractor. Furthermore, they describe the modeling of uncertainty of a risk exposure where the likelihood of occurrence is presented in terms of probability and potential consequences in financial monetary terms. Having formed the uncertainty of various risk events the next step according to them is to assess the overall impact of these risks, through techniques such as Monte Carlo simulation. The quantification of risks is the magnitude and frequency of each event, and every event can be a collection of incidents or a single incident. In order to quantify and evaluate the risks one can implement various analysis methods, everything from subjective estimation to probability analysis (Williams, 1995). One of the most common used methods for assessing risk sources according to Winch (2010) is the probability and impact matrix as illustrated in Fig 2.3.

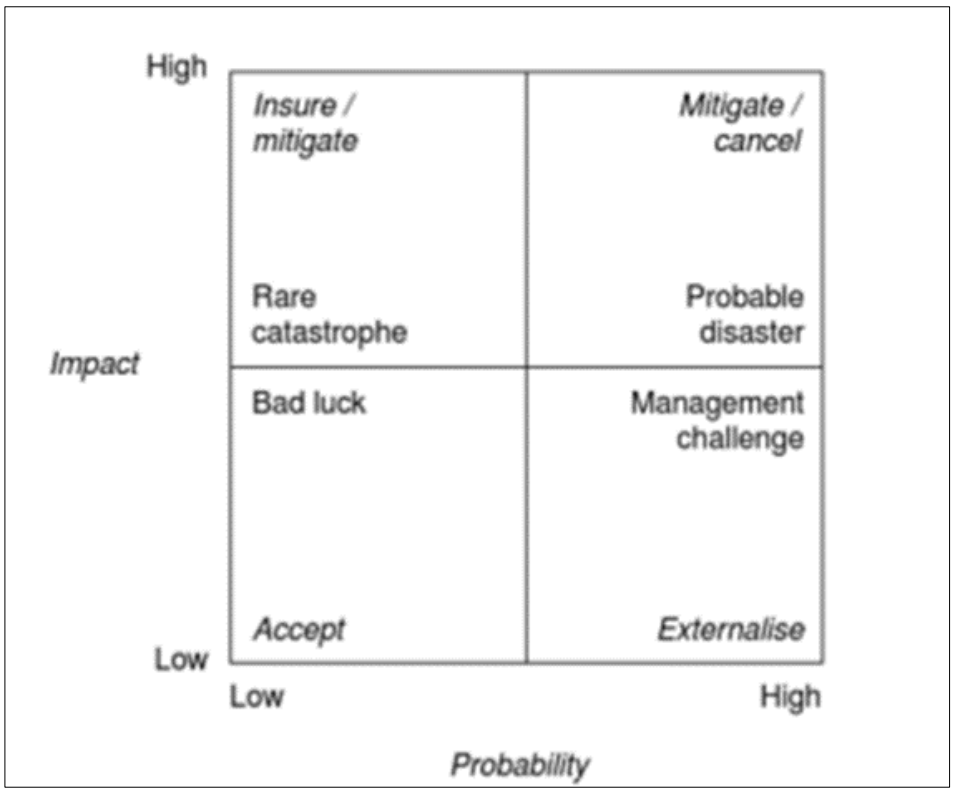

Figure 2.3: Illustration of Probability & Impact Matrix
Source: Winch, (2010).

The classification of the risks is made in terms of their probability of occurrence and the extent of their impact. It allows a prioritization of the risks on the project in terms of them being manageable or not. Qualitative high to low scales can be used for the assessment of known, unknowns as well as the subjective assessment of known knowns as presented in Figure 2.3 (Winch, 2010). Project management institute describes the probability and impact as dimensions of risk that are applied to specific events, as opposed to the overall project.

The usage of a risk matrix as shown in Figure 2.4 is often applied when dealing with static risk, i.e. risks that only have a negative effect. It resembles the probability matrix described above. A decision on how the risks are going to be dealt with is made depending on where the risk end up in the matrix. Each particular project dictates what type of risk that is acceptable or unacceptable and the colors areas should be determined with the project in mind (Flanagan *et al*, 2007).

Figure 2.4: Illustration of a Risk Matrix
Source: Flanagan *et al*. (2007).

Risk assessment can be classified in two major techniques as qualitative and quantitative assessment.

(a) Qualitative Risk Analysis Techniques

(i) Probability & impact assessment: can be applied in order to evaluate the likelihood of a specific risk to occur. The risk impact on project objectives is assessed in terms of opportunities and positive effects as well as threats and negative effects. It is important to adapt and define the probability and impact to the specific project.

(ii) The risk matrix method: can be used additionally by having probability and impact as a basis for further analysis. The priority score can be computed as the average of the probability and impact and the priority score range, rate and color are given to illustrate each risk's significance. The high priority score threats, meaning high impact and likelihood, are viewed as high-risk and could necessitate an urgent response while low scored threats could be further monitored and given attention only if needed.

(iii) Risk categorization: is applied as a way to systemize the threats according to their sources, in hopes of identifying areas with the highest exposure to those risks. The usage of this method 15 breaks down activities into small units and creates hierarchical series of activities, additionally the method can include risk dependencies and a prioritization of them depending on how quick response they require.

(b) Quantitative Risk Analysis Techniques

(i) Sensitivity analysis: is implemented in order to identify uncertain components in the project, which will have maximum impact on the outcome. The aim is to look at the sensitivity of various.

(ii) Elements of the risk model on project outcome, by changing the values of one variable at a time and then showing the impact on the project.

(iii) Probabilistic analysis: is a method used to show the potential impact of different level of uncertainties on project objectives. It quantifies the effect of risks on project schedule and budget and it uses three point estimates such as worst case scenario, most likely scenario and finally best case scenario for each task. Monte Carlo Simulation is most often used for this type of analysis.

(iv) Decision trees: is a useful method to frame the problem and evaluate various options. The usage of this method consists of decision tree diagrams used to represent the project and show the effects of each decision (Mhetre *et al*., 2016).

2.5.4 Risk register

The risk database as shown in Figure 2.5 is a central tool in risk management for monitoring the risk management process (Cooper *et al*., 2005). The design of the register depends on the organization, the type of projects and the people involved. It is essential that the organization creates a customized version of the register that suits them in order for it to be fully used as intended, as opposed to being an additional burden in a demanding work schedule.

			POSSIBLE IMPACT ON THE PROJECT		PROBABILITY			
	IDENTIFIED RISK	IDENTIFIED DATE	COST	TIME	HIGH	LOW	RESPONS	RESULT
1								
2								
3								
4								
5								

Figure 2.5: Illustration of a Risk Register
Source: Cooper *et al.* (2005)

In order to facilitate registration, storage, management and sorting of information the register should be incorporated in a database (Flanagan *et al*., 2007). All the identified risks and results of their analysis associated action plans and evaluation as well as the status of the particular risk are registered within this list. Throughout the entire project life cycle there should be updates and reviews of the risk register. The register is a central component because it facilitates monitoring and correcting progress on risk mitigation measures, it helps identify new risks and close down expired risks as well as adjusting the assessment of existing risk (Potts, 2008) Risks that are no longer relevant due to avoidance or if they already are managed can be removed from the register together with the associated action plans. The status of action plans and specific risks should be reviewed consistently (Cooper *et al*., 2005).

According to (Schieg, 2006) new additional risks, risk status and the progress of the measures is required to be included. The risks that already have occurred must be documented including the amount of damage they have produced. Furthermore, he states that a big part of the monitoring of risk which is the last phase is the internal control system, where the responsibility of monitoring early indicators is allocated to specific people. In order for this process to work effectively there should be a reporting and meeting arrangement in place for the project and the organization as a whole.

2.5.5 Risk response

The third step in the process of risk management signifies what actions should be taken towards the various risks and threats previously identified (Mhetre *et al*., 2016) The planning process of risk response is defined by PMBOK as the development of options and determining actions to enhance opportunities as well as reduce threats to the project objectives. This process involves the assignment of parties to take responsibility for

each agreed risk response, and the efficiency of this phase will determine if the risks increase or decrease for the project. Literature suggests that there are mainly four risk mitigation strategies that can be implemented in order to reduce exposure to the risks associated with a project. Mills (2001) provides an example where incorporated risk control measures resulted in an added value, showing how risk and opportunity go hand in hand. The example he gave was an instance where a hoist was provided instead of ladders to reduce the risk of people falling. The additional benefit from the risk control measures taken was an increase in people's mobility and in turn their productivity. Hence, illustrating an example of potential opportunity arising from risk. The effectiveness of risk response determines whether risk increases or decreases in a project. Risk response is further divided in to four (4) categories namely; risk transfer, risk reduction, risk retention and risk avoidance (Baba, 2014).

(a) Avoidance of Risk

A response in form of avoidance can be justified if the risk is estimated to have serious consequence on such level that may warrant a reappraisal of the entire project (Potts, 2008). One can use avoidance to cope with risk by changing project plans in a way that makes the risk irrelevant (Klemetti, 2006), it might be necessary to reappraise the concept or maybe cancel the project. This method promotes changing project plans to facilitate the elimination of the risk or to protect the project objectives from the potential negative impact. An example might be avoiding an unfamiliar subcontractor (PMI, 2000). Other examples are extending the schedule or reducing the scope of the project (Karimiazari *et al*., 2010). The aim of risk avoidance might also be to reduce the risk via contractual countermeasures. Additional measures that can be taken into account is procedural changes, regular inspections, skill and training enhancement, more detailed

planning, preventive maintenance and the selection of alternative approaches (Cooper *et al*., 2005).

(b) Transfer

This response approach involves transferring the risks and consequences to third parties who are willing to accept responsibility for its management and the liability of the risk (Mhetre *et al*., 2016). This method is most effective in regards to dealing with financial exposure to risk. It includes the use of both contracts and insurance to transfer liability to other parties, for instance by contractor to subcontractor and often involves payment of risk premium to the party that is taking on the risk and responsibility of the consequences (PMI, 2000). In order to avoid secondary risk in case the agent (third party) fails to meet obligations, the transfer should only be done when the agent is in a better position to manage the risk than the principal (Winch, 2010). The main purpose is to ensure that the risk is owned and managed by the party best able to handle the task successfully (Mhetre *et al*., 2016).

(c) Mitigation and Reduction

This approach means to mitigate the risk by changing the scope of the project to minimize the likelihood of the damaging event occurring (Winch, 2010). Implementing risk management early in the project to reduce the probability of the risk event occurring is more effective than trying to repair the damage and consequences after the risk has passed. The mitigation of risk may be done by adopting less complex processes or changing conditions so that the probability of impact is reduced, other forms of action is adding resources and extra time to the schedule (PMI, 2000). Flanagan *et al* (2007) describes implementing an altered construction method and the use of other materials to reduce potential risks, or executing a new or more detailed planning. Additional

reduction strategies include contingency planning, quality insurance, separation or relocation of activities and resources. In practice these categories might often overlap in some fashion as in this case where insurance also can be a mitigation strategy, sharing characteristics with risk transfer (Cooper *et al*., 2005). However, risk reduction can only be used a few times in a project before the project might become unmanageable (Flanagan *et al*., 2007).

(d) Acceptance

It is impossible in reality to take advantage of all opportunities and eliminate all threats to the project, but it is possible to at least be aware of the threats and opportunities through the documentation and identification of them. The usage of this strategy is justified when it is not possible to respond to the risk by the other strategies, or when the grandness of the risk makes a response unreasonable (Mhetre *et al*., 2016). This risk response approach essentially means taking a conscious risk and to deal with the consequences as they occur. This indicates a decision not to change any project plans in order to deal with the risk or engaging in any other response strategies (Cooper *et al*., 2005).

As described above the risk response stage involves planning and execution and should be iterative. Having an effective control process adjacent can ensure the correct execution of this phase (Klemetti, 2006). When it comes to specifically high-impact risks but also with all types of risks, one of the most beneficial risk management strategies is to delay the decision until more information comes to light (Winch, 2010).

(e) Risk Reduction

It means reducing the extent of the loss or possibility of loss. Here, we find a balance between negative effect of risk and the benefits attached to the process. Modern software have been developed which help with in this process.

(f) Risk Sharing

In this process the risk is been shared with another party which means the loss burden or the benefit attached to it will be shared between the parties. In some cases, insurance is used so as to transfer the risk to a third party, but in case of default the original risk will likely revert to the first party.

(g) Risk Retention

By default, all risks are retained if not avoided or transferred. This involves accepting the loss or benefit of gain from a specific risk. Mostly in this kind of situation the cost of managing the risk is far more than the negative effect of the risk. This include risks that are so large that cannot be insured against and premium would be infeasible e.g. war.

2.5.6 Risk Monitoring and Control

The last phase of the risk management process focuses on monitoring known risks, identify new risks, reduce or enhance risks, and track the effectiveness of risk response actions (Kululanga and Kuotcha, 2010; PMI, 2008). Continuous monitoring and review of potential risks is an important in regards to the implementation of the risk management process. It guarantees new risks are detected and managed. The project manager should monitor a list of the major risks that have been identified for risk treatment action, which should be a primary tool used management meetings (Cooper *et al*., 2005). This is the final phase of the process and it is equally important as the others. Given that more information emerges one can reassess the probability and impact of the risks, and once the potential risk event has been passed they can be removed from the

risk register (Winch, 2010). To be able to respond to the risks and thereby to control them, symptoms should be tracked for already identified risks and possible new risks (Nicholas and Steyn, 2012). This step helps in learning, within the project, see which strategies work and which don't, and gives the option to adjust. This learning process and outcome should also be used in future projects.

Risk monitoring and control is the process of keeping track of the identified risks, monitoring residual risks and identifying new risk, ensuring the execution of risk plan and evaluating their effectiveness in reducing the risks (PMI, 2000). Risk monitoring and control records risk metrics that are associated with implementing contingency plans. It is an ongoing process throughout the life of a project. The risk change as the project matures, new risk develops, and/or anticipated risks disappear.

According to Kalyviotis (2013), risk control (or monitoring and updating) requires a system able to generate textual, graphical or video reports (via records, maintenance and assessments) using proper metrics and a suitable process of contingency management and resolution. Ideally, these reports should be constantly updated to reflect new data internal or external to the Project in order to safeguard all stakeholders from new or updated Risks. Good risk monitoring and control processes provide information that assists with making effective decisions in advance of the risks occurring. Communication to all project stakeholders is needed to assess periodically the acceptability of the level of risk on the project.

According to the PMI (2013), the purpose of risk monitoring is to determine if:

(a) Risk responses have been implemented as planned.

(b) Risk responses actions are as effective as expected, or if new responses should be developed.

(c) Project assumptions are still valid.

(d) Risk exposure has changed from its state, with analysis of trends.

(e) A Risk trigger has occurred.

(f) Proper policies and procedures are followed.

(g) Risk which occurred that were not previously identified.

Risk control may involve choosing alternative strategies, implementing a contingency plan, taking corrective action, or deplaning the project. The risk response owner should report periodically to the project manager and the risk team leader on the effectiveness of the plan, any unanticipated effects, and any mid-course correction needed to mitigate the risk.

Risk control is the implementation of methods and techniques outlined in the risk management plan in order to deal with known risks. It includes planning and execution with the aim of tackling risk at reasonable levels. Individuals or parties are assigned to assume responsibility for risk response agreed. This technique helps to correctly manage identified risks and its effectiveness will determine if there is increase or decrease in project risks. The main purpose of risk control activities is to reduce the amount of risk. There are certain circumstances where the risk is wrongly identified or mistakes were made during analysis, therefore the risk management has to be very careful in this stage in order not to execute something that is wrongly identified or analyzed.

2.6 Risk Management in the Nigerian Construction Industry

Nigeria has the biggest economy in West Africa and third biggest in Africa. It is positioned 30th on the planet regarding Gross Domestic Product (GDP). The country operates a mono-product economy which depends totally on the export of crude oil. In 2001, the export of crude oil was estimated to be 98.7% of foreign exchange earned

(Oluwakiyesi, 2011). Oil wealth is believed to be a key driver to construction industry across the major oil producing economies like United Arab Emirates, Saudi Arabia and Russia, for instance, the oil price boom of 1970s started the growth in UAE's construction sector. Nowadays, from the way oil price is booming, we hope that Nigeria's construction sector will achieve its full potential soon. According to a survey by GCP, construction growth in Nigeria would be the fastest of all markets. The survey stated construction is the best sector to be and that it is expected to grow at 128% from 2011 to 2020 (Oluwakiyesi, 2011).

The Nigerian construction industry is relatively small considering the size of the global construction industry, which is estimated at approximately $4trillion in 2008. The industry in Nigeria is valued at $3.2bn also in 2008 (Oluwakiyesi, 2011). Which means it forms only 0.01% of the worldwide total. The government's goal in Nigeria has been to increase the value of the industry. Construction is among the smallest employers in the country, accounting for less than 1% of total labor force according to the NBS (2009). Nevertheless, it also accounts for some 69% of the fixed capital expenditure, which means that approximately 70% of capital expenditure in the country allocated to the construction industry (NBS, 2009).

In the 1980's, the construction industry in Nigeria contributed up to 7% of the GDP (NBS, 2009). As Walsh and Sawhney (2004) stated, construction activities contribute significantly to the GDP in industrialized countries and also has great effect on the global economic growth. This implies that construction is a key driver in the development or improvement of a country's economy. Unfortunately, Nigeria is yet to be an industrialized country though it is aspiring to be one. But the industry's contribution to the overall GDP from 2001 to 2009 averaged about 1.74% (NBS, 2009).

This is as a result of political instability, high disintegration of the industry and poor performance (Awodele *et al.,* 2009). This poor performance is the major cause of the industry's fragmentation which is as a result of a number of risks associated to the industry or construction in general. To say that Nigerian construction industry is poor is an understatement because the industry is characterized by cost overruns, subsequent delays and abandonment of projects (Odeyinka *et al*., 2007). A report by Capital Management Limited on Nigerian construction industry shows that there is insignificant participation from private sector which makes the construction industry highly correlated with the budget allocation (Oluwakiyesi, 2011).

A regression of the construction sector GDP on government's total expenditure (federal and states) has a correlation coefficient of 0.92 from past data between 1982 and 2006 (Oluwakiyesi, 2011). This means that the federal, state and local governments are the major clients in the industry, but as the country continues to deregulate the various parts of the economy, private sector clients have start accounting for larger share of contracts. The biggest private sector clients in Nigeria are mainly the large oil companies such as Shell, Chevron, Oando, Total, Exxon and Mobil, which need infrastructure, housing compounds and office space (Oluwakiyesi, 2011).

There are also new generation banks and international clients such as non-governmental organization, the United Nation as well as large real estate developers especially in Lagos and Abuja. Foreign companies control about 95% of the industry, while local companies have started to come into view over the years, but often partner with foreign firms because the quality of technology in Nigeria is low and high tech equipment have to be imported which is why partnering with foreign companies is of advantage (Oluwakiyesi, 2011). The country has good training in terms of manpower as well as

competent engineers and planners but professionals have been sidelined because contracts are awarded to foreign companies (Oluwakiyesi, 2011). He argued that the country is not developing its own technology by awarding contracts to nonindigenous firms. Belel and Mahmood (2012) assess the practice of risk management in Nigerian construction industry using questionnaire survey method. They found insufficient skilled staffs as the major source of risk in construction; shortage or lack of knowledge is recognized as the most intolerant issue that limits the practice of risk management. They identified contribution to project success as the main benefit of risk management. They stated that most of their respondents are familiar with risk management as related to safety hazard on site rather than recognize risk management associated with fulfilling project objectives of cost, quality and time. They suggested that training of workforce to manage risks should be undertaken in Nigerian construction industry.

Their study differs from the present one in that they took a case study of only Adamawa state which is not regarded among the leading states in terms of construction activities. Results from Adamawa state cannot be used to represent the views of construction participants in Nigeria. Odeyinka *et al*. (2007) investigated the possibility of occurrence and impacts of certain risk factors at pre and post contract stages in the construction industry of Nigeria. They used questionnaire as a source of data collection. They found that at pre contract stage, the likelihood of occurrence of the identified risk factors are in order of design risk, estimating risk, competitive tendering risk and tender evaluation risk. Their impact when occurred is also in the same manner. At post contract stage, the likelihood of occurrence of those risk factors are in order of financial risk, political risk, contractual risk, logistic risk, legal risk and environmental risk. The impact in case of occurrence did not follow the same manner as the likelihood of occurrence. The present

study will investigate prevalence of risk monitoring and control process. But in their study they concentrated only on some certain risk factors while in the present study the applications and barriers of risk management were also investigated.

2.7 Risk Management Procedure

The unclear nature of construction project decisions has introduced to some extent risk occurrences in many firms in the process of business. According to Kwakye (2005), most decisions in the Ghanaian construction industry are made under conditions of risk and uncertainty. He further outlines that, in the construction industry, risk often lies buried at both the pre-tender and post-tender stages of project. Risk encounter on a construction project may lead to the following challenges:

(a) Stoppage to work within budgeted cost.

(b) Stoppage to work within schedule time.

(c) Stoppage to assume the prerequisite technical paradigms for quality, functions, fitness for determination, safety and environmental protection (Asare, 2004).

The monetary and economic misfortune has had a conflicting influence on the Lithuania's economy and the built environment industry. In 2009, the Lithuania's GDP rate decreased by 14.7%. In 2010 to 2011, the GDP rate increased from 1.3% to 4.6%. Annual GDP rate decreased from its highest point of 6.7% gotten in the third quarter to 4.4% in the last quarter of 2011. New industries, precisely construction, trade, transport and communications were not affected by these economic fluctuations.

In 2010, the gross cost further declined specifically in the construction sector by 42.3% and in the trade, transport and communication sectors by 16.6%. In 2011, an optimistic modification in the gross value added was perceived in all the sections of economic events. The major growth in the gross value added was spotted in all assemblies of

economic events. The major improvement in the gross value added was noticed in enterprises striking in construction by 15% and trade, transport and communication services together by 7.3%. The construction industry, one of the backbones of Lithuania's economy over the last decade, is being faced with thoughtful competitions like accumulative unemployment and adjourned or even cancelled investments. These events have as well transformed in clients' and contractors' approaches.

A condensed directive and insufficiency of commands have intensely improved a struggle between companies of the construction sector. This improved burden has enhanced excellence, efficiency and reduced costs, and the requisite for project plans and management, which correctly and efficiently manage risk. Base on Tipili and Ilyasu (2014), the complex nature of risk factors, cost related risk and time related risk were found to be the greatest probable to occur and have the most influence on project. Environmental risk factors understood to be the lowest risk variables, due to its minimum chance nature of incidences and minimum impact score. Risk management falls within the nine knowledge scopes and it is within these scopes that construction risk management becomes a comprehensive and a calculated way of identifying, analyzing and retorting to risks to accomplish the project central objects (Tipili and Ilyasu, 2014). The paybacks of the risk management route include identifying and analyzing risks, and improvement of construction project management processes and effective use of resources. Flanagan *et al.* (2007) stated that, construction projects can be extremely complex and burdened with a whole lot of uncertainty.

They further noted that risk and uncertainty can possibly have severe negative consequences on the construction during the project level. Kpodo and Agyekum (2016) in his published articles also concluded that, increasing frequent disasters call for the

need to acquire the requisite knowledge, adopt preventive measures, develop coping strategies and acquire the needed adequate insurance to become more resilient. He further argued that the effective way of managing risk can either provide a sure way of both resilience to withstand negative events and the ability to take advantage of the opportunities for developments that are locked up in them. In his assessment, further, he realized that proactive risk management is a critical ingredient in the fight to end any challenges and the incapability to manage risk correctly positions important difficulties to finish deficiency and furthering mutual wealth. According to Kpodo and Agyekum (2016) risk management is a powerful instrument for development, building better and more secure future.

2.8 Risk Analysis Techniques for Construction Projects

Over the years, risk associated with the construction industry has always been series of them as the emerging responses are coming up to offset their danger consequences within the project cycles (Thaheem *et al*., 2012). Project risk analysis techniques can be categorized into two key groupings; qualitative and quantitative techniques, with associated sub-categories of semi-quantitative and simulation techniques (De Marco and Thaheem, 2014).

2.8.1 Quantitative risk analysis

These are scientific figures or statistical ways of using numerical measures to ascertain how project risks can affect the entire project plan either by cost or time objectives (Project Risk Management Handbook, 2012). The impact of this outcome has a consequence on the fiscal directory and how often they occurred can be correctly appraised and differences seen by making comparisons between previous information and successive project at hand (De Marco and Thaheem, 2014). The existing quantitative techniques includes:

(a) Decision tree analysis**:** As the name implies, this quantitative technique is like a tree which is in a form of diagram use in forecasting future probable events (Schuyler, 2001).

(b) Expected monetary value: This technique takes keen in aspects on likelihood phase of the scheme conditions and is grounded on a gain matrix (De Marco and Thaheem, 2014).

(c) Expert judgment: Founded on skilled personnel's sentiments to calculate the displeasure rate and attainment possibilities of the whole project (De Marco and Thaheem, 2014).

(d) Fault Tree Analysis (FTA): Potential derivative risk events are derivative from a top event (Delcano, 2002).

(e) FUZZY Logic: A simple way to reach a definite conclusion based on vague, imprecise, noisy or missing input (Konstandinidou *et al.,* 2006).

(f) Probability distribution: Continuous probability distribution signify the uncertainty in standards such as periods of plan actions and costs of project constituents (Delcano, 2002; PMI, 2013).

(g) Sensitivity analysis/tornado diagram: Helps to decide which risks have the most probable influence on the project using a Tornado diagram. An exertion is prepared to capture how greatly risk impacts a specific metric like revenue or earnings (Lyons and Sktmore, 2004).

2.8.2 Qualitative risk analysis technique

This arrangement does not function on numerical or statistical argument of data, it presents outcomes in forms of descriptions, recommendations and ordinal scores (Hubband and Evans, 2010). Qualitative techniques can be list of risk, risk levels, or risk maps. These practices rank risks for succeeding analysis or exploit by evaluating

and scrutinizing their chances of existence and impact. The risk is assessed in more conceptual terms like high, medium or low, depending on the collected opinions and risk tolerance margins in the business. The key qualitative analysis technique includes:

(a) Brainstorming: Greatest probable answers of project risk are produced and determined under the leadership of a facilitator (Berg, 2010).

(b) Cause and effect diagram: Also known as the Ishikawa or fishbone diagram, it is valuable for identifying and analyzing causes of risk (Delcano, 2002).

(c) Check lists: A comprehensive aide-memoire for the identification of possible risks founded on previous comparable projects (Delcano, 2002).

(d) Delphi: A facilitator used a questionnaire to lobby philosophies around the key project risks a project risk professional contributes an anonymously (Berg, 2010).

(e) Vent Tree Analysis (ETA): ETA Models the range of likely out emanates of one or a grouping of initiating events and usually provides qualitative descriptions (Delcano, 2002).

(f) Risk Breakdown Matrix (RBM): An 'activities and threats' Matrix, where the risk number for individually activity and the utmost common whole risk are assessed (Hillson *et al*., 2006).

(g) Risk data quality assessment: Appraises the degree to which a risk is assumed and the truthfulness, quality, reliability and truthfulness of the risk data (De Marco and Thaheem, 2014).

2.9 Factors Hindering the Implementation of Risk Monitoring and Controlling

Chileshe and Kikwasi (2013) explored the barriers to effective risk management explicitly in a developing country, Tanzania. The study identified seven barriers which

include; lack of time, lack of knowledge, lack of potential benefits, project not large enough to warrant the use or risk management tools and techniques, lack of funds, lack of joint risk management, and competition amongst small construction companies. This is relevant to the study as South Africa is also a developing country and therefore similar barriers may be identified in both South African and Tanzania.

Chihuri and Pretorius (2010) identified barriers to effective risk management in South Africa, however the focus of the study by them was only on large projects and did not consider small construction projects. An important finding from Lyons and Skitmore (2004) is that all the barriers listed in their study had a low to moderate impact on the effective implementation of risk management. It is unclear what underlying factors may cause the findings to differ from other findings (Akintoye and MacLeod, 1997, Chileshe and Kikwasi, 2013, Chihuri and Pretorius, 2010, Hwang *et al*., 2014, Tang *et al.,* 2007) where a high impact had been observed from barriers identified in their studies. Hwang *et al*.'s (2014) study lists ten likely barriers to risk management and correlate to the barriers stated in the studies undertaken by (Akintoye and MacLeod, 1997; Chileshe and Kikwasi, 2013; Chihuri and Pretorius, 2010; Lyons and Skitmore, 2004)

2.9.1 Classification of construction risks

Construction risks vary according to a nation's economic, political, resources and technological issues as well as social and cultural conditions (Zarrouk, *et al.*, 2017). The Nigerian construction industry is growing rapidly, with many large and complex projects underway. But this has placed a huge burden on the industry and generated a lot of risks. Most projects involve some risks but many project managers lack sufficient ability to identify or address them (El-Sayegh 2008; El-Sayegh and Mansour 2015).

El-Sayegh (2008) begins by categorising project risks as internal or external depending on the source. Internal risk is generated inside the project and is therefore more likely to

be controllable while external risk is generated outside the project and its likelihood is probably not controllable; however, it may be possible to have some influence over the consequences (Al Mousli and El-Sayegh, 2016; El-Sayegh and Mansour, 2015; Smith and Bohn, 1999).

Aleshin (2001) states that "internal risks are initiated inside the project while external risks originate due to the project environment." There are further categories of internal risks and they are as per the part who may be the initiator of the entire process that involves the owner, contractor, consultant and designer, et cetera. At the macro level, external risks are initiated. (Renault and Agumba, 2016; Rostami and Oduoza, 2017). Figure 2.6 shows the risk breakdown structure (RBS) used to organise the different categories of risk.

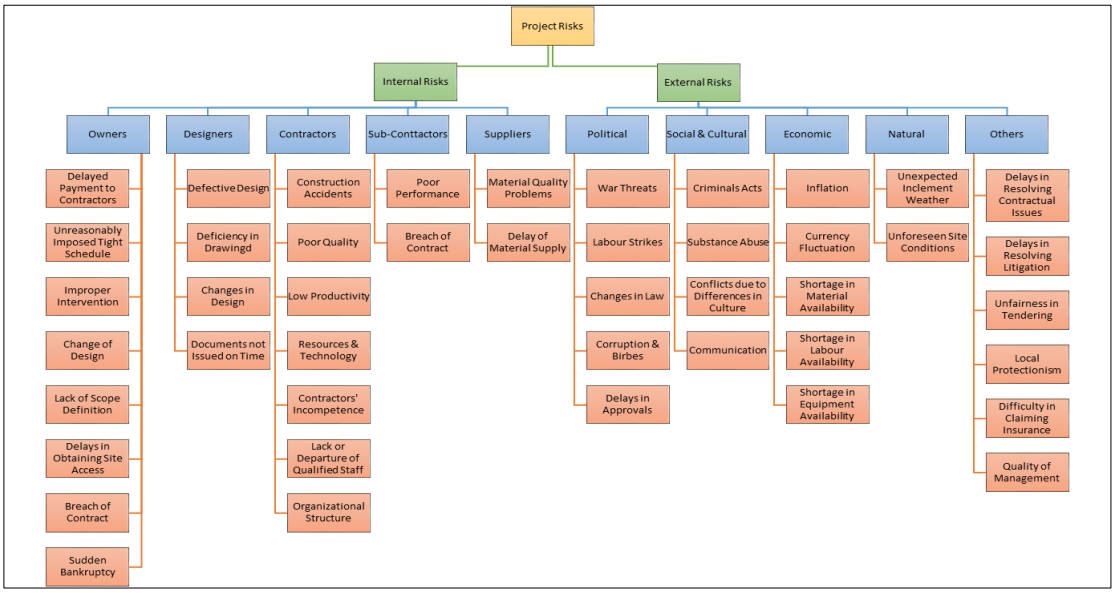

Figure 2.6: Risk Breakdown Structure (RBS)
Source: El-Sayegh (2008)

The attempted classification of the existing risks in construction into internal and external risks is important and practically useful, as it places particular emphases on different individual risks, identifying their sources as within the company's reach

(internal risks) or beyond (external risks). The respective recommendations and risk management strategies should also be developed accordingly, targeting the company management or the government structures. The subsequent sub-division of the internal and external risks into further risk groups is also important as it provides information about possible factors that could be statistically constructed from those smaller groups of individual risks, thus simplifying systemic analytical approach (e.g., based on factor analyses or structural equation modelling). At the same time, it is important to note that no such factor analyses or structural equation modelling were undertaken in several studies (e.g., El-Sayegh, 2008; El-Sayegh and Mansour, 2015). Further sub-division of internal and external risks is also useful to enable the development of specific recommendations targeting particular management groups or government structures having the responsibility of managing particular aspects of economic and social/political development to minimize any construction risks.

2.9.2 Internal risk

Internal risks are generated within the project and hence their control tends to fall within the auspices of the management of the project (Al Mousli and El-Sayegh, 2016; El-Sayegh, 2014, El-Sayegh and Mansour, 2015), making it more likely that they will be controlled (Al Harthi, 2015). These risks are subdivided according to the specific originator, such as the owner, designer, contractor, subcontractors and suppliers.

(a) Owner Risk

Studies have found that the project owner can be a source of project risk; for example, by delaying payments to contractors, making design changes during the course of the project, intervening in the project, delaying contractors' access to the site, imposing an unreasonably tight schedule on them, not defining the scope of the project, breaching

the terms of the contract or suddenly going bankrupt (Al Harthi, 2015; Ng *et al.*, 2004; Remington and Pollack, 2007). Delayed payments can cause financial hardships for contractors. Owners may also demand design modifications which may generate discontinuities, which make it hard or impossible for the contractor to keep to the agreed schedule.

(b) Designer Risk

One obvious risk that can originate with the designers is a faulty design. A design may be incomplete, may include too many 'mistakes' or may not even be repairable. The reasons for this may be that the designers of the items may have been pressured into finishing the design phase because the owners were eager to start construction early; this is mainly in order to meet their market objectives or if the completed building is not fit for purpose.

Another risk is that the drawings and specifications may contain 'mistakes', even though they were produced by design professional. If any of the design professionals make changes during the construction phase, such as to improve the design or fix a deficiency, that too invites risk (Al Harthi, 2015; Fazio *et al.*, 2008; Gladysz *et al.*, 2015).

(c) Contractor Risk

Contractors can generate project risk during construction through cost overruns, delays or the loss of productivity and/or morale, which can, in turn, affect other project objectives. There are also contractor-generated risks with respect to construction quality and the productivity of labour and equipment. Due to a project's uniqueness or to the contractor's inexperience with that type of project, there is also a contractor-generated internal risk of unpredicted technical problems during construction (Al Harthi, 2015;

Forteza *et al.*, 2017). There are still other risks that can arise if the contractors lack sufficient competence to carry out the project objectives or if they do not use the appropriate construction management resources and techniques, including the use of efficient technology and equipment and efficient procurement of resources and materials to control cost, time and quality (Adam *et al.*, 2017; Zaneldin, 2006).

(d) Subcontractor Risk

The construction industries around the world, including in the Nigeria, are becoming increasing dependent on subcontractors because of specialization; i.e., subcontractors perform what contractors cannot. Although subcontracting is advantageous in many ways for the contractor and for the project as a whole, it also presents risks, including, for example, the quality of work, delayed completion, unsafe work practices, breaches of contract, disputes with the general contractor and sudden bankruptcy (Al Mousli and El-Sayegh, 2016).

(e) Supplier Risk

Suppliers can add risk to a construction project if the materials they supply are of poor quality or are delivered late (El-Sayegh, 2008; El-Sayegh and Mansour, 2015; Mills, 2001).

2.9.3 External risk

External risks are generated by parties and by forces that include social, natural, economic, political and cultural aspects that may be outside the project and beyond the control of the project's management (Aleshin, 2001; Altunel, 2017). Research has identified the following types of external risks.

(a) Political and Sovereign Risk

Political risks include war or the threat of war, expropriation, political instability, labour strikes and disputes and changes in law and regulations. For example, a law was passed in the UAE in 2011 that prevents construction work between 1 and 3pm during the hottest months of the year, July and August. This obviously affected many of the ongoing construction projects. Corruption and demand for bribes in the supervisory units for construction projects are also a type of political/governmental risk, as are departmental delays in granting permits and approvals (Al-Hajj and Sayers, 2014; Al Mousli and El-Sayegh, 2016; El-Sayegh and Mansour, 2015; Motaleb and Kishk, 2015).

(b) Economic Risks

Economic risks include inflation, sudden changes in the prices or availability of materials, labour, equipment or services (El-Sayegh and Mansour, 2015; Khan, 2014) and changes in exchange rate that affect the project's profitability, financial stability, exchange rate movements, interest rates, currency exchange rates and foreign investments or joint ventures.

(c) Social and Cultural Risks

Social and cultural risks include criminal acts, communication, cultural diversity, substance abuse and conflicts due to difference in culture language and traditions (Al Harthi, 2015; Al Mousli and El-Sayegh, 2016; Liu *et al.,* 2015; Rajkumar, 2010).

(d) Natural Factors

There are also natural risks. Such risks include unexpected inclement weather and unforeseen site conditions (Erdogan *et al.,* 2017; Loo *et al.,* 2013).

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

Research design is often referred to strategies of inquiry by other researchers (Denzin and Lincoln 2011). According to Creswell (2014) research design are forms of inquiry contain within quantitate, qualitative and mixed method approach that make available the techniques for collecting and analyzing, interpreting and reporting of data carrying out research study.

3.1.1 Quantitative design

The traditions are predominantly originated from psychology, between 19th and 20th century which is based on positivist paradigms (Creswell, 2014). This approach involves quasi experiment (less demanding experiment) and true experiment (Campbell and Stanley 1963). The aim of these design exists on more compound experiment with several variables and treatment. Kuada (2012) proclaim that the approach is a properly process which population sample is selected and afterwards relating the variables to the scope of study. Quantitative traditions elaborate on two design which includes: experiment and surveys. The experiment determines the level at which treatment stimulates an outcome (Fowler 2008). Survey describes trends, opinions or attitudes of population in numeric terms to study a population sample (Keppel, 1991).

3.1.2 Qualitative design

The qualitative design was originated between 90s and 21st century from humanities, sociology, evaluation and anthropology. These approaches give the researcher the ideas on exploring and comprehending how human and social problems are ascribe by individual or groups (Creswell 2014). Constructive hypothesis is determined by the

guide and support of small group of people used in the study (Qualitative Research Consultants Association) as such the outcome of qualitative design are descriptive and not predictive. In 2001, Walcott ascribe some research design which include cultural reflection (ethnography), past experience (historical and narrative research) and development of theory (grounded theory) (Creswell 2014).

3.1.3 Mixed method designs

A research study is identified as mixed method when it integrates quantitative and qualitative research and data together. The closed ended responses like questionnaires tends to be quantitative data and open-ended responses tends to be qualitative data (Creswell 2014), the approach was originated far back and developed in1980s. In 1959, Campbell and Fisk mixed method was adopted to study of psychological behaviors, these enable the researchers to collect multiple forms of data which includes interviews and observation with conversional survey (Sieber 1973). According to Mertens *et al.,* (2003), states that to address issues like poverty, ethnic sections, and women and disable people transformative procedures can be used.

3.2 Sampling Techniques

Research methodologists have developed sampling procedures that should identify a sample that is representative of the population, meaning that the sample closely resembles the target population on all relevant characteristics. Systematic samples will be used based on K = N/%*n: where K = constant (5%), N = total number of population (78) and n = sampling size (39).

3.3 Selection of Research Methods

The careful selection of appropriate research methods is an important component of the strategy in the overall design of any study. The understanding of which research

methodologies and methods are appropriate, is important in development for successful data collection in the construction industry (Abowitz and Toole, 2010). The methods to be employed in undertaking this research will be chosen specifically to support each of the research objectives, the type and availability of the information required, the expertise of the researcher, and the time and financial support available for data collection. This research adopted both rigorous and comprehensive methods that were able to be employed in the whole research process. Primary data was collected through questionnaires whilst secondary data was extracted from journals, text books, seminar papers, lecture notes and occasional publications. The data was processed and analyzed using SPSS statistical analysis software. Descriptive statistics, using mainly simple percentages (%) were applied to collect data where applicable, from variables in the study. The research uses quantitative analytical techniques. Data were collected from stakeholders in construction industry. The variables in the survey focused on determining the factors hindering risk monitoring in construction industry. Likert Scale was used to analyses factors hindering risk monitoring and control.

3.4 Method of Data Collection

The data collection method employed for this research study is quantitative approach. Quantitative approach make use of well-structured questionnaire which will be distributed by hand to construction companies registered of REDAN (Registered Estate Developer Association of Nigeria) documents/register.

3.5 Data Analysis

The data analysis method that was used within the positivistic paradigm is quantitative analysis. The difference between the quantitative and the qualitative analysis is that while quantitative analysis uses numerical analysis to show the relationship among

factors in the phenomenon studied, qualitative describes and brings out an understanding of the situation behind the factors (Chen and Hirschheim, 2014). SPSS 23.0 was used to analyze the data. Risk Index was used to answer research questions. The results were presented in table and charts.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This study assesses the strategies for implementation of risk monitoring and control with a view to develop strategies for implementation. This chapter consists of three sections. The first section identifies the factors hindering the implementation of risk monitoring and controlling. The second section assess the factors hindering the implementation of risk monitoring and control while the third section develop a strategy for implementing the risk monitoring and control system.

4.1 Demographic Characteristics of the Respondents

The demography of the respondent was examined based on Qualification; Age; Working experience in construction industry and nature of client they attended to. The qualification of the respondents was observed in Figure 4.1, it shows that 5% of the respondents have Doctorate Degree, 15% have Postgraduate Diploma, 36% of the respondents have Master Degree and 44% have Bachelor Degree. This signifies that majority of the respondents have Bachelor degree.

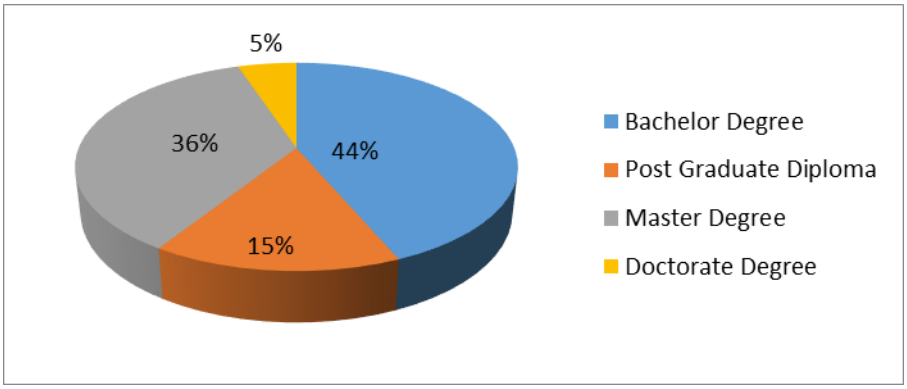

Figure 4.1: Qualification of the Respondents
Source: Authors research (2021)

Figure 4.2 shows the analysis of the age of respondents, it was discovered that 10% of the respondents were within the age group of 21-30 years, 15% were within the age

group of 41-50 years while 75% of the respondents were within the age range of 31-40. This signifies that majority of the respondents are within the age group of 31-40 years

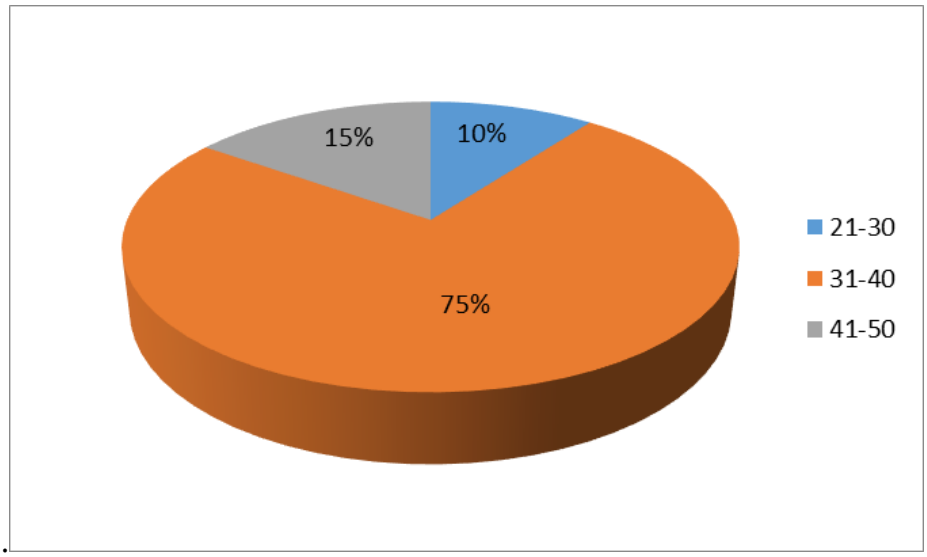

Figure 4.2: Age of the respondents
Source: Authors research (2021)

Years of working experience of the respondents was shown in Figure 4.3, it was discovered that 17.5% of the respondents have been operating in the industry for the period 10-15years, 20.5% of the respondents have being operating in the industry for 15-20 years, while 28.2% of the respondents years of working experience in the industry is less than 5 years and 33.3% of the respondents have being operating in the industry for period of 5-19years. This shows that majority of the respondents have being operating in the industry for 5-10years

Figure 4.3: Years of Working Experience
Source: Authors research (2021)

Figure 4.4 shows the types of clients attended to by the respondents, it was observed that 13% of the respondent's main clients are government parastatals while 87% of the respondent's main clients are private parastatals. This show that majority of the respondent's client are private.

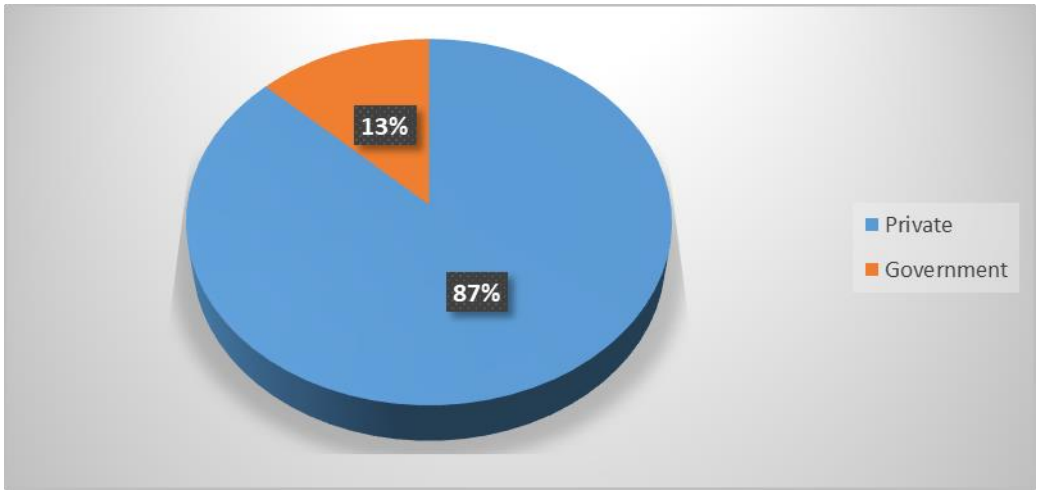

Figure 4.4: Type of Clients Attended
Source: Authors research (2021)

Table 4.1: Identified factors hindering the implementation of risk monitoring and controlling

Barriers	Akintoye and MacLeod (1997)	Chileshe and Kikwasi (2013)	Lyons and Skitmore (2004)	Chihuri and Pretorius (2010)	Hwang *et al.* (2014)	Tang, *et al.* (2007)
Lack of experience	×	×				
Lack of expertise		×	×			
Lack of government legislation					×	
Lack of joint risk management						×
Lack of knowledge/information	×	×	×	×	×	
Lack of potential benefit	×	×		×	×	
Lack of resources					×	
Lack of time	×	×	×	×	×	
Low profit margin					×	
Sophisticated Tools	×		×		×	
Cost		×	×	×	×	
Different recognition of risk control strategies						×
Human / Organization resistance			×			
Lack of Coordination		×				

Choudhry and Iqbal (2013) undertook a study on risk management in Pakistan and presented three significant barriers to effective risk management. The barriers in descending order were: the lack of a formal risk management system, a lack of joint risk management shortage of knowledge and or techniques. Choudhry and Iqbal's (2013) foregoing findings are similar to the findings of Tang et al. (2007) study. The authors, (Akintoye and MacLeod, 1997; Hwang *et al*., 2014; Chihuri and Pretorius, 2010; Tang *et al*., 2007) particularly noted lack of knowledge as a major barrier to implementing effective risk management. In the research from (Akintoye and MacLeod, 1997; Hwang *et al*., 2014; Chileshe and Kikwasi, 2013), lack of time was listed as a major barrier. To

alesser extent, the lack of potential benefit was recorded as a barrier by (Akintoye and MacLeod, 1997; Chileshe and Kikwasi, 2013).

4.2 Factors Hindering the Implementation of Risk Monitoring and Controlling According to Classification

Based on the analysis in Table 4.2 showing the internal classification of risk according their level of occurrence in construction projects. It was discovered that Contractor risk and Subcontract risk with the weighted scores of 122, and risk index of 3.1 respectively ranked 1st among the internal risk classification, it was follows by Supplier risk with a weighted score of 109 and risk index of 2.8 and ranked 2nd, and followed by Designer risk with the weighted score of 101 and risk index of 2.6 while Owners risk have the lowest risk index of 2.4 and weighted score of 92 and ranked 4th among the identified internal risk factors. The analysis signifies that Sub-contractor Risk and Supplier Risk are the higher risks among the identified internal risk

Table 4.2: Internal Risk Factors

Internal Risk Factors	1	2	3	4	5	Weighted Score	Risk Index	Rank
Owner Risk	10	14	8	5	2	92	2.4	4th
Designer Risk	6	13	12	7	1	101	2.6	3rd
Contractor Risk	0	13	13	8	5	122	3.1	1st
Subcontractor Risk	2	8	15	11	3	122	3.1	1st
Supplier Risk	7	10	10	8	4	109	2.8	2nd

Table 4.3 showing the analysis of external risk factors according to their level of occurrence in construction projects. It shows that Social and Cultural Risks was ranked 1st with weighted score of 158 and risk index of 4.1, closely followed by Natural factors with the weighted score of 152 and risk index of 3.9 and ranked 2nd among the external

factors. Economic was ranked 3rd with weighted score of 120 and risk index of 3.1 while Political and Sovereign risk was ranked fourth with weighted score of 99 and the risk index of 2.5.

Table 4.3: External risk factor

External Risk Factors	1	2	3	4	5	Weighted Score	Risk Index	Rank
Political and Sovereign Risk	12	9	7	7	4	99	2.5	4th
Economic Risk	3	7	14	14	1	120	3.1	3rd
Social and Cultural Risks	0	4	4	17	14	158	4.1	1st
Natural Factors	1	3	6	18	11	152	3.9	2nd

4.2.1 Coping with risk in construction industry

Manners in which the respondents are coping with the identified risk was analysis, Figure 4.5 shows that 2.6% of the respondent's action to risk is stoppage to work within budgeted cost, 12.8% of the respondent's action when risk was discovered is stoppage to work within schedule time while 84.6% of the respondent's action is stoppage to assume the prerequisite technical paradigms. This implies that majority of the respondent's action to risk is stoppage to assume the prerequisite technical paradigms.

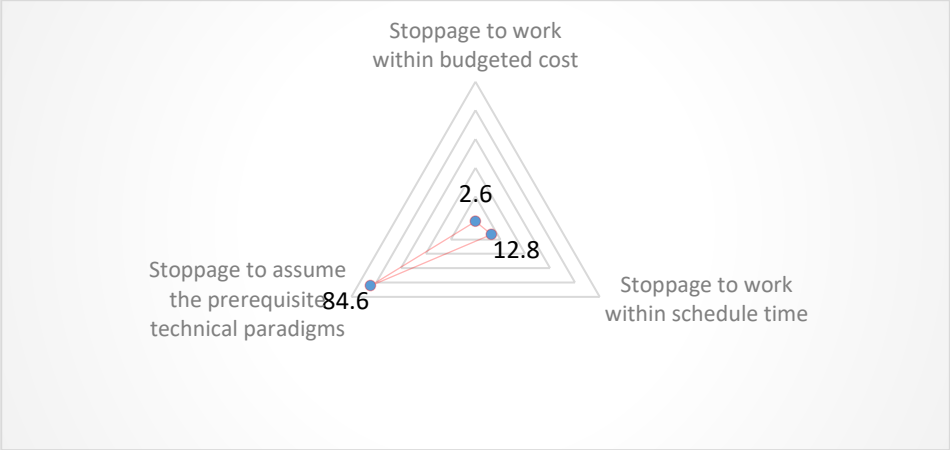

Figure 4.5: Coping with Risk
Source: Authors Analysis, 2021

4.3 Analysis of Factors Hinder Implementation of Risk in Construction Industry

Based on their level of usage in construction projects. The analysis shows that Expected monetary value have the highest weighted score of 157 with Risk index of 4.0 and ranked 1st among the factors, followed by Expert judgment with the weighted score of 133 Risk index of 3.4 and ranked 2nd (Table 4.4).

Table 4.4: Analysis Factors Hinder Implementation of Risk in Construction Industry

Quantitative Risk Analysis Technique	5	4	3	2	1	Weighted Score	RII	Rank
Decision tree analysis	2	2	12	21	2	98	2.5	5th
Expected monetary value	9	22	8	0	0	157	4.0	1st
Expert judgment	4	10	23	2	0	133	3.4	2nd
Fault Tree Analysis	3	7	12	17	0	113	2.9	4th
FUZZY Logic	2	13	18	6	0	128	3.3	3rd
Probability distribution	2	10	8	19	0	112	2.9	4th
Sensitivity analysis/tornado diagram	3	7	14	14	1	114	2.9	4th

It was also observed from the Table 4.4 that FUZZY Logic has a weighted score of 128 and Risk index 3.3 and ranked 3rd. Fault Tree Analysis, Probability distribution and

Sensitivity analysis/tornado diagram have an equal weighted score of 112 and Risk Index of 2.9 and ranked 4th among the factors while the least is Decision tree analysis with a weighted score of 2.5 and ranked 5th.

Table 4.5 shows the analysis of the qualitative techniques and their level of usage. Brainstorming, Checklist, Delphi and Risk data quality assessment were ranked 1st with a weighted score of 115 with Risk Index of 2.9 and ranked 2nd, closely followed by Risk Breakdown Matrix with a weighted score of 104 and risk index of 2.7. Cause and effect diagram has a weighted score of 82, risk index of 2.1 and ranked 3rd. Event Tree Analysis was ranked the fourth among the techniques use with a weighted score of 66 and risk index of 1.7 and ranked 4th.

Table 4.5: Qualitative Analysis Techniques

Qualitative Risk Analysis Technique	5	4	3	2	1	Weighted Score	RII	Rank
Brainstorming	4	4	17	14	0	115	2.9	1st
Cause and effect diagram	1	3	6	18	11	82	2.1	3rd
Checklist	3	6	16	14	0	115	2.9	1st
Delphi	1	10	16	10	2	115	2.9	1st
Event Tree Analysis	1	10	2	6	3	66	1.7	4th
Risk Breakdown Matrix	1	8	7	23	0	104	2.7	2nd
Risk data quality assessment	1	14	6	16	2	113	2.9	1st

4.4 Factors hindering the implementation of risk monitoring and control.

Analysis in Table 4.6 showing the factors hindering the implementation of risk monitoring and control. The analysis shows lack of coordination was ranked 1st among the factors hindering implementation of risk control in construction industry with a weighted score of 151 and risk index of 3.9. followed by Low profit margin with a

weighted score of 145, risk index of 3.7 and ranked 2nd among the factors, Cost of implementation has a weighted score of 142, risk index of 3.6 and ranked 3rd. Project not large enough to warrant the use or risk management tools and techniques have a weighted score of 124 with risk index 3.2 and ranked 4th. Sophisticated Tools was ranked 5th with a weighted score of 119 risk index of 3.1 and 5th. Human/organization resistance scores a weighted scale of 117 risk index 3.0 and 6th on the rank.

It was also observed from Table 4.6 above that Competition amongst small and medium contractors has a weighted score of 114 risk index of 2.9 and ranked 7th. Lack of government legislation, Lack of joint risk management has a weighted score of 106/107 and risk index of 2.7 and ranked 8th, Lack of expertise, Lack of resources, Lack of time was ranked 9th among the factors with a weighted score of 101 and risk index of 2.6. Lack of potential benefit has a weighted score of 96 risk index of 2.5 and 10th among the identified factors. The least among all the factors was Lack of fund with a weighted score of 82 risk index of 2.1 and ranked 12th among the factors.

Table 4.6: Factors hindering the implementation of risk monitoring and control

Risk Factors	5	4	3	2	1	Weighted Score	RII	Rank
Competition amongst small and medium contractors	4	17	6	4	0	114	2.9	7th
Cost of implementation	6	13	20	0	0	142	3.6	3rd
Different recognition of risk control strategies	1	1	6	19	12	77	2	13th
Human/organization resistance	2	9	15	13	0	117	3	6th
Lack of coordination	5	24	10	0	0	151	3.9	1st
Lack of experience	2	3	24	10	0	114	2.9	7th
Lack of expertise	1	2	26	0	10	101	2.6	9th
Lack of fund	2	1	4	24	8	82	2.1	12th

Lack of government legislation	1	7	16	10	5	106	2.7	8th
Lack of joint risk management	1	4	19	14	1	107	2.7	8th
Lack of knowledge/information	1	5	1	27	5	87	2.2	11th
Lack of potential benefit	1	7	7	18	6	96	2.5	10th
Lack of resources	1	9	7	16	6	100	2.6	9th
Lack of time	1	9	6	19	4	101	2.6	9th
Low profit margin	11	9	16	3	0	145	3.7	2nd
Project not large enough to warrant the use or risk management tools and techniques	8	7	9	14	1	124	3.2	4th
Sophisticated Tools	8	11	2	13	3	119	3.1	5th

4.5 Strategies for Implementation of Risk Monitoring and Control Measures in Nigeria Construction Industry

(a) Professional bodies within construction organization e.g. NIQS, NIOB, NIA should setup a periodic training for registered contractors and sub-contractors.

(b) Penalty should be awarded to contractors or sub-contractors who failed to undergo the periodic training as organized by professional bodies.

(c) Government at all levels should as a matter of urgency encourage contractors and sub-contractors who undergo this trainings and seminar in form of incentive or reduction in tax.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

As far as Nigeria is concerned risk management is still a new word in the construction sector and this should be changed as soon as possible. Currently the Government of Nigeria has proposed a risk rating system will help the developers to develop projects at a faster pace by taking quick decisions. Each rating agency will have its own methodology to rate projects. The system will help government to develop a strategy to mitigating risk. This will encourage more response from developers and investors for public-private partnerships projects. It could make the bidding projects more competitive. The system will enable bankers to take quick decisions for lending finances, which could lead to the financial closure of the project at a faster pace. Third party risk rating would certainly raise critical points, which are not normally raised during finalization of project.

This study should assist management in identifying activities where there is a risk of Financial, Time and Construction aspects and hence provide a basis for management to take objective decisions on the reduction of risk to an agreed level. These findings are very important for implementing further effective measures to ensure the right direction of future development. Risk management should be considered a primary tool to assess the project. Data collected was subjected to 5-scale Impact Grid with Scores of Risk. Those scores were the used to determine difference in perceived risks of, General Manager, Project managers, Project Engineers and Site Engineers which was then analyzed by using the software of SPSS.

This will encourage more response from developers and investors for public-private partnerships projects. It could make the bidding projects more competitive. The system will enable bankers to take quick decisions for lending finances, which could lead to the financial closure of the project at a faster pace. Third party risk rating would certainly raise critical points, which are not normally raised during finalization of project.

5.2 Recommendations

(a) Construction organization should be mandated to undergo training on risk monitoring and controlling at least once in every two years.

(b) Clients and contractors should make sure that their workforce is linked with an integrated supply chain management system.

(c) Clients and contractor should carry out effective supervision. In cases whereby the project is massive, they should seek for assistance of relevant professionals.

(d) Clients and contractor should see insurance schemes as tool for incentivizing risk management practices up and down the supply chain.

(e) Clients and contractor are to ensure the best quality material as specified in the BOQ should be supplied to site.

(f) Contractors should always ensure that there is basic risk management training for the field workers and the technical staff.

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APPENDIX A

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF ENTREPRENEURSHIP AND MANAGEMENT TECHNOLOGY
DEPARTMENT OF PROJECT MANAGEMENT TECHNOLOGY

INTRODUCTION LETTER FOR QUESTIONNAIRE

Dear Sir/Madam,

STRATEGIES FOR IMPLEMENTATION OF RISK MONITORING AND CONTROL MEASURES IN CONSTRUCTION PROJECT.

I am a graduate student currently working on the above research topic in partial fulfilment of the requirement of the award of M. Tech Project Management in Federal University of Technology Minna.

This is to intimate you with a M. Tech. Research currently being undertaken in Department of Project Management and Technology at Federal University of Technology Minna. And also, to request your assistance in completing the attached questionnaire as a basis for the research. The aim of the study is to assess the prevalence of factors hindering the implementation of risk monitoring and controlling, with a view to develop strategies for implementation.

The questionnaire has been designed such that it will not take you a long time to complete. We are sorry for the inconveniences imposed on you as we will like to assure you that any information that you provide would be treated as strictly confidential and used solely for research purpose. Your response to this questionnaire would be crucial to the research. Looking forward to your comments, and it would be appreciated if the research could be further discussed with you.

Thank you for your anticipated cooperation.

Yours Sincerely,

MAHMUD, Usman Yunusa

Matric Number MTECH/SEMT/2017/349 Researcher

SECTION A

PERSONAL DATA

1. Name of Organization

   Location……

2. Position of Respondent in

   Organization……...

3. Highest academic qualification (**please tick as appropriate**)
   a. Higher National Diploma ☐
   b. Bachelor Degree ☐
   c. Post Graduate Diploma ☐
   d. Master Degree ☐
   e. Doctorate Degree ☐
4. Age group of respondent **(please tick as appropriate)**
   a. 21-30 ☐
   b. 31-40 ☐
   c. 41-50 ☐
   d. 50 above ☐
5. For how long have you being operating in the Nigerian construction industry?

   (please tick as appropriate)
   a. Less than 5 years ☐
   b. 5-10 years ☐
   c. 10-15 years ☐
   d. 15-20 years ☐
   e. 20 years above ☐
6. Who are your main clients? (**please tick as appropriate**)
   a. Private ☐
   b. Government ☐

SECTION B

RISK ACTION, CLASSIFICATION AND ANALYSIS

1. What do you do when risk is discovered? (Tick as appropriate)

S/N	Action	Tick (√)
1	Stoppage to work within budgeted cost	
2	Stoppage to work within schedule time	
3	Stoppage to assume the prerequisite technical paradigms for quality, functions, fitness for determination, safety and environmental protection.	

2. Rank the classes of risk according to their level of occurrence in construction projects

   1= not often, 2 = less often, 3 = not sure, 4 = often, and 5 = very often. (Tick as appropriate)

Classification	1	2	3	4	5
Internal Risk					
Owner Risk					
Designer Risk					
Contractor Risk					
Subcontractor Risk					
Supplier Risk					
External Risk					
Political and Sovereign Risk					
Economic Risk					
Social and Cultural Risks					
Natural Factors					

3. Rank the risk analysis techniques according to their level of usage in construction projects

   5 = very often, 4 = often, 3 = not sure, 2 = less often and 1 = not often. (Tick as appropriate)

Risk Analysis Technique	**5**	**4**	**3**	**2**	**1**
Quantitative					
Decision tree analysis					
Expected monetary value					
Expert judgment					
Fault Tree Analysis (FTA)					
FUZZY Logic					
Probability distribution					
Sensitivity analysis/tornado diagram					
Qualitative					
Brainstorming					
Cause and effect diagram					
Check lists					
Delphi					
Event Tree Analysis					
Risk Breakdown Matrix					
Risk data quality assessment					

4. Rank the factors hindering the implementation of risk monitoring and controlling

5 = strongly agree, 4 = agree, 3 = not sure, 2 = disagree and 1 = strongly disagree.

Factors	5	4	3	2	1
Competition amongst small and medium contractors					
Cost of implementation					
Different recognition of risk control strategies					
Human / organization resistance					
Lack of coordination					
Lack of experience					
Lack of expertise					
Lack of funds					
Lack of government legislation					
Lack of joint risk management					
Lack of knowledge/information					
Lack of potential benefit					
Lack of resources					
Lack of time					
Low profit margin					
Project not large enough to warrant the use or risk management tools and techniques					
Sophisticated Tools					

5. What strategies do you feel will improve risk monitoring and control implementation?

i. _____

ii. _____

iii. _____

iv. ____

v. ____