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ASSESSMENT OF RISK MANAGEMENT FOR RESIDENTIAL CONSTRUCTION PROJECTS IN ABUJA

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ABSTRACT :

The multiple effect of the construction industry to both developed and developing countries cannot be overemphasized. Risk can be described as the absence of information when a decision is to be made at any time throughout a process. The construction industry is often considered as complex and defragmented due to working in a project-based format, with a unique product and a process where most times decisions need to be made with insufficient information. Therefore, proper risk management processes can be vital to minimizing risks, maximizing opportunities and securing a successful project process. Managing risks in residential construction projects has been recognized as a very important management process in order to achieve the project objectives in terms of time, cost, quality, safety and environmental sustainability.The aim of this research project is to assess the risk management practices in residential construction projects in Abuja. The study explores the different types of risks that are commonly associated with residential construction projects, as well as the strategies and techniques that are utilized to manage these risks. The research is conducted through a mixed-methods approach, which will involve both quantitative and qualitative data collection and analysis.The study utilises a survey questionnaire to collect data from construction professionals, including architects, engineers, contractors, and project managers, who have experience working on residential construction projects in Abuja. The survey aim to identify the types of risks that are most prevalent in these projects, as well as the methods that are most commonly used to manage these risks. In conclusion the findings of this research project contribute to the development of best practices for risk management in residential construction projects in Abuja. The results is also useful for construction professionals, policymakers, and other stakeholders who are involved in the development and implementation of risk management strategies for construction projects. It is recommended that professionals, policymakers and other stakeholders involved in projects should aim to enhance the understanding of risk management practices in the residential construction sector in Abuja and provide insights for improving the quality and safety of residential construction projects in the city.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF STUDY

One of the significant vital factors in a country development is the construction industry. This is because the provision of infrastructures and amenities needed for the growth of the country cannot be established without the industry (Yimam, 2019). Despite the benefit of the industry, it is laden with risks when compared to other projects due to the very nature of the activities that are involved in construction projects. Fadun and Saka (2018), posited that a risk is an unforeseen event that prevents the completion of a construction project at the stipulated time and cost. Development of the construction industry also requires knowledge of risk management policies. It is a well establish fact that every stage of the construction process, from initial investment appraisal through to construction and use of the built facility, is subject to risk for all the parties involved. Indeed, compared to other industries, the Nigeria construction industry has a particularly poor record in this regard with high number of constructions related risks occurring each year (Ojo, 2020; Windapo, et.al 2020). In recent times, the nature, incident and impact of risk in construction have become a topic of interest because of the effects on quality, time and cost of construction projects.

Many industries have become more proactive and aware of using analyses in projects. Likewise, RM has become a timely issue widely discussed across industries. However, with regard to the construction industry, risk management is not commonly used (Klemetti, 2019). More construction companies are starting to become aware of the risk management processes, but are still not using models and techniques aimed for managing risks. This contradicts the fact that the industry is trying to be more cost and time efficient as well as have more control over projects. Risk is associated to any project

regardless the industry and thus RM should be of interest to any project manager. Risks differ between projects due to the fact that every project is unique, especially in the construction industry Gould and Joyce, (2012). However, there are still many practitioners that have not realized the importance of including risk management in the process of delivering the project (Smith et al., 2016). Even though there is an awareness of risks and their consequences, some organizations do not approach them with established RM methods. Risks are unavoidable in almost every construction project whether if it is building projects, civil works, or any other type of construction projects. Risk is inherent in all human endeavors, including construction activities, and the risk factors involved are diverse and varied. Managing construction project risks is considered as compulsory for any project to be successful.

Construction sector has played a crucial role in extending job opportunities for Palestinian labour force. Expansion of the construction activity has generated a lot of jobs for skilled, semi-skilled and unskilled construction workers. The absolute number of domestic constructions increased from 12.8 thousand in 1970 to 40.3 thousand in 2016. The share of this labour domestic employment has risen from 7.9% to 12% for the same period (PECDAR, 2017). Notably, projects are products of change implementation. However, every project is unique; The construction industry, perhaps more than other sectors, is overwhelmed with risks. Ehsan *et.al* (2020) argued that the industry is highly risk prone, with complex and dynamic project environments creating an atmosphere of high uncertainty and risk. The industry is vulnerable to various technical, socio-political and business risks. Deviprasad (2017) further stated that too often this risk is not dealt with satisfactorily and the industry has suffered poor performance as a result.

The main rationale behind construction risk management is not the total elimination of the risks that occur but having proper control over the whole risks (Dallas, 2016). Risk management in the Nigerian construction industry is still in the infancy phase which is unlike the developed countries Odusami *et al.,* (2019). Harmonising the thoughts of Odeyinka *et al.,* (2017), the Nigerian construction industry is known for cost overruns, subsequent delays and project abandonment. Consequently, this study seeks to appraise the present level of risk management practice in Nigeria. The findings of Odusami *et al.,* (2019) & Fadun and Saka (2018) also suggest that it is expedient to assess the factors responsible for the present state of risk management practice in the Nigerian construction industry. Thus, this research is aiming at providing comprehensive discussion on concepts of managing risks in residential construction projects.

1.2 STATEMENT OF PROBLEM

The residential construction industry in Abuja, Nigeria faces several challenges that compromise the quality, safety, and sustainability of construction projects. One of the most significant challenges is the management of risks associated with the construction process. Despite the existence of various risk management strategies, there is limited information on the effectiveness of these strategies in reducing and managing risks in residential construction projects in Abuja. This is supported by Aladenika *et al.* (2020), who found that there is a lack of awareness and inadequate implementation of risk management strategies in the Nigerian construction industry.

The common risks challenges contractors battle with include changes in work, delayed payment on contract, financial failure of owner (client), labour and labour disputes, equipment and material availability, productivity of labour, defective materials, productivity of equipment, safety, poor quality of work, unforeseen site conditions, financial failure of contractor, political uncertainty, changes in legislation and policies, permits and ordinances, delays in resolving litigation/arbitration disputes, inflation, cost of legal process and force majeure (Zou *et al,* 2017). In sum, there are problems of recurring conflict, client and stakeholder dissatisfaction from abandoned projects, and high accident rates.

The absence of comprehensive risk management practices in the residential construction industry in Abuja undermines the development of best practices and effective risk management policies. This can lead to increased costs, delays, and quality issues in construction projects, as well as compromised safety and sustainability standards. According to Oke *et al.* (2019), the lack of a risk management framework in the Nigerian construction industry contributes significantly to the high rate of project failure.

Furthermore, the limited understanding of the types of risks that are most prevalent in residential construction projects in Abuja is also a significant problem. This is supported by Daramola and Ogunsemi (2016), who found that risk management in the Nigerian construction industry is reactive rather than proactive, and risk identification is mostly done informally.

Therefore, there is a need for a comprehensive assessment of risk management practices in the residential construction industry in Abuja to address these problems. The research findings will provide valuable insights that can inform the development of best practices and effective risk management policies in the residential construction industry in Abuja. This will lead to improved quality, safety, and sustainability standards in residential construction projects, as well as reduced costs, delays, and reputational damage.

1.3 RESEARCH QUESTIONS

1. What are various risk in residential construction projects?
2. What are the risk mitigation strategies put in place in the selected construction firm for residential projects in the study area?

3. What are the processes and measures in implementing risk management in residential construction project?

1.4 AIM AND OBJECTIVES OF STUDY

The aim of this study is to evaluate the risk management in residential construction projects in Abuja using Julius Berger construction company as a case study.

The followings are the specific objectives of this study: -

1. To identify the various risks in residential construction project.
2. To assess the risk Mitigation strategies put in place in the selected construction firm for residential construction project.
3. To assess the processes and measures for implementing risk management in residential construction project in Abuja.

1.5 SIGNIFICANCE OF STUDY

Construction projects are usually a one-off endeavour with many unique features such as multiple project participants, long gestation periods (between conception-design construction), complex procurement methods, large financial requirements and dynamic organization structures. All these have made the risk and uncertainties related to construction project more in peculiar environments like Nigeria when compared with other countries Although it has been recognized that construction risk cannot be eliminated, it can be mitigated and managed effectively, if project risks and uncommon characteristics are identified and assessed at the early stages of the project.

Risk management is of great importance to project stakeholder (contractor, client and consultant) because it will minimize the possibility of conflicts, disputes, cost and time overruns, abandonment, disputes, and quality related issues associated with construction project. The implementation of effective risk management practice up and down the supply chain will improve bid success rate, profits, project cash flow, safety record, business continuity and reduce contingencies. Risk management is all about being able to deliver results with a certain degree of certainty and competitive advantage. Risk management will help project stakeholders (clients, consultants and contractors) achieve projects objectives of cost, time, quality and safety. It will help the society and economies achieve cost effective and efficient projects which will create new business opportunities and generate more for people, investors and government. It will undoubtedly contribute to the development of the Nigerian construction industry as risk management variables like power and competitive advantage are aspects of the Nigerian construction process that needs understanding.

Lastly, findings from the study will enable policy makers and construction industry stakeholders improve project delivery in Nigeria and by extension help improve economic growth through multiplier effect.

1.6 SCOPE OF STUDY

This research focuses on how building and civil contractors manage risks in residential construction project. This research is not limited to only project done by Julius Bergers Construction Company in FCT Abuja in which the respondents are being selected from, it also involves other small construction firms and freelance contractors.

Julis Berger Nigeria Plc is a leading Nigeria company offering holistic services such as planning, design, construction, operation and maintenance for building, infrastructure, and industry projects. The study is carried in the branch company situated in Munguno Crescent Abuja, Federal Capital Territory, Nigeria.

Furthermore, for the purpose of this study, the respondents consist of other small construction firms and contractors that are working with Julius Berger Company Nigeria. This is because the classifications of class of the contractor represent the size of the firm and the approximate size of the project they carry out. Contractors that are registered in class 1 and class 2 are considered as quite large organization with bigger size of project. The risks they face vary with the size of project and the size of their organization. Thus, to ensure the reliability of the data gathered, it is essential that the lists of respondents vary in size of the organization and the size of the project.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 CONCEPTUAL REVIEW OF RISK

Winch (2010) defines risk as an absence of information when a decision needs to be made at any time throughout a process. The correlation between risk and time is of great importance since risks can both occur at an instant, as a surprise, or can be identified in advance. The framework of time generates a basic understanding of how risk management can be applied. Regardless if a risk occurs instantly or it is identified in advance the risk stems from a source. The risks trigger an event that has a negative impact on the project itself. Lastly this event mandates a response. The response can be to

the source; if the risk is identified in advance, or to the event; if the risk is not identified in advance.

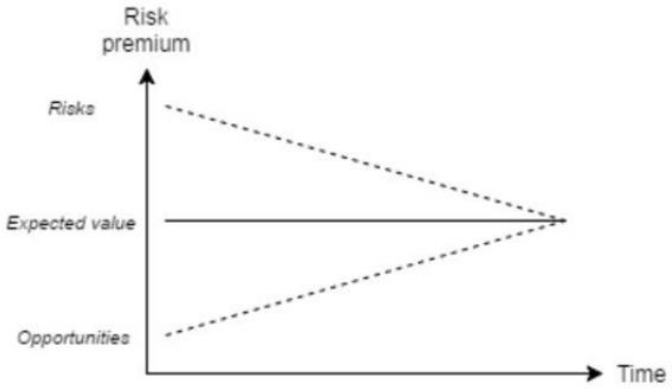

Figure 2.1 Risk premium over time. (Source: Winch, 2010)

Risk shows the absence of information, meaning that there is an uncertainty about what event a risk source will trigger. Therefore, a probability of occurrence can be assigned to risk in order to determine what impact the risk is likely to have on the project. Winch (2010) introduces four different schools on the relationship between risk and probability:

1. ***The objectivist school***: This school uses a statistical approach where it tries to predict future events based on data collected from previous sources.
2. ***The logical school***: Within this school the aim is also to predict the probability of an event. However, the decision made is not solely reliant on data; instead, the experience and knowledge of the event is the key to identifying and assessing a risk.
3. ***The subjectivist school***: Where the two previous schools determine the probability based on statistical data and experience, this school aims to provide the user with explicit tools and techniques to solve the issue at hand.
4. ***The behavioral school:*** In contrast to previous schools, this focuses on the behavioral aspects of decision making when faced with a potential problem.

2.2 OVERVIEW OF CONSTRUCTION INDUSTRY IN NIGERIA

The construction industry is a sector of the economy that transforms various resources into constructed physical economic and social infrastructure necessary for socio-economic development. It embraces the process by which the said physical infrastructure are planned, designed, procured, constructed or produced, altered, repaired, maintained, and demolished. The construction industry is also a fundamental economic activity which permeates most of the sectors of the economy. In short, it is an engine of growth. In Nigeria the construction sector is among the very important sectors that contribute hugely to the Gross Domestic Product (GROSS DOMESTIC PRODUCT). Therefore, the construction sector continues to be one of the most exciting sectors in the Nigeria economy. Unfortunately, in a highly competitive and complex climate that is fraught with risk, unfavorable outcomes can often plague these projects and their participants. Such outcomes might include cost overruns, budget shortfalls, compromised quality, schedule delays; third-party meddling, confusion about scope of work, smeared reputations bruised relationships, and severe financial hardship.

2.3 RISK IN CONSTRUCTION PROJECTS

Within the academic literature, the risk management process in the construction industry approaches the different schools to different extent. Risk is defined as the possible occurrence of negative or adverse effects that lead exclusively to damage or loss (Valeriano, 2016). Perry and Hayes (2018) define risk as an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective. Kartam (2015) defines risk as the probability of occurrence of some uncertain, unpredictable and even undesirable events that would change prospects for the probability on a given investment Risks will be apparent at all stages of the life of a construction project: at appraisal, sanction, construction and operation. The effects, relative impact, and opportunity to avoid, transfer, or retain these uncertainties will change throughout the project. The consideration and assessment of risks therefore needs to be urry and Hayes, 2018).

One solution to a more successful risk management is collaboration, since all members of a project group can share knowledge and experiences. It could be argued that this process would be easier if the project group was smaller. A design-build contract allows the contractor to have more control over the design process since they are the entity responsible for the technical solution. This allows the contractor to have the schedule overlap and shorten the process leading to reduced costs and schedule. By using Early Contractor Involvement there is a possibility to increase the collaboration

within the project group and therefore minimize potential risks and maximize opportunities. This means that a contractor is procured in the earliest stages of the project and has the contractor assist the developer or owner. Since not all risks are identifiable in the early stages (by the design team) the contractor can recognize potential construction risks since their core business, and core competence, is production. When one is an expert at a certain field it is inevitable that they also generate extensive knowledge about their field. The actual practice of risk management in construction projects have been examined in the literature.

Rather, it seems to be because of practitioner's skepticism towards the usefulness of such techniques. When conducting risk management, an underlying problem is the bias that could occur when risks are assessed, an approach that is to be described as heuristic. Winch (2010) introduces three systematic biases regarding risk assessment:

1. When assessing risks there is a small sample size. Winch illustrates this with an example that a project will be faced with budget overruns and schedule delays as both a construction budget and schedule are simply the mean of all available estimates. The lack of *repetitiveness* means that no assessments can be fully viable.
2. The lack of comparable information creates a bias referred to as *availability*. Where decisions are based on the last available information or solution from a complex problem. The problem lays in that there is no evidence that the solution or information is relevant to the current problem.
3. The last bias introduced is *anchoring.* That is when the initial assessment or solution overshadows any solution once new information emerges.

The different forms of bias are hard to overcome and there is no definite solution to the problem. Different methods and techniques, such as training, can help minimize bias but there are no certainties. (Winch, 2010) Despite the vast research available regarding risk management in construction there are discrepancies regarding to which extent the different tools and techniques are used in reality.

Early risk identification ensures that team effort is concentrated in critical areas, focusing the project team's attention on actions and resources where there is a major risk exposure, or where the greatest time and cost savings can be made through streamlined project management. Managing construction project risks from the beginning will contribute to early risks response where problems are reduced as they are identified. This can be differentiated with traditional approach in project management whereby risks are responded only when problem occurs. This is not good as it will incur a lot of time and cost as well as effort. Risk management is the responsibility of every stakeholder involved in a project.

2.4 FORMS OF RISKS IN RESIDENTIAL CONSTRUCTION PROJECTS

Commonly risks can be grouped into seven broad categories:

i. Physical risks in construction project,
ii. Construction risks in project undertakings,
iii. Design risks in construction project
iv. Political risks in construction project,
v. Financial risks in construction project,
vi. Legal – contractual risks in construction project,
vii. Environmental risks in construction project.

2.4.1 Physical risks in construction projects

Physical risks in construction project are risks that often associated with the physical nature of the project. Most of the types of risks fall under this category are uncontrollable source of risk. Enshassi and Jaser (2008) state the following types of risks within this category:

1) Force majeure (acts of God), i.e. inclement weather, fire, landslip, and etc.,
2) Pestilence or deadly disease, disease, and
3) Unexpected events or unforeseen circumstances, for instance aero plane crashed at the construction site.

2.4.2 Construction risks in project undertakings

Construction risks are risks that happen during the construction phase in a project life cycle. The construction phase is one of the critical phases because any changes during this phase will affect to a great extent on cost, time and quality aspects. Due to this fact, it is necessary for the stakeholders to give full concentration on the construction. Enshassi and Jaser (2018) describe the following types of risks that falling under this category consist of:

a) Delay in possession of site.
b) Possible failure of equipment which will affect the productivity of the work.
c) Unavailability of equipment, spares, fuel.
d) Inappropriate equipment, poor inventory management, late ordering of materials and components, poor storage practices weather condition,

poor quality, productivity.

e) Unavailability of labor for both manual and management, the capability level of professional staff such as incompetence, unreasonableness.

f) Construct to program and specification, poor workmanship, ground condition due to inadequate site investigation, inadequate information in documents, unforeseen problem.

g) Error while performing work, poor relationship of professional staff to each other which is with the consultants, architects.

2.4.3 Design risks in construction projects

A design risk is any potential risk in a design process, either in a concept design or a detailed design. Early assessment on design risk will increase the chances of eliminating possible failures and reduce the impact of potential failures. This enables a thorough and systematic examination in the reliability of the design. Design decisions by various engineering disciplines are coordinated with others with respect to function and cost. Design risks in construction project comprise of;

a) Incomplete and poorly defined design scope resulting from inability to comprehensively articulate own and users' needs and requirements,

b) Unavailability of information and incomplete design information; i.e. delay in supplying information required by contractors, new technology, level of detail required and accuracy, appropriateness of specification,

c) Design errors and frequent changes resulting in variations, claims and cost escalations, interaction of design and constructability, complex designs and shapes presenting 'build ability' / 'constructability' problems, non-standardization of details, non-standardization of suppliers, quality control exercised such as inspections and approvals

d) The risk of late confirmation and approval of design.

2.4.4 Political risks in construction projects

Conducting construction business in emerging markets brings a whole new set of challenges and risks to any company including political risks. Thus, it is necessary for risk managers to confront with the political risks of emerging markets. Enshassi and Jaser (2008) describe the following political risks in construction projects:

a) Changes in law, procedures and requirements.

b) Inconsistency of regulations within country or organization, requirement for permits and the procedures for their approval, i.e. for building codes and planning permits, and finally the risks of stoppage.

2.4.5 Environmental Risks in Construction Projects

Environmental risks are a serious and growing issue for the construction industry. Although many construction firms adhere to the belief that environmental exposures are associated only with environmental work, in fact, they exist in every facet of a construction firm's practice. To succeed in today's controversial environment, forward looking contractors are incorporating sound environmental risk management practices throughout their business operations. Environmental risks consideration can significantly reduce minimize or eliminate a contractor's exposure to environmental liabilities. Environmental risks in construction projects can consist of: (Enshassi and Jaser, 2008).

1. Ecological damage, pollution, waste treatment, public enquiry, regulations and possible changes,
2. Environmental constraints: geological / topographic limitations; weather, and working space limitations.

2.4.6 Legal contractual risks in construction projects

A construction project must fit into the legal – contractual framework governing the property. These include governmental regulations on the use of property, and obligations that are created in the process of construction. Legal advisors in the beginning of a construction project seek to identify ambiguities and other potential sources of trouble in the contract structure, and to present options for preventing problems. Throughout the process of the project, they work to avoid and resolve conflicts that arise. Enshassi and Jaser (2008) wrote on Legal – contractual risks in construction projects and in their writings the group have the following risks;

1. Direct liability, liability to others, local law and codes
2. Legal differences between contractors, consultants, suppliers
3. Conditions of contract; i.e. liquidated damages, maintenance

2.4.7 Financial risks in construction projects

In essence, financial risk is any risk associated with money. Financial risks can be expressed as the chance that an investment's actual return will be different than expected. This includes the possibility of losing some or all of the original investment. Many construction projects suffer from preventable financial problems. Underbids ask for too little money to complete the project. Cash flow problems exist when the present amount of funding cannot cover the current costs for labor and materials, and other expenditures. Having sufficient funds at all the time is very important to deliver a successful project. Financial planning for the project is intended to ensure that a solid plan, with adequate safeguards and contingency plans, is

in place before the project is started, and is required to ensure that the plan is properly executed over the life of the project. Enshassi and Jaser (2008) state the following financial risk in construction project:

1. Unavailability of funds, cash flow problems or insolvency due to slow payment and dispute,
2. Loss due to default of contractor, supplier.
3. Inadequate payment for variations.
4. Failure of low bidder to enter construction contract.
5. Inflation, exchange rate fluctuation, under-pricing.
6. Cost of legal decision, insufficient insurance, business disruption, bid validity period extension.

2.5 METHOD FOR PERFORMING RISK ANALYSIS

Risk analysis is the second stage in the RMP where collected data about the potential risk are analyzed. Risk analysis can be described as short-listing risks with the highest impact on the project, out of all threats mentioned in the identification phase (Cooper et al. 2015). Although some researchers distinguish between terms risk assessment and risk analysis and describe them as two separate processes, for the purpose of this paper, this part of RMP will be consistent with the model provided by Smith et al. (2016) and described as one process. There are two methods used for approaching risk analysis; qualitative methods and quantitative methods (Berg, 2010).

2.5.1 Quantitative methods

Quantitative methods need a lot of work for the analysis to be performed. The effort should be weighed against the benefits and outcomes from the chosen method, for example smaller projects may sometimes require only identification and taking action on the identified risks, while larger projects require more indepth analysis. The quantitative methods estimate the impact of a risk in a project (PMI, 2019). They are more suitable for medium and large projects due to the number of required resources such as complex software and skilled personnel (Heldman, 2017).

1. Modeling technique - Sensitivity analysis

The purpose of a sensitivity analysis is to establish the risk events which have the greatest impact or value. Those events are later weighed against the objectives of the project. The higher the level of uncertainty a specific risk has, the more sensitive it is concerning the objectives. In other words, the risk events which are the most critical to the project are the most sensitive and appropriate action needs to be taken. (Heldman, 2017) The result from the analysis can be presented in a spider diagram, Figure 2.1, that shows the areas in the project which are the most critical and sensitive. Moreover, one disadvantage with this analysis is that the variables are considered separately, which means that there is no connection between them (Smith et al. 2006).

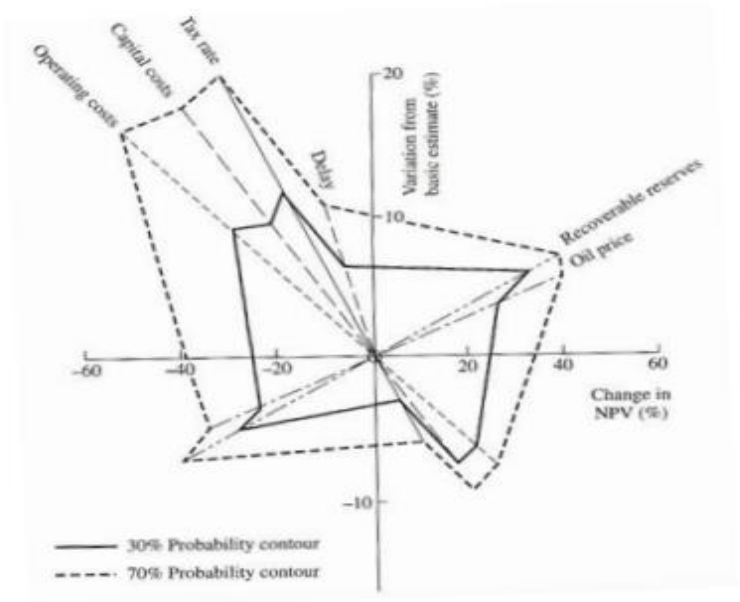

Figure 2.2 This figure shows how a sensitivity analysis can look like.

The method requires a model of project in order to be analyzed with computer software. According to Smith et al. (2006), the project will benefit if the method is carried out in the project's initial phases in order to focus on critical areas during the project.

2. Monte Carlo Simulation

Simulation is a probability-based technique where all uncertainties are assumed to follow the characteristics of random uncertainty. A random process

is where the outcomes of any particular process are strictly a matter of chance (Flanagan, 2018). The Monte Carlo process is simply a technique for generating random values and transforming them into values of interest, the methods of generating random or pseudo random numbers are more sophisticated now and the mathematics of other distributions is more complex (Yoe, 2020). Different values of risk variables are combined in a Monte Carlo simulation. The frequency of occurrence of a particular value of any one of the variables is determined by defining the probability distribution to be applied across the given range of values. The results are shown as frequency and cumulative frequency diagrams. The allocation of probabilities of occurrence to each risk requires the definition of ranges for each risk (Merna & Stroch, 2020). Lukas (2017) presented risk analysis simulation steps:

1. Start with a project estimate done for each cost account.
2. Decide on the most likely cost, pessimistic costs, and optimistic costs.
3. Insert data into simulation software, then run the model.
4. Determine contingencies based on desired risk level.
5. Prioritize "risky" cost accounts for risk response planning.

This method of sampling (i.e. random sampling) will, lead to over- and under-sampling from various parts of the distribution. In practice, this means that in order to ensure that the input distribution is well represented by the samples drawn from it, a very large number of iterations must be made. In most risk analysis work, the main concern is that the model or sampling scheme we use should reproduce the distributions determined for the inputs (Abrahamsson, 2019). On the other hand, Lukas (2017) stated some of the simulation benefits:

i. Improves estimate accuracy, it helps determine a contingency plan for an acceptable level of risk.
ii. Helps determine the bigger cost risks for risk response planning.

2.5.2. Qualitative Methods

Performing a comprehensive risk analysis is essential in identifying and managing risks in residential construction projects. According to Aibinu and Jagboro (2002), the risk analysis process involves identifying potential risks, assessing their likelihood and impact, and developing strategies to manage or mitigate them. There are several methods for performing risk analysis, including:

i. Failure Mode and Effects Analysis (FMEA)

FMEA is a structured approach to identify and evaluate potential failure modes and their effects on a system. It is widely used in the construction industry to identify risks and develop strategies to manage them. According to Raji and Adaja (2016), FMEA is effective in identifying potential risks in the construction process and developing strategies to manage them.

ii. Hazard Identification (HAZID)

HAZID is a systematic approach to identify potential hazards that may cause harm to people, the environment, or assets. It is commonly used in the oil and gas industry and can be adapted to the construction industry. According to Ogunsemi and Olubodun (2017), HAZID is effective in identifying hazards that may be overlooked in the design and construction process.

iii. Risk Assessment Matrix (RAM)

RAM is a simple tool that helps to prioritize risks based on their likelihood and impact. It is commonly used in the construction industry to identify risks and develop strategies to manage them. According to Al-Sulaimani et al. (2019), RAM is a practical tool that can be used to identify and prioritize risks in construction projects.

iv. Bowtie Analysis

Bowtie analysis is a graphical risk assessment tool that visualizes the relationships between hazards, consequences, and control measures. It is effective in identifying potential hazards, evaluating their consequences, and developing strategies to manage them. According to Zavadskas et al. (2019), bowtie analysis is useful in the construction industry for identifying potential hazards and developing strategies to manage them.

In conclusion, risk analysis is a critical process in managing risks in residential construction projects. The choice of method for performing risk analysis depends on the specific project and its requirements. However, it is essential to use a structured and systematic approach to identify and manage risks effectively.

2.5.3 Approaches for performing risk analysis

1. Response actions and control

It is not enough to identify and quantify risks. The main idea is to manage them. There are several ways of managing risks. Lewis, (2011) states in his book titled project planning, scheduling and control five ways of managing risks to be discussed here under; risk avoidance, mitigation (reduction, such as using airbags), transfer (as in loss prevention through insurance), accommodate: accept and live with risk, ignore the risk (very dangerous)

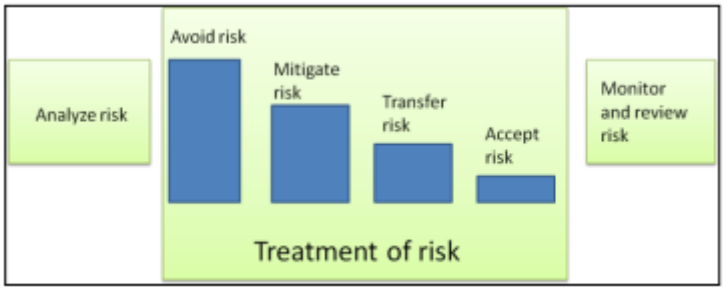

Figure 2.3: Risk treatment (Source: Berg 2010)

2. Risk avoidance

Risk avoidance includes not performing an activity that could carry risk. An example would be not buying a property or business in order to not take on the liability that comes with it. Another would be not flying in order to not take the risk that the airplanes were to be hijacked. Avoidance may seem the answer to all risks, but avoiding risks also means losing out on the potential gain that accepting (retaining) the risk may have allowed. Not entering a business to avoid the risk of loss also avoids the possibility of earning profits

3. Risk mitigation

It involves methods that reduce the severity of the loss. The most obvious strategy is to prevent or avoid unwanted risks. In order to avoid economic loss, the contractor could refuse to bid for any unattractive tenders. The end result would likely be getting no or little work to do. Because if we do not take any risk, we cannot expect any reward. There are two strategies for mitigating risk (a) reduces the likelihood that the event will occur and/or (b) reduce the impact that the adverse event would have on the project. In general, through careful and detailed designs or more thorough pre contract investigation and planning, it is possible to mitigate most possible risks

4. Risk retention

Risk retention accept and live with risk It involves accepting the loss when it occurs. True self-insurance falls in this category. Risk retention is a viable strategy for small risks where the cost of insuring against the risk would be greater over time than the total losses sustained. All risks that are not avoided or transferred are retained by default. This includes risks that are so large or catastrophic that they either cannot be insured against or the premiums would be infeasible. This may also be acceptable if the chance of a very large loss is small or if the cost to insure for greater coverage amounts is so great it would hinder the goals of the organization too much.

5. Risk transfer

Insurance is one way of protecting against loss in the event that a risk manifests itself. Having alternative sites available into which a group can move in the event of a disaster is a loss prevention strategy. Backup personnel can also be thought of as loss avoidance. When a key person falls ill, if someone else can do the work, there will be no loss to the project of course; this is difficult to do with highly skilled personnel.

2.6 RISK MANAGEMENT PROCESS FOR RESIDENTIAL DEVELOPMENT

The risk management process is a crucial component of residential development projects. According to Laryea and Fenton (2018), the risk management process involves identifying potential risks, assessing their likelihood and impact, developing strategies to manage or mitigate them, and monitoring and reviewing their effectiveness. The following are the steps involved in the risk management process for residential development projects:

Risk identification: This involves identifying potential risks that may affect the residential development project. Risk identification can be done through brainstorming sessions, review of previous projects, and consultation with stakeholders. According to Aladenika et al. (2020), risk identification is a critical step in the risk management process for residential development projects.

Risk assessment: This involves assessing the likelihood and impact of identified risks. Risk assessment can be done using quantitative or qualitative methods. According to Alinaitwe et al. (2019), risk assessment helps to prioritize risks based on their likelihood and impact.

Risk mitigation: This involves developing strategies to manage or mitigate identified risks. Risk mitigation can be done through risk transfer, risk avoidance, risk reduction, or risk acceptance. According to Odeyinka and Yusif (2018), risk mitigation is essential in reducing the likelihood and impact of risks in residential development projects.

Risk monitoring and review: This involves monitoring the effectiveness of the risk management strategies and reviewing the risk management plan regularly. According to Odeyinka and Yusif (2018), risk monitoring and review help to identify new risks and ensure that the risk management strategies are effective.

It is crucial to note that the risk management process is an iterative process that requires continuous monitoring and review. According to Aibinu and Jagboro (2019), the risk management process should be integrated into the project management process to ensure that risks are effectively managed throughout the project lifecycle.

When a project has been identified, it is initiated by the business developer. Each region operates in the most suitable way for their local market. For each new project, a project mission is stated; the business developer is to define the project and identify if any predetermined building parts can be used in the project. Before the project reaches the first tollgate, the business developer establishes a project book where the initial risks are documented. The risks are also documented in the estimation tool that is used by both the developer and contractor. Identified risks are assessed as a flat rate based on previous projects and previous experiences, and the analytical tools helps with providing the flat rates. The regional manager for both the developer and contractor need to approve the project mission to ensure that the project is viable for both entities and the contractor provides a tender. For the initial tollgate, no separate risk inventory document needs to be produced.

Once the contractor receives the scope, they initiate their tendering process. The district manager ensures that the scope provided is approved in accordance to the Heat Map, before the tendering process can be initiated. The Heat Map stipulates if the contractor needs to establish an Operational Risk Assessment (ORA). The ORA provides the scope, the tender and information about the client, as well as all the identified risks. The ORA process is similar to the previously mentioned RFI process that the developer adheres to. The ORA is analyzed and approved by the governing body before the tender can be submitted. The contractor also submits a risk inventory similar to the one that developer submits and risks are identified and assessed from the contractor's perspective. The risk inventory for the contractor works in the same fashion as the one for the developer. Each identified risk is given a probability and a consequence. Each identified risk is then given an action plan or workset and a project member responsible for the specific risk. All risks identified are also reported in the estimation tool. Furthermore, technical consultants and experts are asked to provide an independent risk inventory within their respective field. Throughout the tendering process, the risk inventory will be continuously updated as new risks are identified and previous risks are mitigated. If deemed necessary, a separate risk coordinator or risk group is designated to the project.

In conclusion, the risk management process is a critical component of residential development projects. The process involves identifying potential risks, assessing their likelihood and impact, developing strategies to manage or mitigate them, and monitoring and reviewing their effectiveness. The effective implementation of the risk management process can help to reduce the likelihood and impact of risks in residential development projects. The project team reports the knowledge generated from the project to the rest of the organization to share the knowledge. The company's risk management process described in the management system is illustrated below

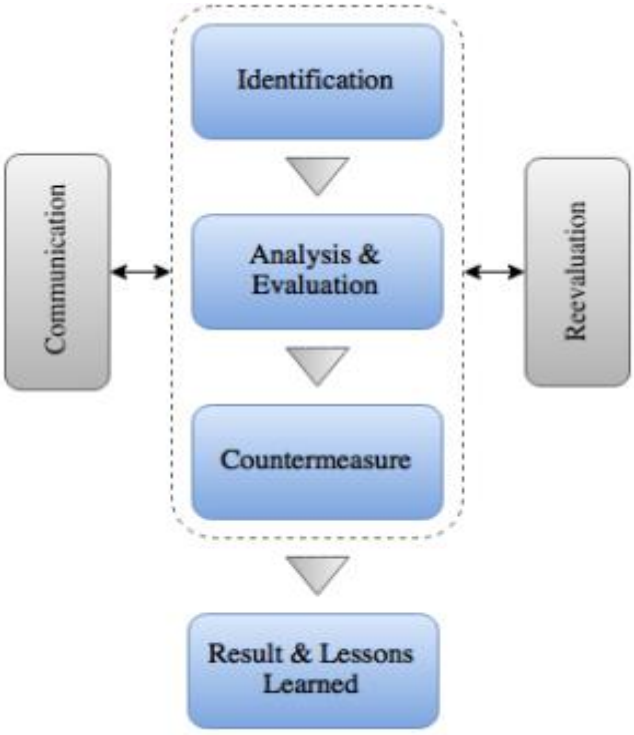

Figure 2.3 Intended risk mangment process (www.techtarget.com)

To summarize, the company intends to work according to the following process: identification, analysis and evaluation, countermeasures, and outcome & lessons learned. During the first three steps, the process is linked to two outside sources: communication and follow-up/reevaluation.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 RESEARCH DESIGN OF THE STUDY

Research design is a blueprint or scheme that is used by the researcher for specific structure and strategy in investigating the relationship that exists among variables under the study so as to enable him or her collect data which will be used for study. According to Onwumere (2019), research design is a kind of blue print that guides the researcher in his or her investigation and analysis. The decision for the choice of a research design should be based on the research style which is also dependent on the formulation of the research question. For the assessment of risk management for residential construction projects in Abuja, a descriptive survey research design was employed. This design was chosen because it enabled the researcher to collect data on the current practices of risk management in residential construction projects in Abuja and provided a clear picture of the situation.

3.2 AREA OF STUDY

The study was carried out in Julius Berger Construction Company, Abuja. Julius Berger is a Nigeria construction company. Julius Berger (2017). Julius Berger Nigeria Plc is a leading Nigerian company offering holistic services covering the planning, design, engineering, construction, operation and maintenance of buildings, infrastructure and industry projects in Nigeria. The company is represented across Nigeria in structural engineering and infrastructure works, and in southern Nigeria through domestic and international oil and gas industry projects. It is known for constructing most of Nigeria's infrastructures, major expressways, Including the construction of Maitama District and Central Area phase II in Abuja which covers the infrastructure of a residential area, highways, and residential roads.

3.3 POPULATION OF THE STUDY

The primary method of sampling for self-reporting measure is purposive sampling useful for deliberating selecting respondents and cases with rich information about the phenomenon under study (Patton 1987). According to Ngcareers (2020) the total number of employees in the construction industry is 18,000, both civil and building contractors. For the purpose of this research, the population is civil and building contractors in the company in Nigeria. But still the population was reduced to a total number of 137 respondents. Whereas building contractors were 92 and 45 were civil contractors.

3.4 SAMPLING TECHNIQUES

For the purpose of this study, the sampling technique that is used is the stratified random sampling technique which involves diving the entire heterogeneous population into homogenous groups called strata then random samples are then selected from each stratum. Therefore as the building contractors in Julius Berger are heterogeneous since they are in different classes and that they are possible to be dealt into respective classes then the stratified random sample is ideal to be used.

3.5 SAMPLING SIZE

The total sample size of the study was 60 respondents/contractors. The sample size of 60 was randomly selected from the sub-population of contractors in both Julius Berger and other construction firms in Abuja. The strata (sub-population) is based on the size of construction project they handle (small projects, medium projects and large projects) from which 60 contractors was randomly selected from the stratum to create the sample size for the study.

3.6 QUESTIONNAIRE

A questionnaire consists of a set of questions presented to a respondent for answers. Babbie (2019) notes that the open-ended types of questions give respondents freedom of response, the forced types facilitate consistency of certain data across respondents, while monadic-type questions help in assessing the level of agreement or disagreement among the respondents, regarding the individual indicators of risk management. The questionnaire identified from literature and through discussion with industry practitioners, various risk types encountered at the project level. In this study, two dimensional approaches to measurement of risk have been adopted, in which case the likelihood or probability of risk occurring and the impact in case of occurrence have been considered.

3.7 DATA ANALYSIS

The analysis was done using descriptive method of analysis. Data obtained through questionnaires were coded, keyed into Statistical Package for the Social Sciences (SPSS) V.20 software and edited.

Using the responses obtained from the questionnaires, mean of the scores was calculated. The formula for mean index is as shown below:
Mean Index =

a^i = constant expressi$\frac{\sum a_i x_i}{N}$ weight to each response (1 to 5)

x^i= frequency of the response

N = total number of responses

The results were then used to assign the scores of likelihoods and consequences into risk matrix analysis. The grading of the results to be assigned in the matrix analysis is as follows:

1.0 - <1.5: Rare/insignificant

1.5 - <2.5: Unlikely/ Minor

2.5 - <3.5: possible/Moderate

3.5 - <4.5: Likely/Major

4.5 - <5.0: Almost Certain/ Catastrophic

CHAPTER FOUR

4.0 DATA ANALYSIS AND RESULT INTERPRETATION

4.1 RESPONSE RATE

Table 4.1 Distribution and returned questionnaires

Questionnaires	**Frequency (N)**	**Percentage (%)**
Distributed questionnaires	60	100%
Returned questionnaires	42	67.7%
Invalid questionnaires	8	13.3%

Source: Field work (2023)

Through a questionnaire survey, randomly selected practitioners in construction projects were involved. However, out of 60 (100%) questionnaires distributed, only 42 (67.7%) responded and 8(13.3%) were rejected due to improper answering. Subjects included practicing quantity surveyors, engineers and builders. These professionals were in the employment of construction companies performing contractors' works.

4.3 RESPONDENT'S DISTRIBUTED CHARACTERISTIC

This section presents the background characteristics of the respondents Considerable percentage of the respondents had handle over in construction projects. This demographic distribution of the respondents makes the data collected fit for analysis as the respondents are all profession gender, professionally qualified and have practical experience of construction work

Table 4.2 Gender Distribution of Respondents

GENDER	**FREQUENCY (N)**	**PERCENTAGE (%)**
Male	38	90.5%
Female	4	9.5%
TOTAL	**42**	**100%**

Source: Field work (2023)

From the table 4.2 above, the results shows that majority 38 of the respondents representing 90.5% were male while few 4 respondents representing

9.5% were female.

Table 4.3: Professional Distribution of Respondents

RESPONDENTS	CLASS I	CLASS II
Building contractors	50%	16.7%
Civil contractors	23.3%	10%

Source: Field work (2023)

The proportion of the respondents comprised of 50% of class I building contractors, 16.7% class II building contractors, 23.3% class I civil contractors and 10% class II civil contractors as shown in table 4.3.

Table 4.4 Years of Experiences of Respondents

Years	Frequency	Percentage
1 – 5 years	9	22.5%
6 – 10 years	20	45%
11 – 15 years	9	22.5%
16 – 20 years	2	5%
21 – 25 years	2	5%
TOTAL	**42**	**100%**

Source: Field work (2023)

Table 4.4 indicates the years of experience of respondents. It was revealed that majority of the respondents have between 6 and 10 years of experience that is 18 (45%) professionals. 9(22.5%) of the professionals have between 1 and 5 years and 11 – 15 years of experience respectively. 4(5%) of the respondents have years of experience ranging from 16 – 25 years. This implies that the respondents are experienced enough to provide reliable information required for the study.

4.4 DESCRIPTIVE ANALYSIS

This section presents the results of the analyses carried out for the study. The discussions of these results also follow the presentation of the results which were summarized according to this study research questions.

4.4.1 Research Question 1.

What are the various risks found in residential construction in your company?

From the study, by conducting literature reviews, it has been seen that, the risks in residential construction project can be classified into seven broad categories which are; physical risk; construction risk; design risk; political risk; financial risk; legal – contractual risk and environmental risk. From these seven categories of risks, four groups have been identified that they need more attention. The respondents were given the tables showing lists of risk for them to rank and they were required to rank: for the risk frequency of occurrence**.** For the degree of risk impact, 1=**insignificant**, 2=**minor**, 3=**moderate**, 4=**major**, **catastrophic (unacceptable)** and the results are summarized in tables below.

Table 4.6: Weighted Values of the Various Risk Types in the Residential Construction Projects

Risk type	Mean index	Ranks	Weighted Value (W)
Financial Risk (F)	3.8212	1	7
Physical Risk (P)	3.7870	2	6
Environment Risk (E)	3.6403	4	4
Design Risk (D)	3.6665	2	5
Legal Risk (L)	3.6072	5	3

Table 4.5 show the summary of the mean index and the weighted values of all the risk affecting construction industry. From the result of the research, financial risk was ranked first, followed by physical risk. The application of Risk Management Index (RMI) will therefore enhance performance of construction projects in Nigeria.

Table 4.6: Risks in Residential Construction Projects

RISK LIKELIHOOD CONSEQUE LEVEL NCES			
FINANCIAL RISK			
Availability of funds	4.16	4.53	Catastrophic
Failure of low bidder to enter construction contract	3.36	3.56	Major
Cash flow problems due to slow payment & dispute	4.53	4.28	Catastrophic
Loss due to default of contractor, supplier etc.	3.67	3.58	Major
Inflation	2.56	3.66	Major
Exchange rate fluctuation	2.06	2.02	Moderate
Business disruption	4.03	4.53	Catastrophic
PHYSICAL RISK			
Inclement, weather, fire, landslip	1.75%	3.75%	Major
Pestilence or deadly disease	1.78%	3.53%	Major
Injury	2.02%	3.11%	Moderate
Unexpected events or unforeseen circumstances, for instance car crashed at the construction site	1.00	5.00	Major
Death	1.12%	4%	Major
Theft	2.10%	3.30%	Moderate

DESIGN RISK			
Incomplete and poorly defined design 2.84 3.09 Moderate scope			
Unavailability of information and 2.81 2.78 Moderate incomplete design information			
Design errors and frequent changes resulting in variations	2.59	2.63	Moderate
The risk of late confirmation and approval of design	2.80	3.89	Major
Appropriateness of specification	2.84	2. 59	Moderate
Interaction of design and constructability	2.10	2.21	Moderate
Quality control exercised inspection & late confirmation and approvals	3.00	3.00	Moderate
ENVIRONMENTAL RISK			
Ecological damage	3.48	3.73	Major
Pollution	2.24	3.00	Moderate
Waste treatment	3.01	3.00	Moderate
Public enquiry	3.37	3.2	Moderate
Regulations and possible changes	2.56	2.56	Moderate
Recording and preserving historical finds	1.91	2.87	Low
Minority interests	2.56	2.98	Moderate

Source: Field work (2023)

In financial risk category, there are seven types of risks all together. Out of the which, Failure of low bidder to enter construction contract was seen as major risk with the value of 4.53, followed by Loss due to default of contractor with the value of 3.58, supplier and Inflation with value of 3.66 while Exchange rate fluctuation was on a moderate risk agreeing with value of 2.02.

From the result shown above in table 4.6, on the physical risk it revealed that among of the risks identified under this category four of them have major level of risks. The rest have moderate level of risk due to the small likelihood of it to happen although each and every type of risk under this category has quite substantial consequences that might affect the construction project. Moderate type of risk means that specific management responsibility is needed to manage this type of risks.

In design risk result from table 4.6, collectively there are seven types of risks identified in this study. As of the seven risks, only one type of risk is recognized as having major level of risk. Whereas the rest are measured as having only moderate level of risk. The type of risk that has major level of risk in the design risk category is late confirmation and approval of design in which it is considered as major level due to the magnitude of its consequences that is too high. However, the likelihood of it is average. In the design risk, the late confirmation and approval of design are accepted as having major level of risk may be due to the absolute important of it in the design stage. Major level of risk signifies that detailed action / plan are required to deal with it. The rest of the types of design risks are accepted as having moderate level of risk as the probability of the likelihood and the severity of the consequences are average. This might be because the respondents can tolerate those risks and it is acceptable to them.

From the findings, the environmental impact has been under attention of government as it becomes public concern. The result shows that under the environmental risk, there are five types of risk identified. Between them, one type of risks is considered as having high level of risk which is ecological damage, and another one is public enquiry on environmental issues with regards to undergoing projects. This type of risk might have high level of risk

due to its probability of likelihood and severity of impact or consequences which are agreed by most respondents of this study as quite high. Pollution, waste treatment, regulations and possible changes, and among others minority interests are considered as having moderate level of risk. In spite of this, there is one type of risk under this category that is recognized as having low level of risk which is recording and preserving historical finds. Only this risk has low level of risk from all types of risk identified not only in this category but also in other categories. This may be due to a very rare likelihood of this risk to happen. Yet, the consequences of it if it does occur are still considered as quite high. Thus, it still needed to be managed.

4.4.2 Research Question 2

What are the risk mitigation strategies put in place in the selected construction firm for residential projects in the study area?

The respondents were given the tables showing lists of risk mitigation strategies put in place for them to rank and they were required to rank: for the risk frequency of occurrence**.** The results are summarized in tables 4.7 below.

Table 4.7 Mean Ranking of Risk Mitigation Strategies in Abuja

STATEMENT	N	MEAN SD		RANK
The project has a defined or standard risk management process	42	5.25	420	1
There is a policy or guideline that recommends how to manage unexpected uncertainties.	42	4.73	378	2
There is a responsible person or department assigned to handle risk when it occurs	42	4.53	362	3

Source: Field work (2023)

From table 4.7, the ranking of the respondents view about risk mitigation strategies in Abuja Residential construction Industry. The results shows that "the project has a defined or standard risk management process" was rank 1st agreeing with the mean of 5.25 and SD = 420, followed by "here is a policy or guideline that recommends how to manage unexpected uncertainties" which was ranked 2nd with the mean of 4.73 and SD = 378. There is a responsible person or department assigned to handle risk when it occurs was ranked 3rd with the mean of 4.53.

4.4.3 Research Question 3

What are the processes and measures in managing risk in residential construction project?

This section presents opinion of the respondents on the process and measures in managing risk in residential construction project. The summarized result is presented in the table 4.8 below.

Table 4.8 Mean Ranking on Preventive Measures of Risk Factors in residential Projects

STATEMENT	N	MEAN	SD	RANK
Relevant stakeholders are involved in risk management planning	42	4.63	370	1st
The project team decides how to approach and plan risk management activities before the project is launched	42	4.53	362	2nd
Expert judgment is considered or meetings are conducted while planning for risks that might occur in the project.	42	4.53	362	2nd
Environmental factors are taken into account during risk planning.	42	4.46	357	3rd
Potential risks are identified and assessed in a methodical way	42	4.39	351	4th
Sources of risks, areas of impacts, and their corresponding causes and potential effects are identified in the project.	42	4.35	348	5th
Overall risks for the project are ranked to indicate the overall risk position	42	4.18	334	6th

of a project relative to other projects undertaken by your company.				
Project documents and risk register are updated after assessment of the risk that might occur.	42	3.93	314	7th
The project keeps track of identified risks , monitor residual risks and ensure execution of risk plans to evaluate their effectiveness	42	3.80	304	8th
The project uses the following tools to monitor and control risk management effectiveness	42	3.75	300	9th
There is a well-developed strategy within the Project to respond to risk	42	3.66	293	10th
Corporate and strategic objectives of the company are clearly defined and they are well communicated and understood at project level.	42	3.65	285	11th

For Table 4.9, the ranking of the respondents view about preventive measures of risk factors that are applied in their respective organisations. It was assigned a scale of 1-5 to represent strongly disagree, disagree, uncertain, strongly agree and agree. Relevant stakeholders are involved in risk management planning was ranked the most with a mean sum of 4.63, the project team decides how to approach and plan risk management activities before the project is launched and expert judgment is considered or meetings are conducted while planning for risks that might occur in the project with 4.53. Environmental factors are taken into account during risk planning with 4.46, Potential risks are identified and assessed in a methodical way with 4.36, while there is a well-developed strategy within the project to respond to risk with 3.66was ranked tenth, corporate and strategic objectives of the company are clearly defined and they are well communicated and understood at project level with 3.65 was ranked eleventh.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY

By conducting analysis and discussion on this chapter, various findings and results are gathered. The pre-defined objectives are achieved by focusing to answer the research question during the analysis and discussion. The results and findings gathered throughout the study are summarized in this chapter by referring to the objectives of the study as the goal of this study is to accomplish the objectives of the study.

5.1.1 Obj 1 Identification of the various risks in residential construction project

Identifying the various risks in residential construction projects is crucial to ensure that risks are effectively managed throughout the project lifecycle. According to Aladenika et al. (2020), the identification of risks in residential construction projects is a critical step in the risk management process.

One of the significant findings on the identification of risks in residential construction projects is that risks can be categorized into different types. Alinaitwe et al. (2019) categorized risks in residential construction projects into four main types: design risks, construction risks, environmental risks, and legal risks. Design risks relate to the adequacy and suitability of the design of the project, while construction risks relate to the construction process itself, such as labor shortages or material supply issues. Environmental risks are related to natural disasters, such as floods or earthquakes, while legal risks involve issues such as permits and zoning regulations.

Another significant finding is that risks in residential construction projects can be classified based on their impact and likelihood. According to Laryea and Fenton (2018), risks can be classified as low, medium, or high impact based on the severity of their consequences. Similarly, risks can be classified as low, medium, or high likelihood based on the probability of their occurrence.

Moreover, the findings suggest that stakeholder engagement is essential in identifying risks in residential construction projects. Alinaitwe et al. (2019) emphasize that stakeholders' input, including project owners, contractors, and design professionals, is crucial in identifying risks.

Finally, the findings suggest that the use of technology can improve the identification of risks in residential construction projects. According to Aladenika et al. (2020), the use of building information modeling (BIM) can help in identifying and managing risks in residential construction projects

by providing a visual representation of the project's design and construction processes.

In conclusion, the identification of risks in residential construction projects is crucial in ensuring that risks are effectively managed. The findings suggest that risks can be categorized into different types, classified based on their impact and likelihood, and stakeholder engagement and technology can improve the risk identification process. Therefore, stakeholders involved in residential construction projects should pay close attention to risk identification and incorporate it into the risk management process to achieve successful project outcomes.

5.1.2 Obj 2 to assess the risk Mitigation strategies put in place in the selected construction firm for residential construction project

Risk mitigation is a crucial aspect of the risk management process in residential construction projects. According to Yacout et al. (2019), risk mitigation refers to the process of taking steps to reduce the likelihood and impact of identified risks.

One of the significant findings is that the construction firm implemented a comprehensive risk management plan. According to Giza et al. (2018), a risk management plan outlines the procedures and strategies that will be used to identify, assess, and mitigate risks. The construction firm's risk management plan included identifying risks early in the project lifecycle, assessing the likelihood and impact of identified risks, and developing mitigation strategies to reduce the risks.

Another significant finding is that the construction firm used a proactive approach to risk mitigation. According to Yang et al. (2018), a proactive approach involves taking steps to prevent risks from occurring. The construction firm put in place measures to prevent risks from occurring, such as using high-quality materials and equipment, hiring skilled labor, and ensuring that the construction site was safe and secure.

Moreover, the findings suggest that the construction firm collaborated closely with stakeholders to mitigate risks. According to Mousavi and Mohammadi (2019), stakeholder collaboration is essential in the risk management process as it enables stakeholders to share their expertise and knowledge, which can be used to identify and mitigate risks. The construction firm collaborated with project owners, contractors, and design professionals to identify and mitigate risks.

Finally, the findings suggest that the construction firm used technology to enhance risk mitigation efforts. According to Wong et al. (2020), technology can help in risk mitigation by providing real-time data, enhancing communication and collaboration, and providing tools to identify and mitigate risks. The construction firm used technology such as building information modeling (BIM) to identify and mitigate risks by providing a visual representation of the project design and construction process.

In conclusion, the selected construction firm implemented comprehensive risk mitigation strategies, including a risk management plan, a proactive approach to risk mitigation, stakeholder collaboration, and technology to enhance risk mitigation efforts. These findings suggest that construction firms involved in residential construction projects should adopt similar risk mitigation strategies to reduce the likelihood and impact of identified risks and achieve successful project outcomes.

Obj 3 to assess the processes and measures for implementing risk management in residential construction project in Abuja.

Assessing the processes and measures for implementing risk management in residential construction projects is crucial in ensuring successful project outcomes. This section will summarize findings on the processes and measures for implementing risk management in residential construction projects in Abuja.

One of the significant findings is that there is a lack of awareness of the importance of risk management in residential construction projects. According to a study by Afolabi et al. (2018), many stakeholders in the construction industry, including project owners, contractors, and design professionals, do not understand the importance of risk management in construction projects. This lack of awareness can lead to a failure to implement appropriate risk management measures, which can result in project failure.

Another significant finding is that there is a need for effective communication and collaboration among stakeholders in the risk management process. According to Oyewobi et al. (2019), effective communication and collaboration among stakeholders can lead to the identification and mitigation of risks before they become major problems. The study suggests that regular meetings, clear communication channels, and the involvement of stakeholders in the risk management process can enhance communication and collaboration among stakeholders.

Moreover, the findings suggest that there is a need for a comprehensive risk management plan for residential construction projects. According to Omoteso et al. (2020), a risk management plan should outline the procedures and strategies for identifying, assessing, and mitigating risks. The study suggests that a risk management plan should include risk identification and assessment procedures, risk mitigation strategies, and a risk response plan.

Finally, the findings suggest that technology can enhance the risk management process in residential construction projects. According to Uzairu et al. (2021), technology such as building information modeling (BIM) can be used to identify and mitigate risks by providing a visual representation of the project design and construction process. The study suggests that the use of technology can also enhance communication and collaboration among stakeholders in the risk management process.

In conclusion, the findings suggest that the processes and measures for implementing risk management in residential construction projects in Abuja should include awareness of the importance of risk management, effective communication and collaboration among stakeholders, a comprehensive risk management plan, and the use of technology to enhance the risk management process. Construction firms involved in residential construction projects

in Abuja should adopt these measures to mitigate risks and achieve successful project outcomes.

5.2 CONCLUSION

Three categories of risks have been identified some of which have extreme and high-risk level. The categories of risks having extreme and high level of risks are financial risks construction risks, and physical risks.

Upon completing this study, the level of risks for each type of construction project risks has been identified. On the same tables that represent the outcome of first objective which is table 4.6 in previous chapter, the level of risk for each type of risk is indicated. For the level of risk, by referring to risk matrix analysis table, the risks are categorized into four level of risk which are low level, moderate level, high level and extreme level. There are several types of risks considered as having extreme level of risk which is under financial risk consists of availability of funds risk, cash flow problem due to slow payment and dispute, and business disruption risk. Therefore, it is obvious that financial risk has highest ranking of risk factors. This is followed by construction risks and physical risks. By comparing to other similar study, the results of this study are reliable as in one of the studies observed, the result are same which in that study too, the financial risk are considered as having highest ranking of risk factors. Other than those extreme risks, there are also other types of risks in this study ranked as having high level of risk. For the extreme risk, it requires detailed action or plan. While for high risk, senior management's attention is needed. In moderate level of risk, it is the responsibility of specific management to overcome the risk and for the low level of risk; it can be managed by routine procedures. By gaining this result, the second objective of the study has been achieved.

In conclusion the (RMI) will reduce cost and time overrun and improves the quality of construction project. The risk index will also help government at all levels to develop a strategy to reduce risk on construction projects, will assist construction investors and developers to make decisions on their project and will enable banks to carry out feasibility and viability analysis on the project before they engage their service. In addition, the insurance companies will also rate construction risk using the (RMI) to determine the risk index of the project. From the analysis above, it becomes imperative that efficient in risk management will have positive effect on the Nigeria construction industry and the economy at large.

5.3 RECOMMENDATION

Based on the findings on the various risks in residential construction projects, this section will provide recommendations on how to identify and manage these risks effectively according to the study objectives.

5.3.1 Identification of the various risks in residential construction project

Firstly, it is recommended that a risk identification workshop be conducted at the onset of the project. This workshop should involve all stakeholders in the project, including the project owner, design professionals, contractors, and subcontractors. The workshop should focus on identifying potential risks associated with the project, such as site conditions, weather, labor shortages, design errors, and material availability. This process will ensure that risks are identified and documented in a timely manner, reducing the likelihood of unforeseen risks impacting the project.

Secondly, it is recommended that a risk register be established and updated regularly throughout the project. The risk register should include all identified risks, their likelihood of occurrence, potential impacts, and the strategies for mitigating them. This document should be shared among all stakeholders in the project to ensure everyone is aware of the risks and the strategies for managing them. Regular reviews of the risk register will ensure that new risks are identified and managed in a timely manner.

Thirdly, it is recommended that a risk management plan be established to guide the risk management process. The plan should outline the procedures and strategies for identifying, assessing, and mitigating risks. This plan should be integrated into the overall project plan and reviewed regularly to ensure its effectiveness.

Fourthly, it is recommended that a risk management team be established to oversee the risk management process. The team should include representatives from all stakeholders in the project and be responsible for managing the risks identified in the risk register. The team should meet regularly to review the risk register, discuss new risks, and develop strategies for mitigating them.

Lastly, it is recommended that technology be utilized to enhance the risk management process. Building Information Modeling (BIM) technology can be used to identify and mitigate risks by providing a visual representation of the project design and construction process. This technology can also enhance communication and collaboration among stakeholders in the risk management process.

The recommendations for identifying and managing risks in residential construction projects include conducting a risk identification workshop, establishing and updating a risk register, developing a risk management plan, establishing a risk management team, and utilizing technology to enhance the risk management process. These recommendations, if implemented effectively, will lead to the successful management of risks in residential construction projects, ensuring project success and client satisfaction.

5.3.2 The Risk Mitigation strategies put in place in the selected construction firm for residential construction project

Based on the findings on the risk mitigation strategies in the selected construction firm for residential construction projects, the following recommendations are proposed to enhance their risk management practices.

Firstly, it is recommended that the construction firm establishes a formal risk management plan that outlines the strategies and procedures for identifying, assessing, and mitigating risks. This plan should be integrated into the overall project plan and reviewed regularly to ensure its effectiveness. By having a formal plan in place, the construction firm can effectively manage risks and ensure project success.

Secondly, it is recommended that the construction firm conducts regular risk assessments at various stages of the project, such as during the design and construction phases. This will ensure that risks are identified and managed in a timely manner, reducing the likelihood of unforeseen risks impacting the project. The risk assessments should be documented in a risk register that includes the potential risks, their likelihood of occurrence, potential impacts, and strategies for mitigating them.

Thirdly, it is recommended that the construction firm establishes a risk management team responsible for overseeing the risk management process. This team should include representatives from all stakeholders in the project and should meet regularly to review the risk register, discuss new risks, and develop strategies for mitigating them.

Fourthly, it is recommended that the construction firm utilizes technology to enhance their risk management practices. Building Information Modeling (BIM) technology can be used to identify and mitigate risks by providing a visual representation of the project design and construction process. This technology can also enhance communication and collaboration among stakeholders in the risk management process.

Lastly, it is recommended that the construction firm engages in continuous improvement of their risk management practices by regularly reviewing and evaluating their risk management processes. By identifying areas for improvement, the construction firm can enhance their risk management practices and ensure project success.

In conclusion, the recommendations for enhancing the risk mitigation strategies in the selected construction firm for residential construction projects include establishing a formal risk management plan, conducting regular risk assessments, establishing a risk management team, utilizing technology to enhance risk management practices, and engaging in continuous improvement of risk management practices. By implementing these recommendations, the construction firm can effectively manage risks and ensure project success.

5.3.3 To assess the processes and measures for implementing risk management in residential construction project in Abuja.

Based on the findings on the assessment of the processes and measures for implementing risk management in residential construction projects in Abuja, the following recommendations are proposed to enhance their risk management practices.

Firstly, it is recommended that the stakeholders involved in the residential construction project in Abuja prioritize risk management by establishing a risk management culture within their organization. This can be achieved by developing policies and procedures that outline the importance of risk management, as well as providing training and education to employees on the importance of risk management.

Secondly, it is recommended that a risk assessment be conducted at the beginning of the project to identify potential risks and their potential impacts. This will enable the stakeholders to develop appropriate risk mitigation strategies and allocate resources accordingly. The risk assessment should be an ongoing process throughout the project, with regular reviews and updates to ensure that risks are being effectively managed.

Thirdly, it is recommended that the stakeholders establish a risk management team responsible for overseeing the risk management process. This team should include representatives from all stakeholders in the project and should meet regularly to review the risk register, discuss new risks, and develop strategies for mitigating them.

Fourthly, it is recommended that a contingency plan be developed and implemented to address potential risks that may arise during the construction process. The contingency plan should include a budget for potential risk management activities and a clear plan of action to be taken in the event that a risk does occur.

Lastly, it is recommended that the stakeholders utilize technology to enhance their risk management practices. Building Information Modeling (BIM) technology can be used to identify and mitigate risks by providing a visual representation of the project design and construction process. This technology can also enhance communication and collaboration among stakeholders in the risk management process.

In conclusion, the recommendations for enhancing the processes and measures for implementing risk management in residential construction projects in Abuja include establishing a risk management culture, conducting a risk assessment, establishing a risk management team, developing a contingency plan, and utilizing technology to enhance risk management practices. By implementing these recommendations, the stakeholders can effectively manage risks and ensure project success.

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