

Analysis Of Risk Management In Construction Project.

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Abstract: The construction industry is highly susceptible to uncertainties and risks that significantly influence project delivery in terms of cost, time, quality, safety, and sustainability. This study examined the analysis of risk management in project construction within the Nigerian construction industry. Specifically, the study identified the types of risks associated with project construction, examined the factors affecting risk management, and evaluated the effects of risk management on construction project performance. A descriptive quantitative research design was adopted. Data were collected through structured questionnaires administered to 80 construction engineers involved in risk management practices, out of which 74 valid responses were retrieved, representing a response rate of 92.5%. Descriptive statistical tools including frequency distribution, percentage analysis, mean item score, and standard deviation were used for data analysis. The findings revealed that inadequate site investigation, inadequate specification, contractor's experience, weather implications, natural disasters, new technology, and shortage of resources were among the most significant risks affecting construction projects. Resource availability, project complexity, and time compression were identified as the major factors affecting risk management implementation. Furthermore, the study established that risk management strongly affects project cost, completion time, productivity, project quality, health and safety, and environmental sustainability. The study concluded that effective risk management is essential for successful construction project delivery and recommended proper site investigation, adequate resource allocation, experienced workforce engagement, and proactive risk management strategies to improve project outcomes in Nigeria.

Keywords: Risk Management, Construction Projects, Project Performance, Construction Industry, Nigeria, Project Cost, Sustainability.

I. INTRODUCTION

1.1. Background of the Study:

The construction industry constitutes a major pillar of economic growth due to its contribution to infrastructure development, employment generation, and national Gross Domestic Product (GDP). Construction projects such as roads, bridges, hospitals, schools, commercial buildings, and residential structures are vital components of socio-economic development and sustainability, Ubayi, S. S. et al. (2024). However, the construction industry is characterized by high levels of uncertainty and risks compared to many other industries. Construction projects often experience delays, cost overruns, poor quality delivery, disputes, and even project abandonment due to ineffective risk management practices. Risks in construction projects are uncertain events or conditions that may positively or negatively affect project objectives.

These risks may arise from financial uncertainties, technical failures, environmental conditions, contractual disputes, labor shortages, design errors, or poor management practices.

Risk management has therefore become an essential component of construction project management. It involves the systematic process of identifying, analyzing, evaluating, responding to, and monitoring risks in order to minimize negative impacts and maximize project success. Effective risk management enhances project delivery in terms of cost control, timely completion, quality assurance, safety performance, and environmental sustainability. Despite the importance of risk management, many construction firms in Nigeria still lack structured and proactive risk management frameworks. Several construction projects in Nigeria continue to experience cost overruns, delays, poor workmanship, and abandonment due to inadequate risk identification and mitigation practices. This situation necessitates an

empirical investigation into the analysis of risk management in project construction.

The construction industry is the pillar part of the economy due to its important contribution in the infrastructure of any country (De Araujo et al., 2023). Today, the construction industry bears a potential risk comparing to other industries due unexpected risks associated with budget and schedule. As risks in construction projects are unpredictable, therefore managing risks in construction projects has been recognized as a very important process in order to achieve project objectives in terms of time, cost, quality, safety and environmental sustainability (Sambasi, 2024).

The construction industry contributes significantly to the growth of a nation's economy through the creation of value chains, providing employment, and contributing to the Gross Domestic Product (GDP). Schoon, (2020) described that construction projects encompass a wide range of endeavors like factories, commercial buildings, hospitals, schools, and highways, which are not just infrastructural developments but essential to modern societies' social and economic value creation. The construction industry has changed rapidly over the past ten years; companies are faced with more risk and uncertainty than before. Clients are more likely to engage in litigation when things go wrong. Risk in construction has been the object of attention because of time and cost overruns associated with construction projects (Owoo, 2022).

Risk is uncertain events or condition that, if it occurs has a positive or negative impact on project objectives. In Construction, risks are important factors to be considered through the different project development stages starting from initiating and planning and ending with construction and commissioning. If risks are not considered in projects this could lead to adverse effect on project objectives mainly: time, cost and quality of work completed. Jaffari, (2019) defined risk as the exposure to loss, gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude. Kartam (2017) has defined 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. It becomes important to address risks at the very early stages of

the project and be able to plan for the consequences of risks happening on the project, this should not be a haphazardous process.

Therefore, Risk management is defined as “the systematic process of identifying, analyzing and responding to project risks”. It includes maximizing the probability and impact of positive events and minimizing the probability and impact of negative events. The risk management process is composed of 6 key steps: risk management planning, risk identification, risk analysis, risk response planning and risk monitoring and control, Yusuwan, N., Adnan, M., & Omar, N. (2018). Bowen (2018), identified risk management as an important tool to cope with construction risks and to overcome problems of a project failure. Uher, (2020) described risk management as a management tool that aims at identifying sources of risk and uncertainty, determining their impact, and developing appropriate management responses. Furthermore, risk management in the construction project management context is a comprehensive and systematic way of identifying, analyzing and responding to risks to achieve the project objectives (ICE, 2015). As observed by Uher, (2020), risk management determines the success or failure of construction projects.

Managing risks in 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 (Kartam (2017). Risk management helps the key project participants - client, contractor or developer, consultant, and supplier - to meet their commitments and minimize negative impacts on construction project performance in relation to cost, time and quality objectives (Banaitiene, et al., 2021). If risks in construction are not properly identify, analysed and develop strategies to deal with them, the project is likely to lead to failures in meeting the construction target and high rate of construction abandonment will be recorded. A study conducted by Aminu (2018) on risk management in Nigerian construction industry showed that knowledge of cost and quality management as well as the attitude of the construction participants is the factors responsible for risk management application in Nigeria. Since it has been

observed that a properly implemented risk management process will enhance the successful completion of construction projects and thereby make the projects more profitable.

Many industries have become more proactive and aware of using analyses in projects. Likewise, risk management has become a timely issue widely discussed across industries. However, with regard to the construction industry, risk management is not commonly used (Klemetti, 2023). More construction companies are starting to become aware of the risk management, but are still not using models and techniques aimed for managing risks. Risks differ between projects due to the fact that every project is unique, especially in the construction industry (Gould & Joyce, 2022). However, there are still many practitioners that have not realized the importance of including risk management in the process of delivering the project (Smith, 2021). Even though there is an awareness of risks and their consequences, some organizations do not approach them with established risk management methods, (Adewale, 2022).

In Nigeria, construction projects cannot boldly claim to be adopting a generic methodology or widely certified or satisfactory method of managing risk within the sector, considering the nation as a developing country. Prior empirical research in Nigeria has demonstrated that industries that offer periodic construction services do not systematically implement project risk management practices, resulting in detrimental effects on project performance (e.g., total project abandonment) (Aibinu & Jagboro, 2022). In addition, the study by Ojo (2023) on claims and contract disputes in numerous construction projects revealed that risks not effectively analysed or integrated by clients, contractors, or consultants were one of the primary causes of claims and disputes in the building projects. In addition, Iroegbu (2024) made a similar point, saying that the Nigerian construction industry needs to put more emphasis on risks during construction projects and that these risks, when mismanaged, have contributed to the failure of many construction projects. Therefore, the study seeks to examine the analysis of risk management in project construction.

1.2. Statement of the Problem:

The Nigerian construction industry faces several challenges including project delays, budget overruns, poor quality delivery, health and safety issues, and project abandonment. These problems are often linked to ineffective risk management practices. Many construction organizations fail to systematically identify and manage risks during project execution. Inadequate site investigation, poor communication, shortage of resources, inexperienced workforce, design changes, and environmental uncertainties frequently contribute to poor project performance. Furthermore, limited empirical studies have quantitatively examined the relationship between risk management and project performance outcomes in Nigeria. This study therefore investigates the analysis of risk management in project construction with a view to identifying major construction risks, factors affecting risk management implementation, and the effects of risk management on project performance.

1.3. Objectives of the Study

The main objective of the study is to examine the analysis of risk management in project construction. The specific objectives are to:

1. Identify the types of risks associated with project construction.
2. Examine the factors affecting risk management in project construction.
3. Evaluate the effects of risk management on project construction

1.4. Research Questions:

The study seeks to answer the following research questions:

1. What are the types of risks associated with project construction?
2. What factors affect risk management in project construction?
3. What are the effects of risk management on project construction?

1.5. Significance of the Study:

This study contributes to the body of knowledge on construction risk management and provides practical insights for construction professionals, contractors, consultants, policymakers, and researchers. The findings will help construction stakeholders develop better risk management strategies for improving project delivery and performance.

II. LITERATURE REVIEW

2.1 Introduction

This chapter is designed to provide details about the concept of risk management, as well as review of relevant literature on the same topic by previous researchers. The chapter also specifically goes further to explain the concept of risk management and project construction. The chapter is presented in three segment conceptual review, empirical review and theoretical framework.

2.2 Conceptual Literature Review:

2.2.1 Concept of Risk Management

The concept of risk has a very long history as it can be said to have been in existence like human existence. It doesn't have a universal definition as every author attempt to display a different orientation. Gallati (2020) defines risk as a condition in which there exist an exposure to adversity or a condition in which there exist a possibility of deviation from a desired outcome that is expected or hoped for. It implies exposure to uncertainty or threat. (Kannan & Thangavel, 2020). Therefore, risk can be described to have adverse impact on profitability and performance because of several distinct sources of uncertainty.

Smith (2021) provide a comprehensive description of the concept of risk management and how it can be used in practice. According to the authors, risk management cannot be perceived as a tool to predict the future, since that is rather impossible. Instead, they describe it as a tool to facilitate the project in order to make better decisions based on the information from the investment. In this

way, decisions based on insufficient information can be avoided, and this will lead to better overall performance. In the literature, risk management is described as a process with some predefined procedures. The scope of its definition differs among the authors; However, the core information is the same. From a number of definitions which can be found in the management literature, Smith (2021), explanation brings the essence of this concept: The risk management process involves the systematic application of management policies, processes and procedures to the tasks of establishing the context,

identifying, analyzing, assessing, treating, monitoring and communicating risks.

Risk management is a concept that has been used since the beginning of human kind; it is an evolving concept (Alina, 2022). Credit creation is the main income generating activity of banks. But this activity involves huge risks to both the lender and the borrower. Risk refers to a condition where there is a possibility of undesirable occurrence of a particular result which is known or best quantifiable and therefore insurable (Periasamy, 2021). Risk may mean that there is a possibility of loss or damage which, may or may not happen.

Risk management structures are tailored to do more than just point out existing risks. A good risk management structure should also calculate the uncertainties and predict their influence on a business. Consequently, the result is a choice between accepting risks or rejecting them. Acceptance or rejection of risks is dependent on the tolerance levels that a business has already defined for itself. Risk management is the process of identifying, assessing and controlling threats to an organization's capital and earnings. These risks stem from a variety of sources including financial uncertainties, legal liabilities, technology issues, strategic management errors, accidents and natural disasters (Mathew, 2022).

Risk management is among the most crucial project management practices for ensuring the successful completion of a project. Experience has shown, according to Royer (2020), that risk management must be a top priority for project managers, as unmanaged or unmitigated risks are one of the leading causes of project failure. Thus, risk management is directly related to the practical completion of a project. In recent years, risk management has begun to affect an expanding number of businesses, not just the most prominent initiatives. Despite this, modest construction projects lack significant systematic risk management (Simu, 2019).

2.2.2 Types of Risk Management associated with Project Construction

1. Financial Risks

Financial risks in construction projects generally stem from budget overruns, inaccurate cost estimations,

variations in material pricing, and finance complications. These risks may lead to expenses exceeding early projections, substantially affecting the project's financial feasibility. Prolonged funding acquisition or fluctuations in currency rates may result in elevated costs. The impact is mostly experienced through cost overruns, which can diminish profit margins and lead to financing deficits, eventually hindering the project's capacity to achieve its financial goals (Antón, 2021).

2. Delays and Schedule Risks

Temporal hazards, including delays caused by unanticipated factors such as inclement weather, labor shortages, equipment malfunctions, or permitting complications, are prevalent in construction. These delays may prolong the project timetable, leading to missed deadlines and heightened expenses. Beyond immediate financial repercussions, extended construction timelines may result in contractual fines, discontented stakeholders, and forfeited commercial prospects. Time overruns adversely impact project performance by prolonging delivery, decreasing stakeholder satisfaction, and eroding profitability (Tawfek, & Bera, 2022).

3. Health and Safety Risks

Construction sites are rife with safety concerns, including accidents, injuries, and violations of safety rules. These hazards may result in job interruptions, heightened insurance costs, and potential legal obligations. In extreme instances, accidents may lead to fatalities or permanent injuries, thus tarnishing a project's image. Safety hazards adversely affect project performance by diminishing worker productivity, escalating expenses from lawsuits or fines, and causing delays during safety investigations, (Tawfek, & Bera, 2022).

4. Supply Chain and Material Shortages

Disruptions in the supply chain, such as delays in material delivery or shortages of critical construction supplies, are prevalent risks in the construction industry. These risks may arise from logistical challenges, variations in market demand, or supplier bankruptcy. Material shortages frequently result in building delays, compelling project managers to seek alternate suppliers or materials, which may incur increased costs and potential quality compromises. Project performance deteriorates as delays extend the project's duration and unanticipated costs escalate, impacting profitability (Panova, & Hilletoft, 2020).

5. Labor Risks

Construction projects rely on proficient labor, and risks associated with labor availability or strikes might result in considerable project delays. In the absence of trained personnel or the emergence of labor conflicts, projects may be delayed, leading to missed deadlines and heightened expenses from idle machinery or the necessity to engage costlier subcontractors. The aforementioned risks compromise job quality when less experienced personnel are employed to address deficiencies, resulting in possible rework and diminished overall quality, (Panova, & Hilletoft, 2020).

2.2.3 Factors Affecting Risk Management in Project Construction

Several factors expose projects to normal than higher risk, the factors are as follows:

- i. **History:** Newer projects pose more risk because the process has not been refined with the passage of time. If a project of similar nature has been done many times before, then the likelihood of success with the current project is also enhanced.
- ii. **Management Stability:** Management stability means that the whole management team shares the same vision and direction, thereby leading successful achievement of goals. If the management is unstable then it can lead to unrealistic and impractical schedules for the project and inefficient use of resources.
- iii. **Staff expertise and experience:** In the event that the members of a project team lack the direct working knowledge and experience of the area, there is a likelihood of time delays, estimated cost upsets and poor quality.
- iv. **Team Size:** In case of large teams, the probability of problem occurrence increases due to the team size. One of the reasons can be the difficulty of communication due to the large team size.
- v. **Resource Availability:** If the availability of resources is easy, the probability of responding to problems in real time also increases. For example, easy availability of money makes securing human, material and equipment resources easy on as needed basis. However, an abundance of resources does not provide guarantee against risks, all it does is to equip the project team with the tactics to respond to risks.

- vi. **Time Compression:** In case of highly compressed time schedule, the risks are magnified in the project. When more time is available, more flexibility is present in the project and there is an opportunity to mitigate and reduce the impact of occurring risk
- vii. **Complexity:** In case of a highly complex or sophisticated project, the opportunity of a mistake or a problem is also enhanced.

2.2.4 Risk Management Process

The risk management process establishes the basis for identifying and addressing dangers in project activities. An effective execution of the procedure in a project requires the inclusion of all stages in the risk management process when addressing hazards. The risk management process is segmented into many components, as enumerated below:

1. **Risk identification:** Risk identification constitutes the initial phase of the risk management process, involving the recognition of all potential hazards that may emerge during the endeavor (Nnadi, et al. 2018). This preliminary phase establishes the foundation for later risk evaluation and management processes, allowing organizations to identify underlying risk domains. Precise risk identification ensures efficient risk management by uncovering hidden sources of losses that may escalate into accidents with uncontrollable repercussions (Ghasemi, et al., 2018). The repercussions of neglecting to recognize positive risks are analogous to failing to identify negative ones.
2. **Risk Assessment/Analysis:** The subsequent phase in risk management, following identification, is the evaluation of the identified hazards. In risk management, risk assessment is the process of utilizing relevant information to evaluate the likelihood of occurrence and the severity of repercussions. Risk analysis may be conducted by qualitative or quantitative methods. Qualitative risk analysis involves assessing the likelihood and consequences of a risk, utilizing various methodologies, such as risk matrices. Quantitative risk analysis employs numerical data and mathematical models to measure and evaluate hazards. This facilitates data-driven decision-making and prioritization of risk management measures grounded in a more objective and

quantitative comprehension of the associated hazards. Quantitative risk analysis employs methods such as the Analytical Hierarchy Process, Bayesian networks, and fuzzy set theory (Ghasemi, et al 2018).

3. **Risk Response:** Risk response is a crucial element of the risk management process that ascertains if any actions will be taken in reaction to the risks evaluated during the identification, qualification, and quantification phases (Ghasemi, et al., 2018). Risk responses are established by presenting many options for eliminating or alleviating a projected risk and selecting the most effective alternative.
4. **Risk Mitigation (Response Strategy):** Upon assessing risks, the subsequent stage is to formulate strategies for their mitigation or management, (Ghasemi, et al., 2018). Four principal methodologies for risk management exist:
 - Avoidance: Modifying the project plan to eradicate the risk.
 - Mitigation: Implementing measures to diminish the probability or consequences of the risk.
 - Transfer: Allocating the risk to an external entity, typically via insurance or outsourcing.
 - Acceptance: Recognizing the danger and ready to address it if it materializes.
5. **Risk Control:** Subsequent to identifying hazards, doing risk assessments, and formulating suitable solutions, the requisite steps must be executed. The implementation of the risk plan is a fundamental element of risk supervision and control, both of which should be integral components of the project. The primary challenge in the monitoring and controlling process is the implementation of risk solutions while assuring their efficacy. The creation of comprehensive documentation to facilitate the process represents the second major challenge to address. The project's risks are managed to provide successful overall project management. It is based on a proactive strategy rather than a reactive approach, trying to assure the adoption of suitable measures while continually adjusting them. The risk management process must exercise utmost caution at this stage to prevent actions based on misidentified or misanalysed risks (Ugwu et al., 2019).

2.2.5 Different Approaches of Risk Management in Construction Projects

Risk management in construction projects is essential for achieving effective outcomes, notably in controlling the budget, fulfilling stakeholder expectations, and maintaining the schedule. Diverse methodologies for risk management have been formulated and used to enhance these facets, each with distinct advantages and disadvantages. This document compares several risk management systems in building projects, focusing on their efficacy in managing budget, stakeholder requirements, and schedule compliance (Bahamid, et al., 2022).

- i. **Qualitative Risk Management:** This methodology includes subjective assessment and the application of instruments such as risk matrices to prioritize hazards. Although it facilitates the early identification of significant risks, it is deficient in accurate financial projections and depends on subjective evaluations. It performs effectively in resource-constrained projects but may encounter difficulties with intricate budget and schedule predictions.
- ii. **Quantitative Risk Management:** This methodology employs numerical data and statistical models to deliver comprehensive financial projections and accurate schedule modifications. Nonetheless, it is data-intensive and necessitates skill, which might be resource-intensive. It is optimally designed for extensive projects requiring precise budgeting and schedule analysis.
- iii. **Integrated Risk Management:** This methodology amalgamates qualitative and quantitative techniques to deliver a comprehensive risk evaluation and ongoing surveillance. It is incredibly versatile, although its implementation can be intricate and expensive. It efficiently manages both money and timeline, but need strong systems.
- iv. **Agile Risk Management:** This adaptable methodology prioritizes flexibility and ongoing input, rendering it useful for stakeholder involvement. Nonetheless, its emphasis on short cycles may hinder long-term planning, rendering it more appropriate for smaller projects (Moran, & Moran, 2024).

2.2.6 Challenges of Implementing Risk Management Strategies in Projects Construction

- i. **Lack of Awareness and Knowledge:** Numerous project stakeholders, such as contractors and managers, may lack a comprehensive understanding of the advantages of risk management or the efficient implementation of solutions. This knowledge deficiency results in inadequate risk identification and mitigation (Bahamid, et al.2022).
- ii. **Cost Constraints:** Efficient risk management sometimes necessitates substantial monetary expenditure in instruments, procedures, and proficient staff. In building projects constrained by limited budgets, this expenditure may be perceived as superfluous or too expensive, resulting in insufficient risk management procedures, (Bahamid, et al.2022).
- iii. **Resistance to Change:** Construction projects frequently adhere to conventional methodologies, and the use of formal risk management may be perceived as disruptive. Opposition from management or employees to the adoption of new procedures or instruments can obstruct the execution of good risk strategies (Darmawan, & Azizah, 2020)
- iv. **Lack of Integration in Project Planning:** Frequently, risk management is not comprehensively included into the project's overarching planning and decision-making frameworks. When risk factors are regarded independently from project management, it becomes increasingly difficult to evaluate and mitigate risks effectively throughout the project lifetime, (Bahamid, et al.2022).
- v. **Complexity and Uncertainty:** Construction projects are intrinsically intricate, characterized by several uncertain factors including meteorological conditions, market dynamics, and labor availability. Effectively managing this complexity necessitates advanced risk management solutions, which are frequently challenging to formulate and implement consistently (Judson, & Paul, 2022).
- vi. **Inadequate Communication:** Effective risk management necessitate collaboration among all project stakeholders, e.g., clients, contractors, suppliers, & regulators. Inadequate

communication or absence of explicit routes for disseminating risk-related information may result in misconceptions & lost chances for mitigation, (Judson, & Paul, 2022).

2.3 Concept of Project Construction

According to Merrow (2018) project construction is the process of planning, designing, executing, and managing the physical activities necessary to build a new facility or infrastructure, encompassing all tasks from inception to completion. Merrow emphasizes that construction projects require meticulous coordination of resources, labor, and materials to ensure the project's objectives are met efficiently and effectively. It involves integrating various disciplines, managing risks, and adhering to schedules and budgets to deliver a functional end product, Hegazy & El-Reedy, 2021.

Project construction is the execution phase within project management that involves converting project plans into physical structures, requiring effective management of labor, materials, equipment, and time. According to Fahola (2020) construction of a project encompasses the entire process of mobilizing resources, managing workflows, and supervising activities necessary to deliver a completed project that meets specified requirements. Fahola's definition underscores the importance of resource mobilization and supervision in ensuring that the final deliverable aligns with client specifications, quality standards, and regulatory compliance.

Project construction is the implementation phase where design is actualized through physical work, involving planning, executing, controlling, and closing all activities necessary to produce a completed facility. Winch (2022) describes construction as a comprehensive implementation process that requires careful control and management throughout its lifecycle, from initial planning to project closeout, ensuring the delivery of the intended outcome.

2.3.1 Types of Project Construction

1. Residential Construction

Residential construction involves the development of housing units such as single-family homes, apartments, & condominiums. It focuses on creating comfortable, & sustainable living environments for

individuals & families. This type of construction includes new builds, renovations, & extensions, requiring adherence to building standards to ensure quality and safety. It is characterized by a high degree of customization to meet client preferences, (Olson 2021).

2. Commercial Construction

Commercial construction pertains to the development of structures used for business purposes, including office buildings, retail centers, hotels, and warehouses. These projects typically involve complex planning, larger scale operations, and faster timelines. They emphasize functionality, aesthetics, and compliance with regulatory standards to support economic activities and customer engagement. Collaboration among multiple stakeholders is common to meet project requirements (Kibert, 2016).

3. Industrial Construction

Industrial construction focuses on building facilities such as factories, manufacturing plants, power stations, & refineries. It involves specialized engineering, heavy machinery, & safety protocols due to the hazardous nature of some environments. These are often requiring detailed planning for infrastructure & compliance with environmental and safety regulations (Hanna, 2020).

4. Infrastructure Construction

This type includes large public works like roads, bridges, airports, water supply systems, and sewage treatment plants. Infrastructure projects are fundamental to economic development and require extensive planning, environmental assessments, and collaboration between government agencies and private contractors. They are typically long-term projects with significant resource and logistical management (Kumar 2019).

5. Institutional Construction

Institutional construction involves building facilities such as schools, hospitals, government buildings, and religious structures. These projects focus on safety, accessibility, and community needs, often involving public funding and strict standards. They play a vital role in social infrastructure and require careful planning to meet functional and regulatory requirements (Abley, 2022).

6. Environmental and Green Construction

Environmental and green construction emphasizes sustainable building practices, renewable energy projects, and eco-friendly infrastructure. It aims to minimize environmental impact through energy efficiency, recyclable materials, and innovative green technologies. This type of construction is increasingly important due to growing environmental concerns and regulations promoting sustainability (Ding, 2018).

3.0. RESEARCH METHODOLOGY:

This chapter discusses research methodology and procedures undertaken by this study. Specifically, the main focus is on the research design, research method, population description, method and source of data collection and methods of data analysis.

3.1. Research Design:

The study adopted a descriptive quantitative research design to examine the relationship between risk management and construction project performance. Research design refers to the plan and structure of the research to conceive how to address the research problem in a coherent and logical way (Vaus, 2011). The study utilizes a descriptive research approach to elucidate the analysis of risk management on in project construction. The descriptive analytical technique refers to a scientific method for accurately characterizing the subject of study using a proper scientific methodology and presenting the findings as interpretable digital information (Lawless et al., 2010).

3.2. Population and Sample Size:

The study population consisted of construction engineers involved in risk management within the construction industry. A sample size of 80 respondents was selected for the study.

Ngechu (2004), defined a population as a well-defined or set of people, services, elements, and events, group of things or households that are being investigated. The study population is crucial for identifying the persons or units who will be the subject of data collection and analysis. These individuals are chosen for their direct engagement in risk management and oversight of project construction. The sample size will comprise 80 construction engineers engaged in risk management within the construction sector.

3.3. Data Collection:

Primary data were collected through structured questionnaires administered to respondents. Secondary data were obtained from books, journals, conference papers, and related literature.

Data collection is a fundamental component of research across many disciplines, including the natural sciences, humanities, business, and others. The validity of research depends on precise data collection, applicable irrespective of the subject matter or the chosen data classification (quantitative or qualitative).

3.4. Data Analysis Techniques:

The Data collected were analyzed using descriptive statistical methods including: Frequency distribution Percentages, Mean item score and Standard deviation. A total of 74 completed questionnaires were returned and analyzed, representing a response rate of 92.5%.

The word "data analysis" refers to the systematic and organized process of evaluating, cleansing, modifying, and interpreting data collected to derive conclusions, address research inquiries, or evaluate hypotheses, Ngechu (2004).

IV. DATA PRESENTATION AND ANALYSIS:

The chapter cover data presentation, the data collected for the research. A total number of 80 questionnaires were administered and distributed. Out of this, 74 questionnaires, representing 92.50% completed and returned. The data was presented in tables showing frequencies and percentage and appropriately analyzed.

4.1. Demographic Characteristics of Respondents:

This section presents the demographic characteristics of the respondents that includes; gender, age group, working status and working experience.

a. Gender Distribution: The study revealed that 83.8% of respondents were male, while 16.2% were female.

b. Age Distribution: Most respondents (37.8%) were between 41–50 years old, indicating that respondents possessed significant professional maturity and experience.

c. Working Experience: The majority of respondents had more than 10 years of working experience in the construction industry, indicating adequate knowledge of construction risk management.

Table 4.1: Gender of the Respondents

Sex	Frequency	Percentage
Male	62	83.8

Female	12	16.2
Total	74	100

Table 4.2: Age of the Respondents

Age Group	Frequency	Percentage
18-30 years	12	16.2
31-40 years	18	24.3
41-50 years	28	37.8
51 years and above	16	21.6
Total	74	100

Table 4.3: Working Experiences

Working Experience	Frequency	Percentage
1-5 years	5	6.8
6-10 years	5	6.8
11-15 years	31	41.9
16-20 years	25	33.8
Over 20 years	8	10.8
Total	74	100

4.2. Types of Risks Associated with Construction Projects: The study identified several major risks affecting construction projects.

a. Risk Type Mean Score Ranking:

1. Inadequate site investigation 4.3514 1st.
2. Inadequate specification 4.0135 2nd
3. Construction procedures 3.9459 3rd
4. Insufficient resource availability 3.9189 4th
5. Change in scope 3.4324 5th
6. Incomplete design 3.3378 6th

The findings indicate that inadequate site investigation constitutes the most critical technical risk affecting construction projects.

Table 4.4: Types of Construction Related Risks

Type	Frequency	Minimum	Maximum	Mean	Std. Deviation	Ranking
Inadequate site	74	3.00	5.00	4.3514	.53462	1

Risk Type	Frequency	Minimum	Maximum	Mean	Std. Deviation	Ranking
investigation	74	3.00	5.00	4.0135	.45309	2
Inadequate specification	74	3.00	5.00	3.9459	.40177	3
Construction procedures	74	3.00	5.00	3.9189	.90291	4
Insufficient resource availability	74	3.00	5.00	3.4324	.62111	5
Change in scope	74	2.00	5.00	3.3378	1.07623	6
Incomplete Design	74	3.00	5.00	3.4324	.64279	3

4.3. Organizational and Environmental Risks:

Table 4.5: Organization and Environmental Related Risks

Types	Frequency	Minimum	Maximum	Mean	Std. Deviation	Ranking
Organization Risks						
Contractor's experience	74	3.00	5.00	4.3784	.63468	1
Communication	74	3.00	5.00	3.4459	.70501	2
Contractual	74	1.00	4.00	3.4324	.64279	3
Attitudes of participants	74	3.00	4.00	3.2838	.45391	4
Inexperienced work force	74	2.00	5.00	3.1351	1.08948	5
Environmental Risks						
Weather Implications	74	2.00	5.00	3.7027	.83960	1

Natural Disasters	74	3.00	5.00	3.4324	.70383	2				0 3																									
<p>The study found that contractor experience, communication, and weather implications significantly affect construction performance.</p> <p>a. Organizational/Environmental Risk Mean Score Ranking:</p> <ol style="list-style-type: none"> 1. Contractor’s experience 4.3784 1st. 2. Communication 3.4459 2nd. 3. Weather implications 3.7027 1st Environmental. 4. Natural disasters 3.4324 2nd Environmental. <p>These findings imply that experienced contractors and effective communication are essential for successful project execution.</p> <p>4.4. Coordinating-Related Risks: The study identified the following major coordinating-related risks:</p> <p>a. Coordinating Risk Mean Score Ranking:</p> <ol style="list-style-type: none"> 1. New technology 4.4730 1st. 2. Shortage of resources 4.2838 2nd. 3. Late completion 4.2703 3rd. 4. Postponement of site activities 4.0811 4th. <p>The results suggest that technological changes and inadequate resources significantly influence construction project coordination.</p> <p>Table 4.6: Construction Coordinating-Related Risks</p> <table border="1"> <thead> <tr> <th>Coordinating-related risks types</th> <th>Frequency</th> <th>Minimum</th> <th>Maximum</th> <th>Mean</th> <th>Std. Deviation</th> <th>Ranking</th> </tr> </thead> <tbody> <tr> <td>New technology</td> <td>74</td> <td>4.00</td> <td>5.00</td> <td>4.4730</td> <td>.50268</td> <td>1</td> </tr> <tr> <td>Shortage of resources (Plant, Labour and Materials)</td> <td>74</td> <td>3.00</td> <td>5.00</td> <td>4.2838</td> <td>.74980</td> <td>2</td> </tr> <tr> <td>Late completion</td> <td>74</td> <td>3.00</td> <td>5.00</td> <td>4.2703</td> <td>.50470</td> <td>3</td> </tr> </tbody> </table>	Coordinating-related risks types	Frequency	Minimum	Maximum	Mean	Std. Deviation	Ranking	New technology	74	4.00	5.00	4.4730	.50268	1	Shortage of resources (Plant, Labour and Materials)	74	3.00	5.00	4.2838	.74980	2	Late completion	74	3.00	5.00	4.2703	.50470	3	Postponement of site activities	74	4.00	5.00	4.0811	.27482	4
	Coordinating-related risks types	Frequency	Minimum	Maximum	Mean	Std. Deviation	Ranking																												
	New technology	74	4.00	5.00	4.4730	.50268	1																												
	Shortage of resources (Plant, Labour and Materials)	74	3.00	5.00	4.2838	.74980	2																												
	Late completion	74	3.00	5.00	4.2703	.50470	3																												
	Discrepancies found in contract documentation	74	3.00	5.00	3.7027	.66876	5																												
	Too high quality standard	74	2.00	5.00	3.4324	1.27168	6																												
Delay in the issue of instructions	74	2.00	5.00	4.0811	.86179	7																													
Design changes	74	3.00	5.00	3.4324	.65830	8																													
Equipment failures	74	2.00	5.00	3.4324	.64121	9																													
Labour productivity	74	2.00	4.00	3.4324	.54914	10																													
Effects on contractor's production by artisans engaged	74	2.00	5.00	3.4324	.56689	11																													

directly by the client				73		
Site condition	74	3.00	5.00	3.2568	.49824	12
Interference by numerous variation in quantity of work	74	2.00	5.00	3.2568	1.06064	13
Labour disputes	74	2.00	5.00	2.8378	1.17073	14

4.5. **Factors Affecting Risk Management:** The study identified resource availability as the most significant factor affecting risk management.

Table 4.7: Factors Affecting Risk Management on Construction Project

Factors	Frequency	Minimum	Maximum	Mean	Std. Deviation	Ranking
Resource Availability	74	2.00	5.00	4.7703	.58631	1
Complexity of project	74	4.00	5.00	4.6892	.46598	2
Time Compression	74	3.00	5.00	4.3514	.58362	3

Staff expertise and experience	74	3.00	5.00	4.2297	.63131	4
History of past project	74	2.00	5.00	3.6622	.62542	5
Management Stability	74	3.00	5.00	3.6486	.65024	6
Team Size	74	2.00	5.00	3.4459	.99508	7

Factor Mean Score Ranking:

1. Resource availability 4.7703 1st.
2. Complexity of project 4.6892 2nd.
3. Time compression 4.3514 3rd.
4. Staff expertise and experience 4.2297 4th.

These findings indicate that adequate financial, material, and human resources are necessary for effective risk management implementation.

4.6. **Effects of Risk Management on Construction Projects:** The study revealed that risk management strongly influences project performance variables.

Table 4.8: Effect of Risk Management on Project Construction

Factors	Frequency	Minimum	Maximum	Mean	Std. Deviation	Ranking
Project cost	74	4.00	5.00	4.9189	.27482	1
Completion time	74	3.00	5.00	4.7027	.51630	2
Productivity	74	4.00	5.00	4.5541	.50046	3
Project quality	74	3.00	5.00	4.3378	.62542	4

Project health and safety	74	3.00	5.00	4.1351	.53184	5
Environmental sustainability	74	3.00	5.00	4.0000	.40544	6

Project Performance Variable Mean Score Ranking:

1. Project cost 4.9189 1st.
2. Completion time 4.7027 2nd
3. Productivity 4.5541 3rd
4. Project quality 4.3378 4th
5. Health and safety 4.1351 5th
6. Environmental sustainability 4.0000 6th.

The findings demonstrate that poor risk management adversely affects construction cost, project duration, productivity, and quality.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary:

The study seeks to examine the analysis of risk management in project construction. The study is divided into five (5) chapters. In chapter one, background and statement of problems were clearly stated which is the reason for conducting the research, objectives of the study were mentioned, research questions were raised from the objectives.

The significance of the study, scope and limitation of the study as well as organization of chapters. Chapter two reviews prior studies on relationship between risk management and project construction. The chapter explains the concept of risk management, types of risk management associated with project construction, factors affecting risk management in project construction, risk management process, different approaches of risk management in construction projects, challenges of implementing risk management strategies in project constructions, concept of project construction and types of project constructions. Empirical studies related to the study were encapsulated and underpinning theory (Lean Construction Theory) were adopted.

The study findings align with previous studies which established that inadequate risk management contributes significantly to construction project failures. The findings further confirm that construction projects are exposed to multiple technical, financial, organizational, environmental, and coordination-related risks. Resource availability emerged as the most influential factor affecting risk management implementation. This implies that organizations with adequate resources are more capable of responding effectively to project uncertainties. The study also established that effective risk management improves project cost control, timely completion, productivity, quality assurance, safety performance, and environmental sustainability.

The study examined the analysis of risk management in project construction within the Nigerian construction industry. The findings revealed that inadequate site investigation, inadequate specifications, contractor experience, shortage of resources, weather conditions, and technological changes are among the major risks affecting construction projects.

The study further established that resource availability, project complexity, time compression, and staff expertise are key factors influencing effective risk management implementation. Risk management was found to significantly affect project performance indicators including cost, completion time, productivity, quality, safety, and environmental sustainability.

The study concludes that effective risk management is essential for successful construction project delivery. Construction organizations that adopt proactive and systematic risk management strategies are more likely to achieve project objectives successfully.

5.2 Conclusions:

The study findings align with previous studies which established that inadequate risk management contributes significantly to construction project failures. The findings further confirm that construction projects are exposed to multiple technical, financial, organizational, environmental, and coordination-related risks. Resource availability emerged as the most influential factor affecting risk management implementation. This implies that organizations with adequate resources are more capable of responding effectively to project uncertainties. The study also

established that effective risk management improves project cost control, timely completion, productivity, quality assurance, safety performance, and environmental sustainability.

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The study concludes that effective risk management is essential for successful construction project delivery. Construction organizations that adopt proactive and systematic risk management strategies are more likely to achieve project objectives successfully.

From the results of the analysis, the following can be concluded:

1. The major type of risk shown were inadequate site investigation and inadequate specification for technical risk, contractor's experience, communication, weather implications and natural disasters for organization and environmental related risks, new technology, shortage of resources (Plant, Labor and Materials), late completion and postponement of site activities for coordinating-related risks.
2. The factors affecting risk were dominated by resource availability, complexity of project, time compression and staff expertise and experience. Organization and environmental risks also pose substantial threats, with contractor's experience and weather implications identified as primary concerns. The findings suggest that a lack of experienced contractors and adverse weather conditions can hinder project progress, increase costs, and compromise safety. Similarly, coordination-related risks such as

new technology adoption and resource shortages were ranked highly, highlighting the need for effective resource management and technological adaptation.

3. The effect of risk management on project construction was pronounced on project cost, completion time, productivity, project quality, project health and safety and environment sustainability. The data emphasizes that resource constraints, project complexity, and time compression are key challenges affecting risk mitigation strategies. The impact of risk management on project performance is profound, with project cost and completion time being most affected, followed by productivity, quality, safety, and environmental sustainability.

5.3 Recommendations:

Based on the findings of the study, the following recommendations are made:

1. Proper and adequate site investigations should be conducted before project commencement.
2. Construction specifications should be clear, comprehensive, and unambiguous.
3. Construction organizations should ensure adequate availability of resources including labor, materials, equipment, and finance.
4. Experienced contractors and qualified professionals should be engaged in construction projects.
5. Effective communication and coordination mechanisms should be established among project stakeholders.
6. Construction firms should adopt proactive risk management frameworks and continuous risk monitoring systems.
7. Government and regulatory agencies should enforce risk management practices in construction projects.
8. Continuous training and capacity building on risk management should be provided for construction professionals.

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