ADDIS ABABA UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS

SCHOOL OF COMMERCE

DEPARTMENT OF PROJECT MANAGEMENT

ASSESSMENT OF PROJECT RISK MANAGEMENT PRACTICES IN CONSTRUCTION OF ELECTRO-MECHANICAL PROJECTS: THE CASE OF JEHOIACHIN TECHNO PLC

By

Michael Hailu

Advisor: Bahran Asrat (PhD)

A Final Project Work Submitted to Addis Ababa University in Partial fulfillment of the Requirements for an MA Degree in Project Management

Addis Ababa, Ethiopia

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DECLARATION STATEMENT

I, Michael Hailu, declare that this project work entitled as *"Assessment of Project Risk Management Practices in construction of electro-mechanical projects: the case of jehoiachin techno plc"* is submitted for the award of MBA in project management from Addis Ababa University College of Business and Economics, School of Commerce Department of Project Management, is my original work and has not been presented for a degree in any other university and all source of materials used for this project work have been duly acknowledged.

Michael Hailu

Signature_____

Date_____

CERTIFICATION STATEMENT

This is to certify that Michael Hailu has executed this project work entitled “Assessment of Project Risk Management Practices in construction of electro-mechanical projects: the case of Jehoiachin techno plc” under my guidance. This work is original and acceptable for submission in partial fulfillment of the requirement for the award of a Master's degree in Project Management.

Bahran Asrat (PhD)

Signature_____

Date_____

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ACKNOWLEDGMENT

First and foremost, I would like to thank the Lord almighty for being my strength throughout my study on this project work.

I also sincerely thank my advisor Bahran Asrat (PhD) for his constructive and encouraging comments; he has offered me throughout this study. I would like to appreciate his patience and friendly treatment. My thanks also extended to my friend and colleague Abyneh Lakew who helped me in general formatting and editing this paper.

Moreover, I would like to thank all employee and top management of Jehoiachin techno plc for their voluntarily involving in this research directly and indirectly.

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ACRONYMS/ABBREVIATIONS

CEM: Construction of Electro mechanical

EEG: Ethio-engineering Group

EM: Electro-Mechanical

EJBM: European Journal of Business and Management

FDRE: Federal democratic republic of Ethiopia

GERD: Grand Ethiopian Renaissance Dam

GTP: Growth and Transformation Plan

ISO: International Organization of Standardization

JTP: Jehoiachin Techno Plc

KAA: Kenya Airports Authority

MCIT: Ministry of Communication and Information Technology

MCR: Monitoring and controlling risk

METEC: Metals and Engineering Corporation

OCRLFDP: Online Content Regulatory Legal Framework Development Project

PM: project management

PMBOK: Project management body of knowledge

PRM: project Risk management

QMS: quality management system

RA: Risk analysis

RI: Risk Identification

RM: Risk Management

RMP: Risk Management plan

RR: Risk Response

SD: Standard Deviation

ABSTRACT

Risk management is a critical component to any successful engineering project. Understanding, evaluating, and planning for risk properly, enables a project to stay on schedule and avoid potential disaster. The main purpose of this research work was assessing project risk management practice in Jehoiachin techno plc during its construction of electro-mechanical projects. The study was a descriptive type, which was able to made use of both qualitative and quantitative approaches as methodology to handle the research objective. Data were collected through close and open ended questionnaire as well as semi-structured interviews. The questionnaires were distributed to 28 participants and the response rate was 89%, while five senior-level managers were also interviewed for in-depth information. The respondents comprised of project managers, Project engineers, Designers, Operation staff, procurement team and also the project commission. Using the SPSS version 26, the quantitative data were statistically analyzed using descriptive techniques and the qualitative analysis was performed by comparing the findings to literature. Additionally, reliability and validity tests were also considered. The main findings revealed that standard project risk management system has not been implemented by the organization that is the company doesn't have established risk policy or strategy and there is no exclusive responsible person or department dealing with risk-related problems, there is also no history documentation system for documenting risks of past projects. Risks were simply addressed at the level of the management meeting after reported from site and actions were taken as required which exposing the organization to cost overruns and time delays in the projects involved. Finally, recommendations such as: formulation of Project Risk Management Policy or strategy; and establishment of a structured and disciplined approach to RM including the development of the Risk Register were suggested based on the result of the research for necessary improvement in the organization to handle the project risk issues in different levels with higher performance.

Key words: Risk, Risk Management, Electro-mechanical projects, Project Risk Management

CHAPTER 1: INTRODUCTION

This is the first chapter of this study; the background of the study, the problem statement, the research question, the research objectives and the significance of the study, the scope of the study, the potential limitations of the study, the organization of the study and the definition of key terms are explained in the following sub-topics in this chapter.

1.1. Background of the study

Constructions that are civil and electromechanical engineering products (road, rail, airport, schools, hospitals, offices, shops, factories, water supply, irrigation and agricultural systems; telecommunications and the like) provide the required public infrastructure and private physical structures for a wide range of productive activities, such as services, commerce, utilities, and other sectors (Peter, 2015). Construction activities can therefore be seen as a major source of economic growth, development, and economic interaction.

According to Zichuan Huang (2020), electromechanical projects are an important part of construction engineering, and the industries involved cover the entire daily life of people, including the installation of various EM equipment and machines. Construction of complete electrical systems for commercial, industrial and residential complexes; plumbing system (drainage & sanitary works, recycling system, piping works, irrigation, etc.); heating, ventilation & central air conditioning for commercial & industrial premises, including district cooling systems; firefighting systems; control systems for communication and automation in industrial, civil, and public services are some of the work of the EM projects (Jamal, 2016; Zichuan, 2020). In addition, EM project construction activities include all stages of procurement, installation, commissioning, testing, and acceptance of completion (Zichuan, 2020).

Considering personal circumstances (health, pensions, insurance, savings, etc.), society (terrorism, economic performance, food safety, etc.), and also business circumstances (corporate governance, strategy, business continuity, etc.), the word 'risk' has become a popular and widely used part of today's vocabulary. Many of the institutions that society has now created, including politics, faith, ideology, technology, rules, ethics, and morality, may be seen as a way to overcome uncertainty (Hillson, 2006).

Risk is the effect of uncertainty on business goals, according to ISO 31000, where the effect can be both positive and negative. ISO 31000 is an attempt to understand that

there is always a degree of ambiguity in business operations and, thus, risk. There's always a possibility that something could go wrong, no matter what our business goals are. All projects are risky with reference to PMBOK Guide-Sixth Edition (2017) as they are unique undertakings of varying degrees of complexity that aim to deliver benefits. In the sense of constraints and assumptions, they do this when reacting to expectations of stakeholders that may be contradictory and evolving. Therefore, in order to generate value while balancing risk and reward, companies have to choose to take project risk in a managed and intentional way.

A risk may have one or more sources, based on (PMI, 2013), and if it happens, it may have one or more impacts. A cause that generates the probability of negative or positive results may be a given or potential requirement, assumption, restriction, or condition. According to PMBOK (2017), the overall risk of the project is the impact of uncertainty on the project as a whole, resulting from all sources of uncertainty, including individual risks, representing the exposure of stakeholders to the positive and negative impact of variations in the outcome of the project.

Risk management is defined by ISO 31000 as the identification, assessment, and prioritization of risks followed by the organized and economical use of resources to reduce, monitor, and control the possibility or impact of unfortunate events or optimize the realization of possibilities. PMBOK (2017) and Karim (2012) also describe project risk management in a similar manner that identifies, analyzes, and evaluates project risks early and systematically, and develops risk management plans; assigning responsibility to the best-in-class risk management party, which may involve implementing new practices, procedures or systems or negotiating appropriate contractual arrangements; and to ensure that the costs incurred in the risk mitigation are proportionate to the importance of the project and the risks involved. The aim of project risk management is to reduce the risk that the project goals and stakeholders with an interest in it will not be achieved and to recognize and take advantage of opportunities (Karim, 2012).

Although there are countless EM projects that have economically changed our society from time to time and EM engineering brings revolutionary technologies year after year (Clr.es, 2019), studies show that engineering projects are exposed to a lack or substandard system of RM that affects their fruitfulness in project management performance, and projects have been carried out using a reductionist approach that

affects the quality of project management, and risks have usually been managed through additional funding and cushion time (Alfredo, et al, 2014) instead of proactively analyzing risks that may affect specific projects. Then, in most cases, projects end up with overrun costs and lately.

Preliminary recent studies in Chile show that construction companies that do not control their projects' risk have been exposed to negative results due to their performance (Wolbers, 2011; Howard et al, 2012). Furthermore, Palma's research (2007) on claims and disputes over contracts for a number of construction projects reflected a number of risks that have not been well analyzed or integrated by both sides, customers or contractors, and that has been one of the main causes of some of those claims and disputes.

When we come to a developing country like Ethiopia, there are so many EM projects like Mega Projects of Hydropower plant and Sugar factory development which are completed with cost overrun, lately finished with poor quality and even there are suspended projects that are not yet finished due to lack or poor project risk management system and other factors (Bacha et al., 2020).Omo-Kuraz sugar development project is the showcase project of the state-owned by Ethiopian Sugar Corporation under the country's first five-year growth and transformation plan launched nearly a decade ago. One of its main goals was to satisfy the rising local demand for sugar. The goal was also to become a net sweetener exporter and to create hundreds of thousands of jobs. Through the development of large-scale irrigated sugar cane plantations, this was to be achieved; however, Omo-Kuraz became just one example of the disappointing results of a decade of state-led industrialization of sugar (Benedikt, 2016).

Jehoiachin Techno Pvt. Ltd. Co. is one of the EM Projects contractor in Ethiopia which is a young and energetic company established according to the Ethiopian laws governing the establishment of private companies. It has emerged as a consummate high-tech solution provider in the areas of electrical, electromechanical, industrial automation and instrumentation. The company has been involving in supplying, installation, testing, and commissioning of EM projects. The company has been engaging as sub-contractor in design and installation of the mega projects like GERD Hydro power project and Sugar factories in Ethiopia as well as Installation and commissioning of Heuft inspection technology automation products in Ethiopia and other African countries like Kenya, Rwanda, and Tanzania etc.

The technical staffs of the company are proven to be well experienced in their respective areas and have worked under different capacities in various governmental and non-governmental organizations and industries. As they have been rendering industrial and engineering support services for the last 15+ years, it has got savvy collection in the group. The management Team of the company is organized in a way that Managing Director and division managers all of whom are Project managers, operation managers, qualified Engineers, Technologists and IT and other professionals, thinking of creating a conducive environment to render high quality and prompt services for its customers.

JTP, though organized with top qualified professionals, has faced a variety of obstacles in its path to participate in the construction of different EM projects. And this caused cost overruns and time delays in certain projects that forced additional costs from the company. Mishandling risks or inappropriate treatment of risks in projects is one of the key causes of cost overruns, poor quality, and time delay in projects, as I have tried to discuss in this section by referring to various sources. Therefore, evaluating the project risk management methodology which is used by Jehoiachin techno plc is indispensable for identifying the weak side of risk management practices and to generate the effective risk management system for the successful completion of future projects.

1.2. Statement of the problem

The need for risk management emerged after the global financial crisis of 2008 because it was important to reduce losses in construction management (CM) firms. This was due to a decline in the number of orders placed on the Korean CM market, which increased the order rivalry between companies. Research findings, however, showed that risks due to the absence of RM systems were not routinely controlled (Kyungmo, et al, 2017). It was therefore concluded that the development of standard operating systems and the implementation of RM systems were important to efficiently manage risks.

The goal of PRM is to execute projects in accordance with the approved budget, on schedule, and in accordance with the stated details. RM has been closely linked to PM collectively with the potential risks to the project, which can lead to disparities in achieving the pre-defined goals and thus the project's success (Holt, 2004). The traditional view of PRM emphasizes the importance of planning as one of its main

processes and is integrated throughout its life cycle in connection with project activities (Dvir et al., 2002).

Several risk management and project uncertainty models and frameworks have arisen in an effort to better control and implement risk and uncertainty management (Mills, Donald, 2001). Olsson (2008) argued that as the company is prepared to cope with different risks and challenges, risk management is essential to the project's success. According to Roque Rabechini and Marly Monteiro (2013), the research findings of 415 projects in Brazil's various industrial sectors indicate that the introduction of the RM method has had a major positive effect on project performance. They also reveal a positive effect on project performance from the presence of a risk manager.

Emmanuel Rwagasana (2019) results indicate that Rwanda's construction industry faces critical RM activities in construction projects due to the identification of high-impact risk factors and high probability of occurrence that come under the logistics, physical, construction, subcontractors, and design-related factors criteria. Most construction companies in Rwanda deal with risks, according to Emmanuel (2019), often with expert systems that include software kit, decision support system and computer-based analyses techniques, direct decision using experience and personal expertise, risk transfer, or sharing to/with other elements, and analysis comparison, which implies comparing similar projects with similar circumstances. Project risk monitors, however, should search for more methods for risk analysis that can shift project teams.

In his report, Peter Mwangi (2015) reveals that Kenya's construction industry was vulnerable to several risks with contractors lacking awareness of them and therefore there was no RM procedure in place and where it is reacted in a haphazard manner, in which its impact was produced over the expense, time delay, and poor project quality.

Major investment in housing, transportation, dam building, followed by industrial development, such as the construction of Industry Park, sugar factory construction, etc. that includes EM projects, in various parts of the country was the first Ethiopian Growth and Transportation Plan (2010/11-2014/15&), but many projects failed either before completion and delivery or after, and exposed to delay, poor quality, and cost overrun (Bacha et al, 2020). During the implementation of GTP I, numerous challenges such as implementation capability limitations, rent-seeking and governance issues, inflation, the discrepancy between aggregate supply and aggregate demand, weak infrastructure facilities, and financial resources limitations were established according to FDRE's

national planning commission (2016), which caused many projects to fail to meet the schedule, budget and quality objectives. This demonstrates that there was no appropriate risk management mechanism included in GTP I that should have been responsive to the challenges listed that should have made the project completed as far as possible on time, within the budget, and with quality.

Researches like Fertuna (2019), Imran (2017) and Yehualashet (2019) shows that many construction and other project organizations in Ethiopia doesn't practice formal risk management standards or doesn't practice proper risk management system, most of risks are responded by their knowledge and experience, this has been its own impact on the cost, quality and schedule of the projects.

Jehoiachin techno plc has been facing a problem of completing projects with a cost overrun and over schedule and even there have been occasions when the company terminated the project after 80 to 90 percent completed, although most projects were completed with quality (Jtech ltd, 2015,2016,2017,2018 &2019). This initiated to assess the company's RM practice as lack of or improper RM system is one of the main causes for failure of achieving project objectives. This research investigated: the degree of practicing PRM in JTP during the construction of EM projects; examined whether formal RM requirements were applied; also identified available challenges that limit the implementation of standard risk management system in the company; and identified major risk factors faced by JTP during the construction of EM projects.

1.3. Research Question

The following questions were attempted to be answered by this research, for addressing the purpose and objectives of the study.

What is the degree of practicing project risk management in JTP?

What techniques are used the company for assessing the level of occurrence and impact of risks in projects?

What are the obstacles available in the company that restricts implementation of risk management in practice?

1.4. Research objectives – general and specific

1.4.1. General Objective

Evaluating project risk management activities at Jehoiachin Techno plc was the overall objective of this study. In order to cope with project risk issues at various

levels with better performance for the company, it also suggested a suitable standard risk management system for necessary changes in the organization.

1.4.2. Specific Objective

The research aimed to realize the specific objectives of the following points:

- ✓ To find the degree of practicing project risk management by JTP during the construction of EM projects.
- ✓ To learn the risk management system methods and technique's effectiveness used by the organization for construction of EM projects.
- ✓ To identify challenges that restricts implementation of risk management in the company.

1.5. Significance of the study

The hugeness and complexity of EM projects leaves a lot of scope for various environmental, socio-political and other unforeseen problems during conceptual phase, design, procurement, execution, turnover and startup which, leads to time and cost overruns in projects and compromise in quality (Nadeem et' al, 2010: 16). For rectifying this problem and to attain the objectives of the project in relation to quality, cost and time as well as safety and environmental sustainability, there has to be real and standard risk management system (Zou et al, 2005)

Many EM projects have been built in Ethiopia in recent years and some are being constructed by local companies as contractors and subcontractors, such as Sigma Engineering, Mesfin Industrial, Jehoiachin Techno, and Ethio-engineering Group (formerly METEC), etc. These projects have, however, faced several challenges at various stages of their life cycle. Scope change, design problem, right of way problem, delay, and quality problems are some of the challenges that will lead to additional cost and loss of value, especially Mega projects like Sugar sectors, GERD and other EM projects have not been completed within the time schedule and allocated budget (Mo UDC, 2012).

The study provided feasible recommendations and suggestions for improving the project risk management system of JTP based on standard risk management system which, can bring to high level of project execution. Hence the research is mainly worth for JTP and similarly may have a contribution for other electro mechanical contractors.

1.6. Scope of the study

Investigating and reaching towards practice of PRM system in contractors involved in construction of EM projects is difficult to accomplish the research clearly and completely on time. The scope of this study was limited to the assessment, evaluation, interpretation, description, and identification of the project risk management activities in JTP considering the availability of the data to be analyzed and the time constraints. The study was realized through questionnaire, interviews, document analysis and provided recommendations and suggestions for improving the project risk management system in the company.

1.7. Potential limitations of the study

The potential limitations that affect the conducting of the study were: findings may not be as accurate as they should be because of methodological, conceptual and instrumental issues like, I faced with yes or question regarding challenges that may be available as a restriction for implementation of PRM, more respondents said "NO" for the availability of challenges but they listed possible challenges. Responses from respondents also may not be accurate enough as it depends on their willingness, level of awareness, personal conditions and others having a direct effect on the preciseness of the findings.

1.8. Organization of study

This study is structured in five chapters. In chapter one, an introductory portion that includes such as study history, problem statement, research questions, and study purpose is allocated. Chapter two addresses a review of related literature, which covers both empirical and theoretical literature. The research design and methodology for the achievement of the study objectives are discussed in Chapter Three. Chapter four contains the analysis of results and the discussion portion. Conclusion, suggestions, and recommendations based on the main findings of the research are discussed in chapter five.

1.9. Definition of key terms

Construction Industry: Construction Industry: consists of construction projects of civil and electromechanical engineering for products such as houses, apartments, offices, schools, roads, highways, bridges and tunnels, factories, electrical systems, erection of structures and machinery, plumbing systems, etc. (peter, 2015).

Constraint: State quality, or the sense of limitation to a given activity or action. An applicable risk or limitation that affects the performance of projects or processes either internally or externally to a project (PMBOK, 2017)

Funding: Defines the funds needed to execute project risk management activities. It defines protocols for the use of reserves for contingency and management (PMBOK, 2017).

Heuft inspection system: is an automation system manufactured by Heuft Company, in Germany in which installed in beverage, food and pharmaceutical factories for inspection of packaging instruments like bottling automatically (Heuft, 2020).

Methodology: Define the basic methods, tools, and information sources that will be used to manage the projects risk (PMBOK, 2017).

Probability and impact: The probability is the likelihood of an event happening, and the impacts of the risk are the extent to which the project is influenced by the event (Karlotta, 2018).

Project—According to PMBOK, 6th edition (2017) a project is a temporary endeavor undertaken to create a unique product, service, or result. In which a unique product that can be either a component of another item, an enhancement or correction to an item, or a new end item in itself. And a unique service is capability to perform a service. And a unique result refers such as an outcome or document.

Project management—is the discipline of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria with applying of knowledge, skills, tools, and techniques to project activities (PMI,2017).

Project life cycle— A project life cycle is the sequence of stages in which a project moves from its beginning to its completion. (PMBOK, 2017)

Risk: The likelihood that a project will fail to meet its objectives (PMBOK, 2017).

Risk strategy- describes the general approach to managing risk on this project (PMBOK, 2017).

Roles and responsibilities- For each form of operation defined in the risk management plan identify the leadership, support, and risk management team members and explain their responsibilities (PMBOK, 2017).

Timing- Defines when and how often the project risk management activities are carried out during the life cycle of the project and sets up risk management tasks for inclusion in the project schedule (PMBOK, 2017).

Risk categories- Provide a means for grouping individual project risks. The risk breakdown structure (RBS), which is a hierarchical representation of possible risk sources, is a common way to structure risk categories (PMBOK, 2017).

CHAPTER 2: REVIEW OF RELATED LITERATURE

2.1 Introduction

The study of theoretical literature on project risk, project risk management and its application to EM construction projects, as well as the risk management process, is introduced and discussed in this chapter. Empirical literature reviews were also supported by objective consideration of the work done by other researchers that is relevant to this research. Related literature is summarized and discussed in separate sub-sections, as illustrated below.

2.2 Meaning and nature of Project Risk Management

2.2.1 Introduction

Risk management seeks to recognize additional opportunities that are necessary for any company regardless of its size, operation, or sector to prevent losses. Industries such as construction suffer losses when they fail to identify and evaluate risks on time. Understanding the nature of project risks and knowing how to deal with them is necessary to reduce losses and maximize profitability (Sivagami et al, 2018). Therefore, from various related-literature works, as in sub-topics below, the meaning and nature of project risks and project risk management in relation to the construction industry are reviewed.

2.2.2 Project Risk

Daily life has many complex circumstances that can be friendly or disagreeable and unknown causes. Practically, risks and uncertainty are found in all human efforts and movements. Theoretically, it is possible to describe risk in varying ways. The risk can be characterized as any potential deviation from the predefined target with its specified specifications, typically linked to terms such as ambiguity, unknowingness, and unpredictable nature (Mulcahy,2003). Risk is an uncertain situation with possible effects that are unwilling (Rescher,1983). As potential differences in outcomes, Williams et al (1998) describe the risk as either good or bad.

Dale et al. (2005) note that the risk in the project entails the probability of loss, benefit, and/or deviation of a desired or expected outcome as a result of uncertainty in projects which are likely to arise that will affect the objectives. The project risks in reference to PMBOK (2017) may be regarded as individual and overall project risk where the individual project risk is uncertain or is conditional on having a positive or negative

impact on one or more project goals and where the overall project risk has an effect on a project as a whole product of ambiguity arising from all sources of uncertainty including individual risks, representing stakeholders' vulnerability to both positive and negative effects of changes in project outcomes. Consequently, the definitions indicate that the probability of a risk occurring and the extent of the consequences are considered two main risk definition parameters, and the risk of a project encompasses all risks which may affect project cost, schedule, and/or quality.

All projects involve risks and uncertainties that can have a major impact on all project phases, including the study of feasibility, design, planning, construction, and even the marketing and operation process. Risk exposure can arise from the possibility of economic, financial, or social loss or gain, physical harm, damage, or delay (Cooper et al, 2005).

From the construction point of view which is composed of civil engineering and electromechanical projects, risks are usually considered to affect the key objectives of specific projects which are time, cost, and quality (PMI, 2013). Risks are commonly considered from the construction point of view which is composed of civil and electromechanical engineering projects to impact the main objectives of particular projects, which are time, expense, and quality (PMI, 2013). As a result of its construction activities, the construction industry is exposed to greater risks compared to other sectors, which are known to be unique and have specific characteristics such as long-term projects with complex processes, financial intensity, abominable conditions, and diverse organizational structure (Taylan et al, 2014). In the face of risks, most construction industries are also infamous for their poor reputation, as projects do not meet their cost targets and proposed deadlines, which in turn adversely impact each of their participants, such as contractors, public customers, and others (Tesfaye et al, 2016).

2.2.3 Project Risk Management

In a number of ways, different scholars may describe risk management. PMBOK (2017) and Pm4dev (2019) describes Project Risk Management as the processes to identify, assess and respond to risk during the life cycle of projects with the goal to ensure the project will be able to reach its objectives. With respect to Dale et al (2005), Risk management is an integral part of good management and is key to achieving good business and project performance

A good understanding of the risks enables the parties involved to take steps to minimize their adverse impacts (Sayegh et al, 2015). As a result of the lack of measures to avoid uncertainty and risk inherence in the project, the lack of an effective project risk management plan has many unpleasant effects on a project participant (Serpella, et al, 2014). To identify and evaluate risks, risk identification and assessment is critical. It is not possible to tackle all the risks in a construction project. Focusing on essential risks though is important.it can be a waste of time and expensive to attempt to identify all the risks (Sayegh et al, 2015). It is not possible to tackle all the risks in a construction project. However, it is important to concentrate on critical risks. As it can be a waste of time and costly to try to identify all risks (Sayegh et al, 2015). And with respect to National Research Council (2005), successful risk management includes the identification and analysis of project risks. If one does not classify them to know what they are, how likely they are, and what their effect may be, one cannot handle risks.

Most construction risk management decisions are based on the manager's intuition, prior knowledge, and professional judgment, according to Jarkas and Haupt (2015). The formal approaches available have not been applied to construction project activities as a result of ignorance and concerns about sustainability. In developing countries, construction projects are subject to a number of unknown factors (Ebrahimnejad et al, 2010) which leads to poor project performance. However, various project issues are also avoided by integrating proactive risk management into projects (Tadayon et al, 2012).

Various publications on risk management are available to the public, as are hard and soft copies in books and magazines, very little is comprehended in practice about the implementation of risk management, particularly in developing countries (Sayegh, 2014), and the risk management process has not been adequately addressed (Tadayon et al, 2012). Very few facts are known about the successful implementation of the risk management system in most construction industries in developing countries, based on Bowers and Kahorakian (2014) research.

2.3 Importance of Project risk management in construction industry

Risk Management is the mechanism over the life of a project and in the best interests of its goals of identifying, assessing, and reacting to risk factors. Proper risk management requires managing incidents and is proactive instead of reactive (Adarsh, 2016). According to Dieter (2013) Project risk management plays a key role in achieving the

project's objectives by identifying, analyzing and responding to risks that impact on them throughout the life of a project. PRM plays a key role in choosing good projects, identifying the nature of the project, and making reasonable forecasts, thus leading to an effective outcome of the project. Successful risk management techniques allow the strengths, weaknesses, opportunities, and threats of projects to be identified through preparing for unforeseen events (Tara, 2019).

Project risk management is considered the least advanced of all fields of knowledge in project management (Schwalbe 2007). The explanation for this is the high degree of contact with all the other fields of project knowledge are. Due to the diverse nature of projects, it is difficult to define every potential project risk within these project areas (Dieter, 2013). Figure 2.1 is presented to illustrate the variety of potential project risk incidents. It provides examples of potential conditions of negative risk that can be experienced in each of the areas knowledge of the project management.

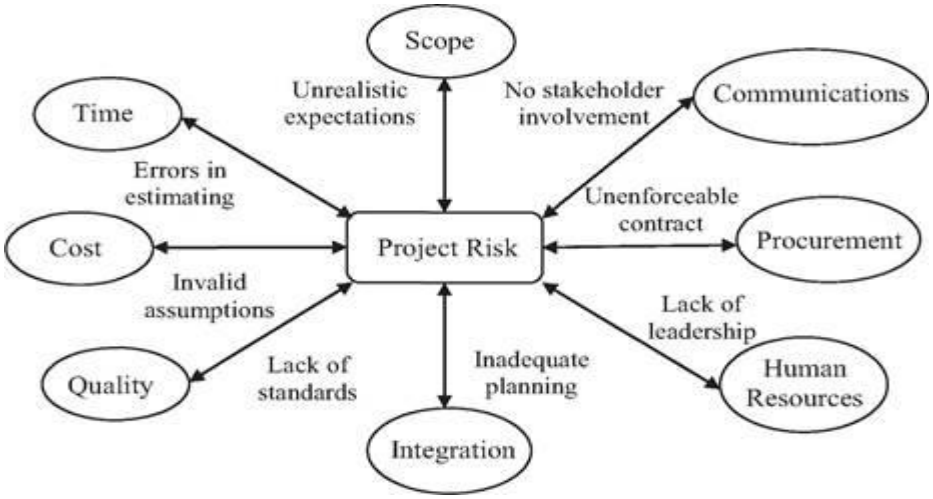

Figure 2.1 Project risk events/conditions across knowledge areas (source: Dieter, 2013)

In contrast with other sectors, the construction industry faces greater risk and uncertainty (Hiley, 2001). A risk-free construction project is thus unlikely (Loose more, 2006). These show the importance of systematic risk management to minimize risks in the construction project. Thomas (2005) and PMI (2007) suggest that RM is a compressive and structured way for the construction management to identify, analyze and deal with threats to achieve project goals. And risk management is important in decision making on construction project according to Jazid (2017), Aziz et al (2018) and Yazid (2018). In addition, Lee and Azlan (2012) introduce the PRM as a way of improving project management. Its standardization means that it must be applied with company-wide strategies. RM is also one of the construction elements that is required to

prevent unnecessary losses and to gain additional benefits that could enhance project efficiency (Oehmen, et al, 2014). This indicates how risk management is critical for successful projects, particularly for complex projects like construction.

2.4 Project Risk Management Process

The project risk management process applies across all project phases; there are different requirements for risk management at different stages in the life of a given project. So many risks analyze such as the concept development and assessment phases of the given project can be carried out to determine and evaluate alternative project strategies for the construction of the approved project and for its operations (Dale et al, 2005). By making use of the RM method, a major improvement in the quality of construction project management can be achieved. The purpose of the RM approach is not to fully eliminate all project risks. The aim of introducing RM is to create an organized structure to make management more effective and efficient in managing project risks, especially the most critical ones, and there are three stages in the methods of managing risk in the construction industry which are risk identification, risk analysis and evaluation as well as risk response (Wang et al, 2004). However, PMBOK (2017) categorizes the RM process in five stages which are RMP, RI, RA, RR, and RMC in which each is discussed as in the subtopics below.

2.4.1 Risk Management planning

From the early stages of a project, it is important to use RM, where major decisions such as choosing alignment and method of construction can be affected (Eskesen et al, 2004). The RMP is an aspect of the project management plan that explains how, beginning from the early stage of the project life cycle, RM operations will be planned and carried out, and may include risk strategy, methodology, roles and duties, funding, scheduling, and categories of risk (PMBOK 2017). A reliable project that fails due to defective execution can undoubtedly be prevented by proper attention to the project and risk preparation in which projects can succeed (Tom, 2015). Michael (2016) notes that RMPs are usually documents that outline how the project is designed and carried out in terms of risk management and are more useful for complex projects such as construction. Risk and project preparation based on PMBOK (2017) allows three situations to be differentiated and dealt with: projects that are demonstrably outside the state of the art, planning and other analytical data usually provide adequate details to terminate the project or at least to redirect the objective; risk and planning data provide

us with a persuasive basis for project negotiation for projects with unrealistic scheduling, finances, or other constraints, resulting in a more plausible target. This implies that it is indispensable to prepare for unexpected threats with a risk management plan to minimize risks and additional costs before they occur. Resources can be saved and the company's future can be secured by getting a risk management plan in place to consider potential threats or accidents before they emerge.

2.4.1.1 Tools and techniques of Risk planning

Meetings: to establish risk management planning, project teams attend planning sessions. The project manager, selected project team members, and stakeholders, everyone in the organization with responsibility for risk planning and execution activities, and others, as required, may attend these meetings (PMBOK, 2017).

Expert Judgment: to create a unified risk management plan is established, judgment and expertise from groups or individuals with specialized skills or knowledge on the subject area, such as Senior Management, Project stakeholders, Project managers who have worked on projects in the same area (directly or through lessons learned), and Subject matter experts (SMEs) in business or project management, should be considered (PMI, 2013).

Analytical techniques: used to comprehend and classify the project's overall risk management context. Based on the overall project context, the risk management context is a mixture of stakeholder risk attitudes and the strategic risk exposure of a given project (PMI, 2013).

2.4.2 Risk Identification

The first and perhaps most important step in the RM phase after risk planning is risk identification, as it to identify the source and existence of risks, including the identification of potential risk incident factors in the construction project and clarification of risk liability (Wang, 2003). Ineffective project management, Carbone and Tippet (2004) suggested that risk identification and reduction are essential steps. And with reference to PMBOK Guide (2017) defining risk is the process of identifying and recording the characteristics of overall project risk sources. Documenting existing individual project risks and the sources of total project risk are the main benefits of this process. It also collects data so that to identify risks, the project team can respond accordingly.

There are several potential risks that could lead to a construction project's failure. As Razz et al (Raz et al, 2002) point out, too many project risks may lead to delays in construction projects, unnecessary expenditure, unsatisfactory project results, or even complete failure as undesirable events. Failure to identify potential risks could, therefore, lead to inadequacy in the whole process. In essence, this can have a vital effect on the available resources of the company. Risk identification, however, enables risk management organizations to: identify the best and most appropriate input information; better understand the importance of the process; Identify risks and the impact they may have, and provide decision-makers with details (Rostami, 2016).

2.4.2.1 Tools and Techniques of Risk Identification

A variety of methods and techniques, such as checklists, brainstorming, expert judgment, past experience, SWOT analysis, and presumption analysis, can be used to identify risks (Rostami, 2016). The first four methods are popular, which are common techniques, particularly in developing countries, but the last two techniques are used in particular to explore a wider range of possible occurrences (Crnkovic et al, 2016).

SWOT Analysis: This method looks at the project from each of the strengths, weaknesses, opportunities, and threats (SWOT) views in order to broaden the scope of risks identified by adding risks developed internally. The approach begins by identifying the organization's strengths and weaknesses, focusing on whether the project, the organization, or the business area in general. The SWOT analysis then defines any project possibilities that arise from organizational strengths, as well as any threats that arise from organizational deficiencies. The analysis also looks at how well organizational strengths counteract threats, as well as possibilities that may help overcome weaknesses (PMBOK, 2017).

Assumptions Analysis: A set of ideas, scenarios, or assumptions underpins the conception and development of every project and its strategy. The validity of assumptions as they relate to the project is investigated through assumptions analysis. It describes project risks due to assumptions' inaccuracy, volatility, contradiction, or incompleteness.

The four common risk identification tools and techniques that are mostly used in developing countries in construction projects are summarized as an in the table below.

Table 2.1: Common project risk identification tools and techniques which used in construction industry of developing countries.

S/N	Tools and techniques	Description
1	Brainstorming	This can be applicable for developing initial checklist, new management arrangement or projects associated with new risks. This can be helpful in risk management workshop.
2	Past experience	Monitoring related historical data from past projects can only be helpful in a limited number of conditions. These systems are most often constrained in terms of their accessibility or essential stored data.
3	Checklist	Understand potential issues that may fail in previous projects and are, therefore, very helpful in identifying risks. This allows the project team to know the risks involved and to participate in the risk the identification process, which will consequently lead to greater acceptance of any means put in place to minimize the risks.
4	Interview	Interviewing experienced project participants, stakeholders, and subject matter experts and analysis of historical data for projects that appear similar and sounds identical in past or current projects, risk analysis, lessons learned or assessment of projects are other methods available for obtaining feedback on the risks associated.

(Source: Bahamid et al, 2017)

2.4.3 Risk Analysis

Risk analysis is known to be a mechanism incorporating the critical assessment of possible risks, organizing them according to the relevance, and enabling the management team to determine the appropriate ones (Sayegh et al,2015). RA is the most critical procedure in RM. This is due to the fact that it requires the evaluation of the probability of risk occurrence and its results on the goals of a project (Thomas, 2006). Its key objective is to measure risk by distinguishing unnecessary events, the probability of the occurrence of unexpected events, and the extent of such events (Karimi et al, 2011). According to PMBOK (2017) and Choudhry et al (2012), two main approaches are widely used in risk analysis; they are qualitative RA and quantitative RA in which each is discussed as following.

2.4.3.1 Qualitative Risk Analysis

One of the most valuable aspects of the risk management process is a qualitative risk evaluation that lays the groundwork for all subsequent phases of the process including quantitative assessments often needed to identify budgets and schedules (Karim, 2012). Based on (PMBOK, 2017) the method of conducting qualitative RA includes determining their probability of occurrence or effect as well as other features through prioritizing individual project risks for further analysis or intervention. It focuses attention on the high priority risks, which is the major benefit of this approach. This method is done throughout the entire project.

2.4.3.2 Quantitative Risk Analysis

The quantitative risk assessment process aims at numerically evaluating the probability and impacts of each risk on project goals and the magnitude of overall project risk (Karim, 2012). This approach uses different techniques and decision analysis to calculate the probability of achieving a specific project objective: quantify the risk exposure for the project, and determine the size of cost and schedule contingency reserves that may be needed; identify risks requiring the most attention by quantifying their relative contribution to project risk; and identify realistic and achievable cost, schedule, or scope targets. And PMBOK (2017) states that quantitative risk analysis is the practice of numerically assessing the cumulative impact of individual project risks found and other sources of uncertainty on overall project goals. The primary benefit of this approach is that it quantifies total exposure to project risk, and can also provide additional quantitative risk data to facilitate the planning of risk response. Not every project involves this process, but where it is used, it is carried out throughout the project.

2.4.4 Risk Responses

There are two fundamental choices for RM: dealing with causes and dealing with consequences. In both of these themes, however, there are variations. Dealing with the causes of project risk incorporates risk avoidance – risk removal (prevention), minimizing its likelihood or possible effect (mitigation), or making it an issue for someone else (transfer). RR means adjusting the plan or strategy for projects in order to reduce the root cause of the risk (Tom, 2015). Wang et al (2004) note that, once the project risks have been identified and analyzed, appropriate risk reduction strategies must be used. The key basis of these mitigation actions is the nature and potential

effects of the relevant risk. The main purpose is to increase the degree of risk handling and minimize the negative consequences of the risk as much as possible. When a mitigation measure is more regulated with regard to a single risk, it becomes more successful. As shown in Table 2 below, six distinctive risk responses are summarizing retention, reduction, control, sharing, transfer, and avoidance.

Table 2.2: Techniques of risk management response

S/N	Techniques	Description
1	Risk avoidance	Rejecting the interventions or risks to make sure the risk will not proceed
2	Risk transfer	Shift from one part to another and changes in the ownership group without changing the overall risk or reducing the value of the sources of risk.
3	Risk sharing	Mainly accomplished by a method to establish a sense of project stakeholders' collective responsibility.
4	Risk retention	It requires taking into account the nature of a specific risk situation and taking an intentional step to acknowledge the level of risk without engaging in special efforts to manage it.
5	Risk reduction	A strategy adopted to lower the risk's chances and consequences below the appropriate threshold.
6	Risk control	Does not attempt to avoid the source of the risk entirely, but takes measures to minimize the present risk

(Source: Bahamid et al, 2017)

In developing countries, preventive (avoidance) techniques and remedial (needed to minimize the risk effects and, if possible, to stop them completely) are frequently taken for risk-response methods (Iqbal et al, 2015; Kartam et al, 2001), and according to Wang and Chou [(2003)] findings on their study, Contractors generally use three approaches for the translation of the risk in project development: by insurance to insurance undertakings; by amending contractual terms to clients or other parties; transfer risks to sub-contractor by subcontracting.

2.4.5 Monitoring and control risk

PMBOK (2017) outlines the monitoring and control process for carrying out-negotiated risk response plans; monitors identified risks; identifies and analyses new risks, and

measures the efficiency of risk processes across the entire project. It allows projects to be focused on current information on total exposure to project risks and individual project risks, which is the main benefit of this process. As Tom (2015) points out, effective project risk management depends on a frequent and systematic evaluation of new information and status as the project progresses. We can't know everything about the work at the beginning, particularly on longer projects. Regular project reviews are necessary to keep the project running and successful.

These findings must be applied once risks identified, evaluated and adequate responses have been established. Risk monitoring and control involves the execution of the risk plan, which should be an important part of the project plan (Berenger et al 2016). There are typically two main challenges during monitoring and control risks: the first is to enforce and make sure the risk plans are still successful; the second is to generate substantial supporting documentation. Based on Lester (2007), the purpose of risk management is to monitor variations, reduce risks and maximize the value of the project. This process of risk monitoring and control manages risks in order to meet project goals efficiently. Risk management is based on a non-reactive, proactive approach to enforcing and consistently enhancement of the correct steps. With reference to Schatteman (2008), As no ready-made risk mitigation solutions are available, these corrective measures will help address the risks of construction projects: modifying work scope plans and estimates to counter the risk implications; regularly track risks and, if necessary, create alternate strategies to handle predictable risks; make decisions that are relevant; and Make aware of potential risks for those concerned stakeholders.

2.4.5.1 Tools and Techniques of Monitoring and Control Risks

Technical Performance Measurement: It relates technical achievements made during project execution to the technical achievement schedule. It necessitates the definition of impartial, quantifiable technological performance measures that can be used to compare real results to goals. Weight, transaction times, the number of supplied defects, storage capacity, and other technical performance measures are examples. Deviation, such as displaying more or less functionality than expected at a milestone, would aid in predicting the project's scope success (PMBOK, 2017).

Meetings: At regular status sessions, project risk management should be on the agenda. The time needed for that item will vary based on the risks identified their

priority, and the difficulty of responding to them. Risk management becomes simpler as it is practiced more often. People are more likely to identify risks and opportunities if they have frequent conversations about risk (PMBOK, 2017).

Risk Audits: It examines and documents the effectiveness of risk responses in dealing with identified risks and their root causes, as well as the effectiveness of the risk management process. The project manager is responsible for ensuring that risk audits are performed at an appropriate frequency, as defined in the project's risk management plan. Risk audits may be included during routine project review meetings, or the team may choose to hold separate risk audit meetings. The format for the audit and its objectives should be clearly defined before the audit is conducted (PMBOK, 2017).

Risk reassessment: Control Risks frequently lead to the discovery of new risks, the reassessment of current risks, and the closure of outdated risks. Risk reassessments for projects should be done on a regular basis. The amount and level of repetition that is appropriate depending on how well the project is progressing toward its goals (PMI, 2013).

2.5 Impact of risk management on construction projects success

The construction industry has changed dramatically over the past 20 years, according to Al-Balqa (2013), with businesses facing more risk and uncertainty than ever before. Clients expect more, most critically, they don't want surprises, and are more likely to participate in lawsuits when things go wrong, making project managers in Jordan and around the world think more about the link between these emerging threats and uncertainties and the performance of the project they are managing and forcing them to ask. Does risk management contribute to the success of the project?

RM is an important part of the management process for any project. In fact, risk management has been at the forefront of business literature over the last two decades of the 20th century (Loose more et al., 2006), the situations of complexity and poor performance in the construction industry have led to the practice of risk management and analysis (Akintoye et al, 2003). If the risk is applied properly, it can have a positive impact on the working effectiveness of the organizations. By doing such organization can achieve capital value of rareness and capital value of limitability via which the firm can build stronger competitive advantage by developing, maintaining and retaining core competencies; According to (Fewings, 2005) application of PM techniques such as risk

and value management effectively are thought as key supporting processes and to add to them quality, cost, time and change control; all together generate an integrated approach to the project success.

2.6 Challenges of Project risk management in construction Industry

The introduction of the functional risk management system is a dynamic process that is subject to several conditions and influenced by many variables. One of the key challenges is the difficulty in describing how beneficial it is for the organization as a poor awareness of RM and as a consequence of still uncertain boundary of the impact of risk management over other actions taken by the organization (Adina et al, 2017). Based on Ciocoiu (2015) and Fraser et al (2016) the lack of risk management expertise and training continues to be a major obstacle to the implementation of risk management. Therefore, in order to effectively integrate risk management, it is necessary to involve staff by holding well-structured forums and training sessions, and the training framework should at least comprise: basic risk management measures, risk assessment techniques, and procedures, best practice in the field, clear regulatory criteria, safety regulations, risk management targets, etc.

According to Durenberger et al (2014) the decision to select an appropriate RM framework from the multitude available frameworks is very challenging as it should form with organizational characteristics. Furthermore, Lack of a shared risk language in the organizational staff (Renault et al, 2016), the establishment of suitable techniques and/or techniques mix (Durenberger et al, 2016), the establishment of a risk function, which could be executed by a senior executive (Fraser et al., 2016), and shortage of resources or lack of top management support and participation (Ciocoiu, 2015; Renault et al, 2016) are also some of the main challenges in implementing project risk management.

The success of construction projects requires the effective integration of risk management practices (Banaitiene et al., 2011). However, since construction projects are experiencing in an ever more competitive and diverse business exacerbated by complex relationships with all stakeholder like contractors, designers, owners, suppliers, subcontractors, the public, and authorities, the performance of the RM in construction is often limited by the lack of knowledge of RM techniques, the lack of processing resources and assistance, and the absence of midsize and top management support, mainly in developing nations(Hwang, et al, 2014).

RM activities are very limited in the Chinese construction industry due to challenges such as lack of expertise retention and communication has always been a severe challenge for the construction industry; contractors lack a realistic attitude to construction risks emerged, Fragmentation and confusion in policy drafting of regulatory authorities and lack of appropriate legislation to enforce the construction insurance scheme (Junying et al, 2007). The introduction of the RM system in the construction industry therefore challenged by a scarcity of information and knowledge about RM, a lack of stakeholder support, lack of engagement between various players (customers, contractors, and insurers, suppliers), weak alignment between risk management systems and other main processes.

2.7 Review of Empirical Studies

Several local and international studies have been carried out in the field of RM practice in projects focused on the construction industry (combined civil and electromechanical engineering) and IT projects. The empirical review of some studies related to the purpose of this study is discussed in this section.

In Nairobi County Government in Kenya, Muthoni (2018) studied risk management practices and construction project performance. The goal of his study was to explore the impact of RM practices on the effectiveness of construction projects in Kenya. The questionnaire of the research focused on a total population of 380, consisting of 200 project engineers, 100 contractors, and 80 consultants/specialists, active in construction projects in Nairobi City, with a sample size of 190, which is 50 percent of the 308 participants selected by random sampling. With the aid of SPSS instruments, the researcher evaluated the collected data quantitatively with descriptive and inferential statistics, and the effect of critical risk on the performance of construction projects was assessed using multiple linear regression analyses.

According to Muthoni's study (2018) research results: 92 percent of respondents reported the significant influence of design risk management practices on project success in the construction industry in the city of Nairobi and indicated a positive relationship between design risk management practices and project performance. The design of the projects, the project costs, the conflicts on land, and the construction of the project were the most common risk management practices used by the Government of Nairobi City County for the construction projects. However, after each review of the

project life cycle risk mitigation should be carried out as the practice of risk response was poor.

According to the findings of Muthoni (2018), most contractors did not have a defined project scope and implementation plan, which means that the project objectives were not established, the expected deliverables were not identified and there was no clear implementation procedure usable. Furthermore, contractors fail due to a flaw in the project schedule, and appropriate engineering methodology, an acquisition plan, and a site evaluation plan, a design basis, and, more significantly, the absence of measured risks due to the lack of sufficient project management skills and procedures. The author has shown that the absence of contractors' supervision and the deterioration of government and contract communications has also been a big barrier to the completion of construction projects in Nairobi City.

A research on risk management in relation to project performance in the construction industry in the UAE was carried out by Mohammed Hassan (2018). The research was conducted to test the influence of the RM on the performance of the project by analyzing the literature on project success, project failure, and risk management; defining the relationship between project success and risk management, and evaluating the models of project risk management and selecting the model leading to project success. Data was obtained from 119 respondents, 5 percent of planning and development managers, 10 percent of the project managers, 12 percent of project engineers, and 64 percent of project managers, and 2 percent program managers in Dubai. In the SPSS software, the author used correlation and linear regression tests to evaluate questionnaire answers.

The discussion of the researcher on the association of the three variables that are risk identification, risk analysis, and risk response with project performance in Dubai's construction industry reveals that the three practices have a positive value of practice though poor correlation with the success of the project. The author did not place on his discussion or conclusion a simple explanation for the poor correlation of the dependent and independent variables, instead, he typically notes that checklists, documentation, and lessons learned from the similar project, interview, and brainstorming are resources we need to use in risk identification and he thought respondents were not aware of the tools and software that were used in the risk assessment in which it brought the weak relationship between risk assessment and project success. His research, however, shows

that there is an essential relationship between project success and risk management process, and the more the implementation of the risk management process, the more the project success was found to be optimistic.

There was also research conducted by Bernard (2012) on project risk management activities and the performance of capital projects in Kenya. The research objectives were to assess the effect of project risk management practices on the performance of projects by identifying the degree to which project risk management practices were applied in KAA projects and by identifying the relationship between project risk management practices and the success of the KAA's capital projects. 44 questionnaires were distributed by the researcher and 86% were successfully completed and obtained from respondents. 27 respondents were from completed projects and 11 were from projects implemented as of June 2012. The researcher used descriptive statistics (frequencies, percentages, means, variance, standard deviation) multiple analysis, and correlation analysis to interpret the data.

The association between risk management practice and three dimensions of project performance (budget/cost, time/schedule, and efficiency) in Kenya, based on the study results, indicates that the implementation of RI has the highest positive correlation with a budget of 0.413 and methods and tools have the least positive correlation with the quality of 0.024, risk response and monitoring had a positive correlation of 0.402 with a budget. According to the findings of his study, most projects met the budgetary costs with a mean and variance of 40.73 and 5.34 respectively, and most projects exceeding the budget fell below the quantity limit of 15 percent deviation. With mean of 17.85 and a variance of 2.86 relatives to those within time or ahead of schedule. Most of projects were still completed behind schedule, in which majority of them were comprised mainly of existing projects. In terms of meeting technical and client expectations, most of the projects did not meet standard requirements.

The researcher concluded from his study that, even though, most projects had applied risk management practices such as risk identification and risk response and monitoring, most of the projects recorded delays, project budget overruns and complaints from users and customers implying that risk management must be considered as a project management process with the all variables consistently applied. And based on the study result, if risk management practice consistently applied on a project, it increases the rate of the project success.

Yehualashet (2019) had carried out a study to assess risk planning, identification, risk analysis, risk response, and risk monitoring and control activities in MCIT OCRLFDP which is the extent of practicing project risk management. He gathered the data to be evaluated from 27 project team members who engage actively in the planning, initiation, supervision, and promoting overall delivery of projects of the organization. He assessed the data obtained by Likert and the ordinal scale and interpreted the data quantitatively using the SPSS program by means of descriptive statistics.

The findings of Yehualashet (2019) data review indicate that the ministry's project teams lacked comprehensive risk management skills. The company policy and structure were unable to lead the project team by the process of RM; the company's policy and framework are incompetent in terms of the risk management and evaluation of the project team. With respect to the RP, RI, RA, RR and risk monitors, his findings reveal that the various parties involved in risk management's activities, responsibilities and the RM management approach, including instruments and data sources, have not been well identified.

Moreover, no comprehensive method has been established in defining the risks and there was no clear explanation of the risk with causes and consequences. The researchers have found also that the factual data was not used to determine the risks and that the financial consequences were not measured. Even, the project documents were not updated after risks were qualitatively analyzed. The risk response process, followed by change and acceptance, was mainly mitigated. He consequently finds that the ministry had improperly used the risk assessment process and this resulted in bad project performance.

These empirical findings show that the early risk planning, risk identification, proper risk assessment, risk assessment and risk analysis procedures of a project are closely connected to the project performance in a timely, financial manner and good quality over the project life cycle. RM is important for a company, especially in the construction field, as without it a company would not be able to determine its potential goals. If a company sets goals without taking into account the risks, it will lose its path when any of these risks arise.

2.8 Conceptual Framework of the Study

The study assessed project risk management practice by JTP in construction of EM projects. Hence the conceptual framework for this study was derived from different

literature reviews related to project risk management. The project risk management aims to maximize the possibility and effect of positive outcomes, minimizing the likelihood and impact of catastrophic project events; hence literature reviewed from PMBOK (2017), Karim (2012), and Tom (2015) was a better source of idea. The process of RMP, RI, RA, RR and MCR that affect the level of project risk management practice are included in the standard way of project risk management as it is shown in figure 2.2 which is the conceptual frame work of this study.

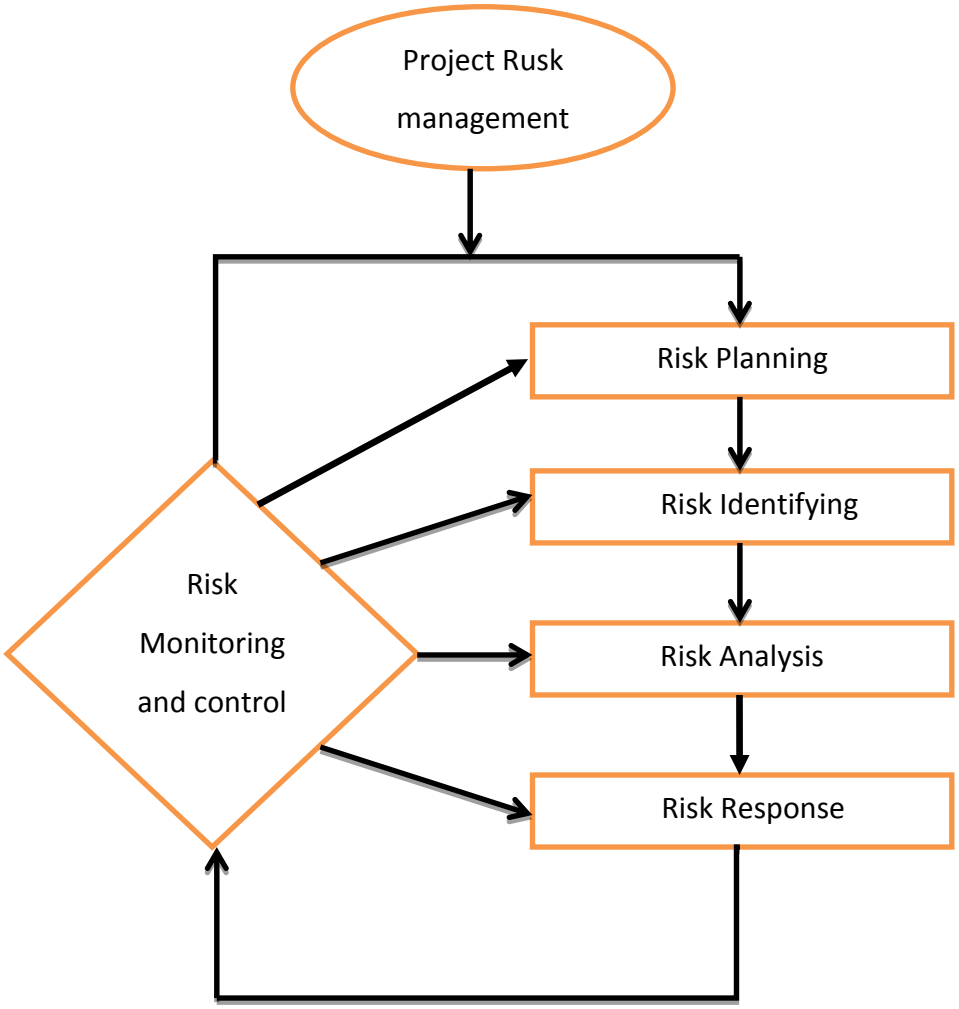

Figure 2.2 Conceptual frame works on project risk management (compiled from various sources)

CHAPTER 3: RESEARCH METHODOLOGIES

3.1 Introduction

The overall methodology used to conduct this research study is outlined in this chapter. This chapter discusses the research design, description of study variables, study area and population under consideration, Sampling technique and sample size, the methods of data collection, the methods of data analysis, reliability and validity analysis, as well as ethical consideration that the researcher employed in the study.

3.2 Research design

The approach to the collection, assessment, analysis, and reporting of data in thesis work is study design (Creswell et al, 2007). It is the structure for the planning and addressing of study questions (Shona, 2019). A reasonable option of research design is needed to correctly and consistently answer the research issue in order to achieve the purpose of the study. The key objective of the study was to assess the degree to which RM has been practiced and in JTP, requiring the description of population features, frequencies, patterns, and categorization, as well as the overview and conclusions of the results. Hence a descriptive type research design is used, as it is intended to provide a picture of a situation, person or event, or to demonstrate how things are related to each other and how they happen naturally (Blumberg et al, 2005), and was supported by inferential statistics for making the study more complete.

The goal of this research is to reflect on the extent of project RM activity in a particular organization that involves an interpretation of a complex problem through a detailed contextual analysis of a small range of incidents or situations and their relationships. In this study, descriptive case-study was used as this is designed to systematically and accurately define a particular population in a systematic and accurate way and focus on a single category or a small number of identifiable subjects with similar measurable characteristics, and since the purpose of the case study is also to acquire in-depth information on a specific entity or a small group of subjects (Mugenda et al, 2003).

Time Horizons, Saunders et al. (2009) defined research time horizon divided into two categories and are longitudinal and cross-sectional time frames, cross-sectional is the analysis at a specific time of a particular phenomenon, which can at a single point in time compare various population groups. While researchers perform many studies of the same subjects over a period of time in the longitudinal study, they may last for

several years. According to Yin (1998), in a fixed timeframe, cross-sectional study questions address existing problems. A cross-sectional study was suitable for this study, as this research was an attempt to evaluate the extent of practicing project RM in the organization at snapshot time horizon.

The data collection approach used in this study was arranged by the closed and open-ended questionnaire and semi-structured interview. Qualitative research requires capturing and analyzing non-numerical results to grasp concepts, opinions, or attitudes. It can also be used to gather in-depth information about a problem (Saunders et al, 2009) which was used to analyze data collected by open-ended questionnaires and interviews in this study. Objective measures and statistical, mathematical, or numerical interpretation of data obtained by closed-ended questionnaires were emphasized through quantitative methods (Saunders et al, 2009). This study, therefore, employed mixed approaches to analysis, both qualitative and quantitative techniques.

3.3 Description of study variables

There are so many variables in research that because what can be considered a variable in one study might not actually be a variable in another study, a variable is an entity, occurrence, thought, feeling, time span, or some other form of the category we are attempting to quantify, it may be impossible or extremely difficult to account for all of them (Sitwe, 2011). There are two main types-independent and dependent-of variables. In this analysis, RMP, RI, RA, RR, and MCR are the descriptive independent variables that apply. And the dependent variable of this research is risk management, which is assessed with the assistance of risk management practices and, in particular, within the company, their level of usage.

Project risk Management is one of the ten (10) knowledge areas of project management. And it includes the processes of carrying out RMP, RI, RA, RR and MCR on a project. The aim of PRM is to advance the probability and influence of Positive events and to reduce the probability and influence of negative events in the project (PMI, 2017).

RMP is a component of the project management plan that describes how risk management activities will be structured and performed (PMI, 2017).

RI Risks is the process of identifying individual project risks as well as sources of overall project risk, and documenting their characteristics (PMI, 2017)

RA qualitative risk analysis is the process of prioritizing individual project risks for further analysis or action by assessing their probability of occurrence and impact as well as other characteristics, and the quantitative risk analysis process aims to analyze numerically the probability of each risk and its consequence on project objectives, as well as the extent of overall project risk (PMI, 2017).

RR is the process of developing options, selecting strategies, and agreeing on actions to address overall project risk exposure, as well as to treat individual project risks. The key benefit of this process is that it ensures that agreed-upon risk responses are executed as planned in order to address overall project risk exposure, minimize individual project threats, and maximize individual project opportunities (PMI, 2017).

MCR is the process of monitoring the implementation of agreed-upon risk response plans, tracking identified risks, identifying and analyzing new risks, and evaluating risk process effectiveness throughout the project. (PMI, 2017)

3.4 Description of study area and target population

The study of project risk management practice was conducted on JTP in which to what extent was practicing risk management while engaging in construction of EM projects and challenges that limits implementation of RM system. JTP has been participating in Design, supplying, installation, testing, and commissioning of different EM and Automation projects including mega projects Like GERD, Sugar factory project and Heuft inspection system automation machinery as contractor and sub-contractor for the last 15 years and currently is also participating as EM sub-contractor in GERD from the current EM main contractor Voith which, is a Chinese company.

The study was limited to the assessment of risk management practice used by JTP. The target population of the study were all professionals including project managers, senior project engineers, designers, marketing manager and supporting staffs that have been responsible in planning, design, procurement, executing, managing, and supporting the overall project's implementation of the organization and the target population were total of 28 in number. 25 respondents had returned the questionnaire with a complete answer; that is the response rate was 89% and 5 senior managers were interviewed which was adequate to conduct the analysis.

3.5 Target Population

The main objective of the research was to test the PRM practice in JTP; as the population of this study was small, the census approach was appropriate for this study. Since the census method is the statistical enumeration method in which all population members are studied, data collection and analysis from any possible case or group member in a population is collected and analyzed (Saunders et al, 2009). Thus all of the 25 population were carefully chosen according to their competency and relation they have to the study requirement to fill a questionnaire. And 1 project Managers, 1 project lead, 1 Engineering manager and 1 electromechanical head and 1 operations manager were selected no-randomly for semi-structured interview. The frequency of respondents for the questionnaire along with their responsibility is summarized in the table below.

Table 3.1: frequency of respondents along with their responsibility

S/N	Responsibility of the respondents	Frequency	percent
1	Project Managers	4	16%
2	project engineers (Civil, Mechanical, Electrical and Electromechanical engineers)	9	36%
3	Designers (Electrical, Mechanical and drafting)	4	16%
4	Operations Manger	1	4%
5	Engineering manger	1	4%
6	Electromechanical head	1	4%
7	marketing manger	1	4%
8	marketing officer	1	4%
9	Executive assistant	1	4%
10	Other	2	8%

(Source: own survey, 2021)

3.6 Method of Data collection

For achieving the purpose of the study both primary and secondary data were collected. Questionnaire and interview were the instruments used for collecting the primary data (Cohen, 2013) whereas the source of secondary data was from existing research papers, journals and publication, books and websites. The questionnaires were dispersed by email and in person. The researcher was also conduct a deep interview with the selected competent sample that are 1 project Managers, 1 project lead, 1 Engineering manager

and 1 electromechanical head and 1 operations manager and analysis of the available document was also considered. The questionnaire in which designed by referring to related studies and literature is the main data collection instrument. Interview and document analysis triangulated the information gathered by questionnaire. All the independent variables RP, RI, RA, RR and MCR which identified for this study were addressed through questionnaire instruments and the interview also tried to address those variables for collect more elicit data about the research problem with semi-structured questions.

3.7 Data analysis

Given the descriptive nature of this study, data collected were analyzed using techniques like the mean and standard deviation. Charts and graphs were also used to view and rate the respondent's answers. According to Greener (2008), the data analysis method includes preparing the data for analysis, evaluating the data and eventually interpreting the data in most forms of research studies. Thus, the content analysis of data involved the presentation of data or respondent responses by table and graph form then data was analyzed by tools like the mean and standard deviation and secondary data information supports the analysis. The data from open questions and semi structured interviews were analyzed using qualitative method. The data was ultimately translated as results.

Quantitative data analysis and qualitative data interpretation converge to look for a connection between the findings, as Creswell (2003) says. This study consists of the numerical information (ordinal data) collected by a questionnaire instrument, which was used to explain and interpret the data collected by the descriptive data analysis process. The collected data was calculated on an ordinary scale (measured from 1 to 5 points) and included close style queries (coded for "yes" for 1 and "no" for 0), data were collected for data presentation using version 26 of the statistical SPSS kit. Mean and standard deviations were applied to tabular presentations as part of the descriptive method and inferential tools to complete the study in order to adequately represent and describe research results and findings. To interpret the data from semi-structured interviews and documents, additionally, a narrative interpretation tool of qualitative data analysis was used.

3.8 Reliability and validity analysis

Reliability and validity are the two most important and fundamental aspects used to test measuring tools or instruments used in the analysis for a successful study (Mohajan, 2017). Validity explores what measures an instrument takes and how well it does so, and reliability refers to the confidence that one may have in the data collected by the use of an instrument. In another way, the truthfulness of findings is interpreted on the basis of Altheide et al (1994) validity, while reliability refers to the stability of findings.

Reliability testing is one of the critical factors for conducting research, in which, the accuracy between the questions is tested (Stainton et al., 2010). According to ATS (2012) Cronbach's alpha value is used to measure the internal consistency that can be achieved in the SPSS by conducting the reliability test. For all the questions, the reliability test was carried out and the overall result was 0.926. The alpha of the Cronbach should be above 0.9 to achieve excellent reliability. It can be considered good and appropriate for conducting data analysis on the data collected from the questionnaire if the value is more than 0.8. The alpha of Cronbach above 0.7 is appropriate and 0.5 - 0.7 is deemed to be bad, ultimately Cronbach below 0.5 is not acceptable for further test as the data obtained are not reliable (Bonett et al, 2015). If the alpha value of Cronbach is below 0.7, then it is suggested to use the SPSS option to raise the SPSS value by recommending that some of the questions be removed. However, since the Cronbach's alpha value for each variables was greater than 0.7 as shown in the table below, it was good and appropriate for conducting data analysis, hence there is no need further actions to improve the reliability.

Table 3.2 Reliability test results for each variable

S/N	Risk management general awareness and variables	No. of Items	Cronbach's Alpha
1	General Awareness about PRM	6	0.904
2	Risk Management Planning	3	0.828
4	Risk Identification	5	0.812
5	Risk Analysis	4	0.801
6	Risk Response	4	0.772
7	Monitoring and controlling risks	5	0.782

(Source: Own survey, 2021)

3.9 Ethical consideration

During and after the research has been completed, ethical problems should be addressed in every kind of research study. The study would take ethical issues of data collection and usage into account, and examine them in a responsible manner. Participants will be notified of the purpose of the study and the potential effects of their involvement in the research. In general, any information that might affect their decision to participate in the research will be given to the participant. Participants should be volunteers and, without being coerced, participate. Test data will be secured and the respondents' confidentiality will be maintained.

CHAPTER 4: DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introductions

The objective of this research, as stated in the previous chapter, is to study the extent of risk management practices at Jehoiachin techno plc mostly during the construction of EM projects. That is to find out the degree of practicing project RM process including the effectiveness of methods and technique's used for risk process and identifying the challenges that constraints implementation of RM in the case study company.

This chapter presents the results of the data collected from the respondents using questionnaires and interviews in order to achieve this objective. The questionnaire was built in three types: using a form scale of Likert; where 1 represents strong disagreement, 2 disagree, 3 Not sure, 4 agree and 5 strongly agree; multiple choice of methods and strategies used in the risk process to help respondents chose from or specify their own if others are often used; and finally, yes or no questions. For the purpose of easy and complete study and explanation, the data are described using descriptive and inferential statistics. SPSS Statistics version 26 was used to analyze the collected data. Furthermore, the outcome obtained from the interview and associated documentation available to the organization was also reviewed in relation to the literature. The outcome and interpretation of the data obtained is therefore summarized as follows:

4.2 Biographical Information of the Respondents

The general request for biographical information including age, educational background, experience in projects, and current responsibility in the respondent's organization was specified in the first section of the questionnaire, and the reply of the respondents is presented as shown in the table below.

Table 4.1: Biographical information of the respondents

Biographical information		Frequency	Percent	Valid Percent
Respondents' Age in Years				
Age in Years	21-30	6	24 %	24%
	31-40	12	48 %	48%
	41-50	6	24%	24%
	above 50	1	4%	4%
	Total	25	100%	100%
Educational background				
Level of Education	Bachelor	18	72%	72%
	Master	6	24%	24%
	Other	1	4%	4%
	Total	25	100%	100%
Experience in projects				
Experience in Years at projects	less than 3	3	12%	12%
	3-5	5	20%	20%
	6-7	7	28%	28%
	greater or equal to 10	10	40%	40%
	Total	25	100%	100%
Current Job Title				
responsibility at the Organization	Other	8	32%	32%
	Designer	4	16%	16%
	Project Engineer	9	36%	36%
	Project Manager	4	16%	16%
	Total	25	100%	100%

Own survey source; 2021

The respondents were required to indicate their age as per the above table, where the study results showed that the majority (48 %) indicated that they were between the ages of 31-40, which was calculated from a frequency of 12 respondents. This was followed by equal frequency of participants (24%) who said they were in the range of 21-30 and

41-50 years of age. Only one respondent was above 50 years' old which indicates the lowest percentage (4%) from the overall 25 respondents. Therefore, it can be concluded from these results that the respondents were old enough to have the necessary knowledge and information on the project risk management activities in the organization.

Regarding the level of education of the respondents, almost all (%) of the 24 respondents graduated from university; only one respondent (4 %) was on his way to graduating in electromechanical engineering. Of the 24 respondents' majority (72%) are 18 respondents were degree holders and (24%) were completed a master's degree. This is an indication that almost all of the respondents in this study had a university degree as their highest level of education and therefore had the knowledge to evaluate the risk management practice in their organization.

The majority of the 25 respondents were 40%, with 10 respondents having more than 10 years of experience in various electromechanical projects. 7 out of 25 respondents (28%) had 6 to 7 years of experience and 20% had 3 to 5 years of experience. Only frequency 3, covering 20% of all respondents, had less than 3 years of experience. Therefore, as almost all of the respondents which covers 80% of the respondents had more than three years' of experience in the construction of EM projects by the company, they had a clear understanding that to what extent the company applies the risk management system during construction of EM projects.

The participants were from various positions in the case study company. 36%, of which the majority of respondents were project engineers with a frequency of 9 (Electrical, Mechanical and Civil engineers). Project managers and designers (electrical and mechanical) were 16% of the respondents each and the remaining 32% of respondents who responded as other as stated in the data collection instrument were operations manager, Engineering manager, Electromechanical head, executive assistant and marketing officers. This indicates that almost all the respondents were in a position that enables them to give adequate response regarding practice of risk management in the organization.

4.3 General awareness of project risk management

Section B of the questionnaire was designed in order to get a response for the general knowledge of project risk management system. This section consists of seven questions that try to know whether, the organization has strategies or guidelines that explain how

to cope with unforeseen uncertainties, whether, given or standard risk management techniques were implemented, If the company had a responsible person or department to monitor or manage the risk and implements the project risk management system over the life cycle of the project, whether, the company offers ongoing project risk management system training and if there is a history documentation system for registering risks of previous projects, finally, this section sought to know, if, there were challenges that make it difficult to implement a risk management system. The responses from the participants regarding those questions are organized as shown in the table below.

Table 4.2: General Awareness about project risk management

General awareness regarding RM	N	Mean	Std. Deviation
Availability of strategies or guidelines that illustrate how to deal with unexpected uncertainties	25	3.3200	.94516
The company applies a defined or standard risk management techniques	25	2.7200	1.06145
There is a responsible person or department in the company to handle or manage the risk in the projects.	25	2.5600	1.19304
The company applies Project risk management system throughout the project life cycle.	25	3.1600	.98658
The company provides continuous training on the project risk management system	25	2.1600	1.06771
Availability of history documentation system for registering risks of past projects	25	2.3200	1.10755
Valid N (list wise)	25		
Grand Mean	2.7067		

Own survey: 2021

As it can be seen in the above table the mean (3.32) and SD (.945) indicates that most of the respondents are not aware whether the company has strategies to deal with risks that may occur in projects, even though there are some who agree and a few disagree that the company has strategies or guide lines to handle risks. The response obtained from interview of high level senior officials like Engineering Manager, Electromechanical head and senior project engineer and result of available document

analysis indicated that the company doesn't have any established risk policy or strategy, though the operations manager tried to say there is taking care system of risks based on types of projects. This result related with finding s of Furtuna (2019) in which her study reveals the unavailability of risk policy and guidelines related to risk management.

The respondents were asked if the company applies a defined or standard risk management technique. The response result with the mean (2.72) and SD (1.06) indicates that the company doesn't have standard risk management technique while there are some respondents who agree with its availability. This is similar with Fertuna (2019), in which, the findings from her study revealed that there is no formal procedure concerning risk management. The interview and document analysis result supports the unavailability of defined or standard risk management technique in which according to the engineering manager and other senior engineers' risks were considered after they were reported from site and more concentrate on cost based. One of the top managers, engineering manager, said that the only risk foreseen is usually project cost implications during project cost calculations.

The respondents were also asked, if the company provides training regarding RM system. The values mean (2.16) and SD (1.07) indicates that the company doesn't provide continues training regarding RM system even most of them believes there has never been training regarding RM. In support of this the interview response of all respondents including the top management indicates that the company has not been offering continuous based training regarding PRM system. This lack of training had its own impact on the response of more respondents which says "not sure" and "agree" for the general information about RM in the company, even though the senior officials like engineering manager dis agree with their response. Furthermore, the history document of the company shows that the company has been organizing technical training for the purpose of giving technical solution and QMS training for ISO certification purpose. There was not any document that shows the company has ever offered training regarding RM exclusively.

The response with the mean (3.16) and SD (0.99) value indicates that company doesn't always make risk assessment throughout the projects life cycle though most of the respondents not sure. The interview and document analysis results also support the non-continual of PRM system throughout the projects life cycle, in which most of the respondents to the interview said that there is no continuous risk assessment for

complete project life cycle, risks were discussed whenever there was a report from site engineers and there is not any report or document in the history of company project status report file that shows the company has been making continuous risk assessment throughout project life cycle.

There were also questions regarding availability of risk management department and/or history documentation system for registering risks.as shown in the above table of mean (2.56) SD (1.19) and mean (2.32) SD (1.11) values, there was no responsible person or department and history documentation of risk registering respectively in the case study company, which is similar with the findings of Yehualashet (2019), in which there was no recorded risk registry from previous projects to support the risk assessment and review of the project team. Furthermore, the response from the interview shows that the unavailability of both of them. One of the high level managers in company who is engineering manager says during interview "Neither responsible department nor history documentation is available for project risks in the company", in which all the interview results including the operations manager response who is one of the top management agrees with this.

Finally, the participants were expected to answer for the open-ended question provided on the questionnaire which is, if there were challenges that restrict the implementation of risk management system and were also expected to mention them, if their answer was yes. As shown in the graph below more than 60% of the response indicates the existence of challenges that can restrict the implementation of risk management system in the company. As per the respondents the challenges are lack of established guidelines, procedures, and systems as well as lack of transparency between top management and lower staffs, lack of attention given to project risk management by the company. A Project manager on his interview said that lack of support and involvement from management, less appetite of the employee about the issues and scarce of financial resources are the main challenges for implementing risk management system properly. However, as per the top management believes, the main challenges are the project uniqueness, complexity and customer demand.one of the top management operations manager says "since risks are project dependent, they all vary depending on the type of project and customer interest, thus it makes difficult to implement properly".

Majority response were related in somehow with challenges mentioned in different literatures such as shortage of resources or lack of top management support and

participation (Ciocoiu, 2015; Renault et al, 2016), Lack of a shared risk language in the organizational staff (Renault et al, 2016), lack of establishing suitable techniques and/or techniques mix (Durenberger et al, 2016), and unavailable of establishment risk function, which could be executed by a senior executive (Fraser et al., 2016).

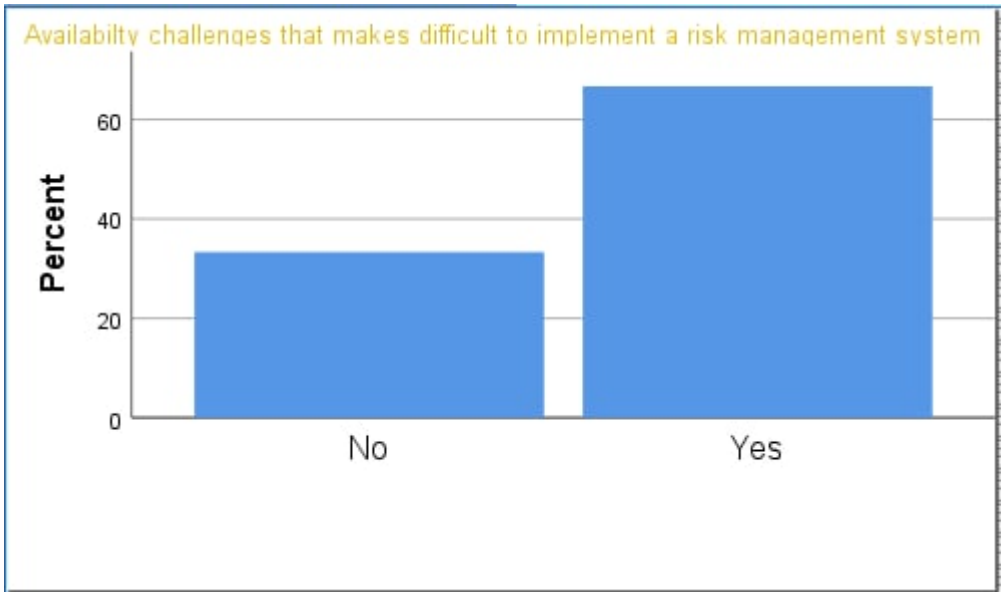

Figure 4.1: Responses regrading challenges which makes difficult to implement RM in the company

4.4 Practice of Risk Management Planning

To say risk management plan is implemented by a given company there should be available at least clearly defined role and responsibilities and involvement of concerned stakeholders in the risk planning phase, and a proof of risk management plan consideration during project plan as well as written document about risk management planning (Parker & Mobley, 2004).Four questions were posed in the questionnaire to determine the practice of project risk planning in the organization, and these are: whether the risk management strategy is considered during the project planning phase; whether the relevant company stakeholders are involved in the project risk planning phase; and whether the role and responsibilities of the stakeholders are clearly defined. Furthermore, the respondents also questioned if there was any written document describing the risk management planning of the company. The findings of the respondents are summarized as shown in the table below.

Table: 4.3: Response regarding Practice of Risk Management Planning

Risk Management Planning factors	N	Mean	Std. Deviation
Jehoiachin Techno plc considers risk management plan during planning phase of projects.	25	3.0400	1.24097
Relevant stakeholders of the company participate in the risk planning phase of projects	25	3.0400	.88882
The company clearly defined the role and responsibilities of stakeholders in the risk planning phase.	25	2.6800	1.10755
Valid N (list wise)	25		
Grand Mean	2.9200		

Own survey: 2021

As can be seen from the above table, the mean (3.04) and more deviation with SD (1.24) implies that the company mostly considers the risk management plan during the project planning phase, while some of the respondent didn't agree. However, the interview with the engineering manager, project lead and electromechanical head reveals that during the planning phase of projects, the company does not always take risk management plan into consideration while the project manager said during interview "risk is considered during planning phase however, all concerned stakeholder are not usually involved". One of the top management member operations manager said that PMP was always applied beforehand; depending upon the project type and the client need, as per his response usually depends upon client demand.

The mean value 3.04 with SD 0.8 implies that most of the staff workers were not aware about the involvement of relevant stakeholders in the risk planning phase of projects, even though there were some and few respondents who disagree and agree respectively. Most of the interview response also indicates the lack of involvement of relevant stakeholders, while the operation manger from top management disagreed with this. He said that, the relevant stakeholders including CEO of the company and client representatives always involve in risk planning particularly during estimating of activity cost and schedule during project cost budgeting by assuming contingencies and reserves for they think of incase something happened that shifts from the plan.

It is not expected to have clearly defined roles and responsibilities of stakeholders in the absence of concern for risk planning. As Yehualashet (2019) research findings suggests that the roles and responsibilities of the various parties engaged in risk management have not been well identified as there were inadequate risk planning consideration during planning process of projects. This was illustrated by participant responses in which the mean (2.68) and SD (1.1) suggest that stakeholder roles and responsibilities have not been adequately defined. This is even acknowledged by the results of the interview in which they did not accept their availability. In comparison, the company's quality manual does not contain the concept of stakeholder roles and responsibilities solely with respect to risk planning, although it covers the general roles and responsibilities of individual stakeholders, most of whom centered on their overall responsibility for delegated tasks.

The respondents were also questioned if there was any written document describing the risk management planning of the company in the open-ended section of the questionnaire. The response outcome, as seen in the figure below, means that there was no written document that considered risk planning. Even the top management admits that written records deemed to be RMP are not available. In its quality manual, the case study organization notes that planning has discussed future challenges and has established the risks and opportunities that need to be resolved in order to improve favorable outcomes, eliminate or minimize undesired effects, and achieve enhancement, although there was no formal written paper outlining RMP. Furthermore, there were also records about project planning in the organization. They just reflect, though, on whether, when, and how the project's goals will be achieved. There were no documented materials that called risk planning in focus that states such as recognizing possible potential concerns that could adversely influence the schedule, quality, and expenditure of a project and how to eliminate or mitigate them if they occur unless only a certain percentage of contingency and reserves were usually retained.

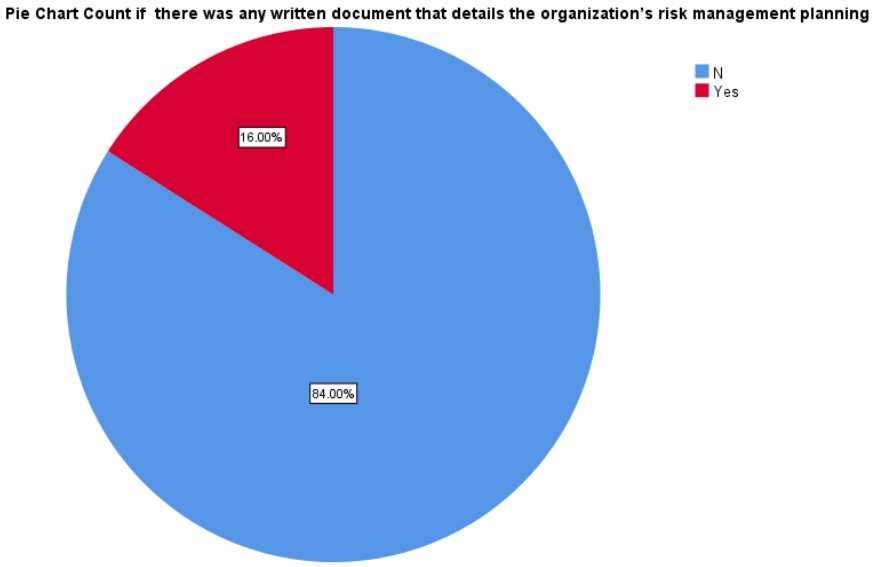

Figure 4.2: Pie chart count for the availability of risk planning

4.4.1 Tools and techniques used in risk planning

The tools and techniques used by the company during risk planning as per participant's response are summarized as in the following table.

Table 4.4 Response result of tools and techniques used in risk planning

Tools and techniques used by the company in projects during risk planning stage		
	Frequency	Percent
Expert judgment	3	12%
Meetings	18	72%
interpersonal and team skill	2	8%
Not sure	2	8%

Own survey: 2021

As seen in the table above, the organization has often used team meetings and occasionally expert judgments as tools and techniques in risk planning. While risk planning was not often regarded by the organization during the planning process of projects, past records from some projects indicate that concerned managers have often held meetings to address project planning and results in general, including sometimes the risk question of how to avoid or mitigate unintended consequences and how to enhance them. All interview participants, including top managers, agree that project risks are typically discussed on the basis of reports from sites as input for discussion at meetings.

4.5 Practice of Risk Identification

Carbone and Tippett (2004) indicated that risk identification is one of the key projects' achievements; they argue that risk should be identified in the very early stages in order to have better risk management to achieve project success. Boehm (1991), and Ahmed el-at (2007) also, noted that risk identification procedures are aimed at achieving effective project success. This is therefore a critical process for the risk management model because if this aspect is not properly implemented, the overall risk management process will not be effective, as important risks have not been identified in this process. Checklists, lessons learned from a similar project, expert judgment, and brainstorming tools are common critical tools for identifying risks, especially in the construction industry. The result of response related with the implementation of these tools in risk identification are summarized and presented as in the table below.

Table 4.5: Response results regarding Practice of risk identification

	N	Mean	Std. Deviation
Risk is identified in the company from the lessons learned of similar past projects	25	2.8800	1.20139
The company uses checklist in risk identification	25	2.6400	1.11355
The company uses expert judgment in risk identification.	25	2.9600	1.01980
The company uses brainstorming for risk identification	25	3.4400	1.12101
Valid N (list wise)	25		
Grand Mean	2.9800		

Own survey: 2021

The participants were asked if the company uses risk identification from past similar projects. The mean (2.88) with higher SD (1.2) value indicates that the company was not identifying risks from lessons learned of similar projects. The main reason for this could be unavailability of history documentation of risk registering for past projects as the response result in section 4.4 implies this. In the company, there were some record histories documenting the progress of the projects, but they did not provide in-depth what potential problems were faced and how they were addressed in the life cycles of the project. They focused largely on what and how things were performed, what steps

were taken when project success was out of schedule, but the root causes were not stated.

The respondents were also questioned if the organization uses a checklist, expert judgment, and/or brainstorming for risk identification as they are popular tools and techniques for project risk identification used in developing countries' construction industry (Sayegh, 2014; Tipili et al, 2015; Choudhry et al, 2012 & Smith, 2009). As seen in the table above, the mean and SD values for the checklist, expert judgment, and brainstorming indicate that brainstorming was primarily used by the organization for risk identification, while occasionally checklist and expert judgment were used.

In regards to risk identification practice, five senior managers including engineering and operations managers from top management were interviewed precisely tools and techniques used to classify risks. The checklist and brainstorming were used as a means of risk identification, according to the project manager and project lead. And the Engineering Manager said that while no organized risk identification scheme is in operation, brainstorming and expert judgment has been used. However, the operations manager states, for risk identification, that an assessment format developed by the customer is used.

The participants were asked in the open-ended questions if their organization specified the stakeholders that should participate in risk identification. As seen in the histogram below, the company has not been identified stakeholders that should participate in risk identification as per the majority response. However, the plurality response contradicts the response from top management, in which the organization identifies stakeholders that can engage in risk identification. Among the stakeholders listed by the top management were clients who offer the project, project managers, engineering managers, project engineers, and supervisors to the stated project.

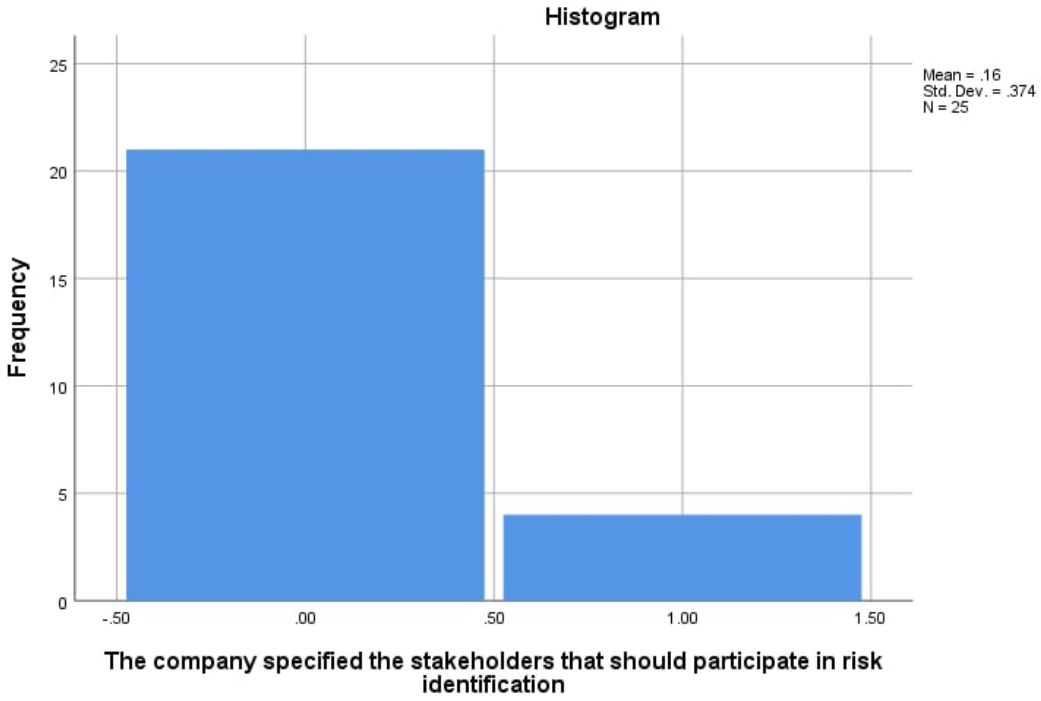

Figure 4.3: response regarding to stakeholders that should participate in risk identification.

4.5.1 Tools and Techniques used for risk identification

The participants were also asked again in a multiple questions form whether the company uses checklist, expert judgment or brainstorming as tools and techniques for risk identification, the result in the table below approves that the company typically uses brainstorming during risk identification as the result showed in the above section.

Table 4.6: Response result of tools and techniques used in risk identification

Tools and techniques used by the company during project identification			
S/N		Frequency	Percent
1	Expert judgment	6	24%
2	Brainstorming	10	40%
3	Checklist	2	8%
4	Document Analysis	5	20%
5	Other	2	8%

Own survey; 2021

4.6 Practice of Risk Analysis

In the risk management model, risk analysis is an integral process. The analysis of the likelihood and the consequences of risk is an implication of a good risk management system that helps to ensure satisfactory achievement of projects (Fabricius et al, 2015). The questions in the survey were general about risk analysis, which is

whether risks were assessed by the organization based on their likelihood of occurrence and/or their impact. The participants were also asked, if the qualitative and/or quantitative approach is used for risk analysis. The outcome of the answers is presented and summarized in the table below.

Table 4.7: Response results regarding practice of risk analysis

Risk Analysis factors	N	Mean	Std. Deviation
Jehoiachin techno analysis risks based on their probability of occurrence.	25	3.5600	.71181
The company analysis risks based on their impact.	25	3.4000	.76376
the company uses Qualitative risk analysis	25	3.0400	1.01980
the company uses Quantitative risk analysis	25	2.6000	.81650
Valid N (list wise)	25		
Grand Mean	3.15		

Own survey; 2021

Based on the results obtained from the respondents, the mean (3.56) and (3.4) with low deviation from the mean value, as shown in the table above, suggest that the organization analyzes risks based on their likelihood of occurrence and impact, respectively. All interviewed participants also agree with the idea of the company analysis risks based on their likelihood of occurrence and their impact. As per the engineering manager, while there was no organized risk analysis framework in place and there was no comprehensive project risk analysis, the identified risks were prioritized for analysis based on their level of effect on scope, scheduling, and/or budget. This is related to Karlotta (2018) stating that it is common to look at impact versus likelihood in order to categorize and prioritize risks, as some risks may have a significant impact on project goals, but only occur occasionally, while others have a mild impact, but occur more frequently.

For qualitative and quantitative risk analysis, the mean (3.04) with SD (1.02) and mean (2.6) with SD (0.82) values respectively show that the organization mainly used qualitative rather than quantitative approaches to analyze identified risks. The interview outcomes also confirmed this. Project risks were generally examined, classified, and assessed after they were reported from sites, according to the project lead. While the project manager said that the organization often uses the process of

quantitative risk analysis, for example, a scale of "Low, Medium, and High" was used to show the likelihood of the risk event happening for any risk event and process.

One of the senior managers who lead the organization as engineering manager said "Project risks were usually discussed on the basis of reports from the site and qualitative approach was taken, although no detailed analysis of project risks ". According to the results of the interview, risks were discussed at the level of the management meeting, and actions were taken as required. The result means that while risks were evaluated by their probability of occurrence and impact and used to analyze qualitative and quantitative approaches, there was no detailed analysis and all concerned staff was not involving.

4.6.1 Tools and Techniques used in risk analysis

Table 4.8: Response results of tools and techniques used in risk analysis

The tools and techniques used by the company in risk analysis				
		Frequency	Percent	Valid Percent
Valid	Risk probability and impact assessment	5	20%	22%
	Interpersonal and team skills	11	44%	48%
	Representation of uncertainty	3	12%	13%
	Expert judgment	1	4%	4%
	other	3	12%	13%
	Total	23	92%	100%
Missing	System	2	8%	
Total		25	100.0	

Own survey; 2021

The outcome of the above table reveals that most of the time interpersonal and team skills were used as a tool of risk analysis in the company, additionally, probability and impact assessment, as well as expert judgment, was seldom used as risk analysis tools and methods. The response to the interview with respect to the tools and techniques used in risk analysis was not identical. For example, according to the project lead, meetings were held at the level of management, and necessary actions were taken, however, based on the operations manager an assessment format designed by the client was used for risk analysis.

4.7 Practice of Risk response

Risk response is an important risk management mechanism, as Zwikael et al (2011) indicate that risk management contributes to a reduction in the amount of risk in the

project, which is accomplished first by identifying the risk, then by analyzing the risk incidents, and then by determining the risk response over the life cycle of the project. There should be a risk response when the risk arises. There are several tools that have a beneficial effect on the RM that influence project performance, such as planning charts and predictability of impacts. The main risks should be promptly reported to the top management in order to have a good risk response and should be given high priority, and construction insurance is strongly recommended to protect the business against injuries and/or property damage.

Table 4.9: Response results regarding practice of risk response

	N	Mean	SD
Planning charts is applied by the company for risk response process	25	2.5200	.96264
The company gives high priority to the risks which has high negative impact on the objectives of project	25	3.2400	.92556
Clearly defined strategies are established by the company to avoid the identified risks in project	25	3.0000	.76376
The company have construction insurance for coverage of property damage and/or personnel injury during project construction	25	3.8800	.78102
Valid N (list wise)	25		
Grand Mean		3.16	

Own survey; 2021

The risk response planning chart is useful in identifying suitable ways to handle individual and overall project risk, as well as in allocating resources and incorporating activities into project documents and the project management plan as required (PMBOK, 2017). However, as can be seen in the table above, the mean (2.52) with SD (0.96) implies that the company was not good at applying planning charts during risk response. The company has been giving priority to the risks which had high negative impact on the objectives of project, though there were a lot of respondents who were not certain. Even though, there should have been clearly defined strategies or mixed strategies for choosing the most suitable risk response (PMBPK,2017), the mean (3) with SD (0.7) indicates that there was no certainty that the company had clearly defined

strategies to avoid the identified risks. And there was not any document in the company that indicates its availability.

Finally, the respondents were asked whether the company has construction insurance for coverage of property damage and/or employee injury during project construction and this question was also re-organized with yes or no questions on item 26 of the questionnaire to validate their answer. The values of the mean (3.88) with SD (0.78) and the outcome of the yes or no questions (shown in the following histogram), as well as the interview results, confirms that the company has insurance coverage which includes property damage and personnel injury to protect the business of the company. Furthermore, the working manual of the company released in 2018 addressed in-depth the provision of insurance for workers' physical injuries during EM works on the site,24 hours' coverage of health insurance, insurance coverage for the fixed asset machinery, etc.

Figure 4.4: Response for the availability of construction risk insurance (own survey)

4.8 Practice of Risk monitoring and control

In the majority of risk models, risk monitoring and control is one of the main methods. Throughout the project, Cervone (2006), risk should be monitored and controlled in risk management and the method, such as risk identification, is engaged. Throughout the project life cycle, risks do not stay the same, some of the risks have arisen and established, and there are risks that do not exist anymore. Charts and indicators should

be evaluated to report them regularly in required to bring out risk monitoring and control, one risk is over it should be closed in a systematic way according to the risk closure protocol.

The status of risk reduction, the status of risk mitigation, whether or not the risk mitigation has been effective, should be recorded on a regular basis. The failure of the risk mitigation means that the risk response action should be taken on the particular event or circumstance (Mohammed, 2018). All risks are controlled during risk monitoring and control, so top management may not be involved in the risks. In order to speed up seeking solutions and taking risk responses, only the vital risk should be communicated to the top management. The outcome of the response from the participants in the case study company which includes these listed issues is presented and summarized in the table below.

Table 4.10: Response results regarding practice of risk monitoring and control

	N	Mean	Std. Deviation
Any developments of uncertainty in the projects of the company are analyzed and reported periodically.	25	3.2800	.84261
The identified and reported risks of the company projects are controlled with considering of project objectives	25	3.6000	.86603
Risk mitigation status in the projects of the company is reported periodically.	25	3.4000	.86603
Critical risks are reported to the top Management	25	4.0000	.70711
The company evaluates the effectiveness of risk management process in the life cycle of projects.	25	3.2000	.81650
Valid N (list wise)	25		
Grand Mean	3.496		

Own survey; 2021

As it can be seen in the above table any occurrence of uncertainty is evaluated and documented to some degree, the identified and reported risks were also monitored in relation to project objectives with the uncertainty of most respondents. Furthermore, mitigation status was also reported periodically. The mean (4) with SD (0.7) means that critical risks have been highly reported to the top management. However, the response

from the interview didn't indicate that, unless strongly agree with the point that the critical risks were reported to the top management and decision taken after meeting held by the concerned staff. As the per the interview result any development of uncertainty was not always evaluated and reported, in order to monitor it in relation to project objectives. In addition, the quality manual of organization addressed about monitoring, assessment, review and evaluation of quality management system but not explicitly discussed risk based monitoring and control system.

The respondents were also questioned, whether; the effectiveness of the risk management process was assessed during the project life cycle. The mean (3.2) with SD (0.82) suggests that most of the staff were not certain with the issue that, the organization evaluates the risk management process during project life cycle to their effectiveness, even though there were some respondents who agree with the issue. The findings from an interview of senior staff and record review indicate that the organization conducts monitoring and controlling of risks to some degree but not as detail as required and not consistent over the life cycle of projects.

4.8.1 Tools and Techniques used in Risk monitoring and control

The participants were asked the type of tools and techniques their company used for risk monitoring and control, the result of their response is summarized and presented as shown in the table below.

Table 4.11: Response results of tools and techniques used in risk monitoring and control

Tools and techniques used by the company in monitoring and control of risks:				
		Frequency	Percent	Valid Percent
Valid	Technical performance analysis	11	44%	46%
	Reserve analysis	3	12%	13%
	Auditing	4	16%	17%
	Risk reassessment	5	20%	21%
	Other	1	4%	4%
	Total	24	96%	100%
Missing	System	1	4%	
Total		25	100%	

Own survey; 2021

The result of the response in the above table indicates that, the company was mostly used technical performance analysis as a tool for monitoring and controlling of risk, and

sometimes risk reassessment auditing was applied. The result of the interview approves the majority response in which the company uses technical performance analysis for risk monitoring and control.one of the interview respondents project manager said" the tools and techniques used to control and monitor the risk in the project carry out by Jehoiachin are mainly using technical performance measurement. Sometimes meeting also arranged and discussion is held with different department in the organization to addresses the outcome and incident of risks in the particular project". This approves the majority response in which the company uses technical performance analysis for risk monitoring and control.

4.9 The overall degree of practicing project risk management

The respondents result indicate, on a Likert scale of 1-5, the degree to which project risk management practices are applied by the organization to their projects, that includes risk planning, risk identification, risk analysis, risk response & monitoring and control risks, A scale of 1 implied that the project risk management is not very well-practiced, while a level of 5 indicated that the project risk management is widely practiced by the organization during the construction of electromechanical projects. This study also sought to reveal which risk process variable is most practiced and which one in the organization is less practiced as shown in the figure below.

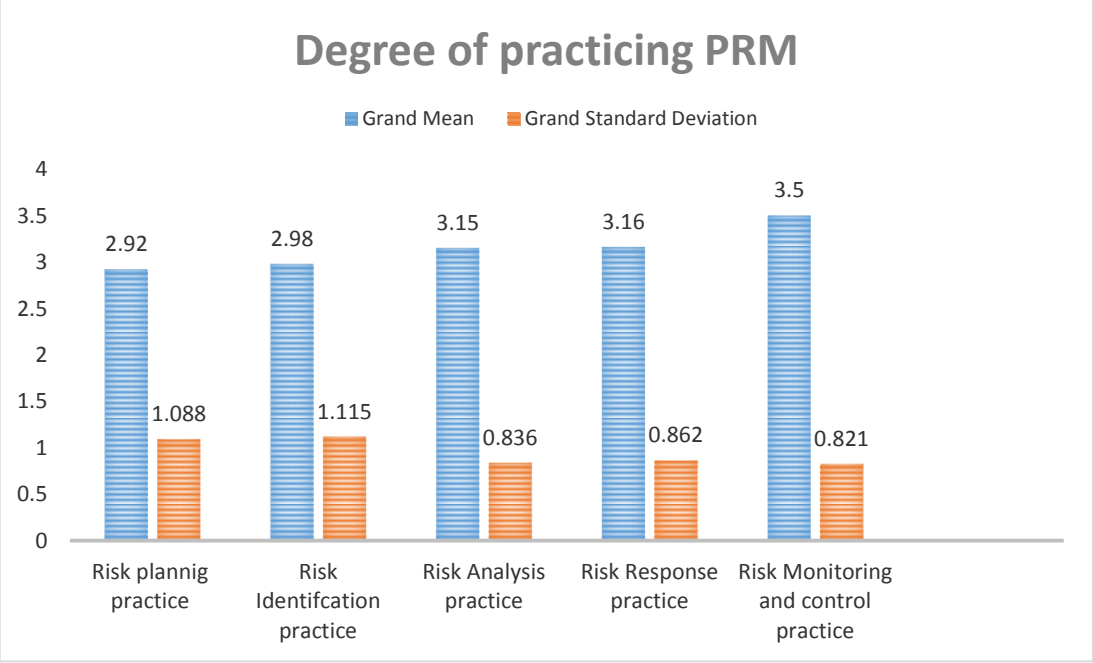

Figure 4.5 the overall degree of practicing PRM as per the result of respondents

The above graph indicates that all the risk process variables were not practiced equally, that is as per the response result from the participants. The company gives relatively a better attention to risk monitoring and control (3.5), risk response (3.16) and risk analysis (3.15), even though they are not well practiced as per their mean value indicates. Risk identification (2.98) and Risk planning (2.92) was given low attention while they need to be given high priority throughout project life cycle because they are the first and perhaps most important step in the PRM phase, as they attempt to identify the source and existence of risks in a very early stages in order to have better risk management to achieve project success (Wang, 2003). Generally, the result indicates that organization was not extensively practicing project risk management system as should have been as it compared to practice of project risk management suggested by PMI (2017).

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Introduction

The aim of this study was to analyze Jehoiachin Techno plc's project risk management practice while constructing electromechanical projects. The study's objectives were to evaluate the extent to which the company practiced risk management. Questionnaire items were therefore formulated in accordance with the research goals that the researcher set out to look for answers. The researcher used questionnaires and interview tools to collect the study-related information. Both 25 questionnaires and 5 interview respondents were selected using the census process, where all members of the population are studied. The research results have been analyzed, discussed, and interpreted. Therefore, in this chapter, the researcher tried to summarize the key findings, conclusions and also some suggestions for better risk management practice for future projects in the organization as well as recommendation for future study.

5.2 Summary of findings

The findings from the analysis of data collected through questionnaire, interview and document analysis like reports and company working manuals reveals that: the company doesn't have any established risk policy or strategy; There was neither history documentation system for registering risks of past projects nor responsible department for handling project risks; project risk management system have not been implemented throughout the projects life cycle; and staffs of the company have been involving in projects of the organization have never been getting training regarding PRM. This implies that the company has not been applying a standard project risk management system.

There were different challenges mentioned that could be an obstacle for implementing standard PRM system in the case study organization. The main challenges are lack of established guidelines, procedures, and systems as well as lack of transparency between top management and lower staffs, lack of support and involvement from the top management, less appetite of the employee about the issues and lack of attention given/lack of awareness by the top management to PRM.

The company didn't always consider risk management plan during planning phase of projects and there was not continues involvement of concerned stakeholders. There was

also not any written document that details the organization's risk management planning, and the company didn't have clearly defined roles and responsibilities of stakeholders. Furthermore, the findings reveal that the company mostly used meeting of concerned staffs and rarely expert judgment as a risk management planning tools and techniques.

Mostly brainstorming, sometimes expert judgment and rarely checklist were used for risk identification in the organization. However, risk identification system from lessons learned of similar projects was not practiced by the company. This is related in somewhat with techniques used in construction industry, especially in developing countries which are checklist, expert judgment, and/or brainstorming (Sayegh, 2014; Tipili et al, 2015; Choudhry et al, 2012 & Smith, 2009). Generally, there was not organized system in place for risk identification in the case study company.

The organization practiced both qualitative and quantitative project analysis based on their likelihood of occurrence and their impact. However, risks were discussed at the level of a management meeting and measures were taken, even no comprehensive project risk analysis. While risks were analyzed by their probability of occurrence, and impact, there was no detailed analysis, and all concerned staffs were not involved, furthermore, interpersonal and team skills mostly while risk probability and impact assessment have rarely been used as risk analysis instruments.

There were not clearly defined strategies and that preparation of planning charts has not been taken into account in the risk response, while the organization is better off giving high priority to the risks of having a high negative effect on project objectives. In addition, the company had construction insurance for coverage of property damage and personnel injury.

The presence of uncertainty was analyzed and reported, but not regularly. After meetings conducted by the staff concerned, critical risks have been reported to the top management, and decision taken after meeting held by the concerned staff. Risk monitoring and control have been carried out by the company to some degree, but not as comprehensive as needed and not consistent across the life cycle of projects. In addition, the organization has mostly used technical performance analysis as a risk monitoring and control method.

5.3 Conclusion

To claim that project risk management is performed in a given organization, risk management planning, identification, analysis, response planning, response implementation and processes for risk monitoring should be practiced in a standard way (PMBOK, 2017). Hence the main objective of the study was to evaluate the risk management practice at Jehoiachin Techno, wherein the extent to which the main risk process variables, such as risk planning, risk identification, risk analysis, risk response and risk monitoring and control implementation, were practicing while engaging in the construction of electromechanical projects. The following conclusions are made on the basis of the findings of the analysis in the previous chapter of this study.

- In the company, there was no established risk policy or strategy and there was no exclusive responsible person or department dealing with risk-related problems, there was also no history documentation system for documenting risks of past projects and staff of the organization's project teams has not undergone PRM training, as a result of which there was no continuous risk assessment for the entire project life cycle. This suggests that a standard project risk management system has not been implemented by the organization. As the overall outcome demonstrates that risks were addressed at the level of the management meeting and actions were taken as required, but not as comprehensive as they should be, this had its own contribution to exposing the organization to cost overruns and time delays in the projects involved.

- The key challenges that could limit the implementation of the standard project risk management process were the lack of established guidelines, structures, and procedures, as well as lack of transparency between top management and lower employees, lack of support and engagement from top management, less appetite of the employee about the issues and lack of attention given/lack of awareness by the top management to project risk management, even though the top management does not agree with the issues posed.

- There was no written framework outlining the risk management planning of the organization, such as the clearly defined roles and responsibilities of stakeholders, which has prevented the company from continually considering the risk management plan during the project planning phase and not continually involve

the stakeholders concerned. The company mostly uses meeting of concerned staffs and rarely expert judgment as a risk management planning tools and techniques.

- Checklist, expert judgment, and/or brainstorming are common project risk identification tools and techniques used in the construction industry, particularly in developing countries (Sayegh, 2014; Tipili et al, 2015; Choudhry et al, 2012 & Smith, 2009). The company mostly used brainstorming, sometimes expert judgment, and rarely risk identification checklist as tools and techniques for identifying risks. The organization also was not practicing the method of risk identification from lessons learned of similar projects. Generally, there was no organized risk identification system in place. This indicates that the risk identification practice in the company was poor compared to the standard should it be in accordance with (PMBOK, 2017) and other literature.
- Project risks are typically addressed on the basis of reports from the site in which the quantitative and qualitative approach used to analyze the risks is discussed at the level of the management meeting and action is taken but no comprehensive project risk analysis has been carried. There was no detailed risk analysis carried out as all concerned staff was not involved. However, interpersonal and team skills have mostly been used as risk analysis tools. Generally, the practice of risk analysis was better as compared to risk planning and identification, even though not good enough.

- There should be a risk response when the risk arises. There are several tools that have a beneficial effect on the RM that influence project performance, such as planning charts and predictability of impacts (Mohammed, 2018). The main risks should be given high priority, and construction insurance is strongly recommended to protect the business against injuries and/or property damage. The company practiced reasonably in that it gave high priority to risks having a high negative effect on project objectives and the existence of construction insurance to cover property damage and personal injury in the event that anything unnecessary occurred during the construction of electromechanical projects, although the strategies were not well specified and planning charts preparation has not been taken into account.

- There has been some method of review and reporting in the event of any risk development but not always. key risks have been reported to the top management and decision made accordingly. However, the assessment of the effectiveness of the risk management process during the project life cycle was low and the organization's risk monitoring and control practices were not in-depth and continuous throughout the life cycle of the projects. In addition, the technical performance analysis was often used by the organization as a method for monitoring and controlling risks.

In general, the overall result shows that risk response and risk monitoring & control were better implemented by the organization compared to the other independent variables of this study such as risk planning and identification, but not to the desired degree relative to the standard risk management framework.

5.4 Recommendation

Risk management is critical to all organizations, particularly the construction industry, due to the complex nature. This is both to protect the company's assets, finances, and processes, and to lead to satisfactory regulatory enforcement, corporate governance, and due diligence. The company's image, integrity, and position would be secured by successful risk management. Thus, the development of a "culture" of risk management in the company is important. This emphasizes the importance of risk management as part of the daily activities of each staff member at all levels of the organization. The aim of developing a culture of risk management is to create a situation in which partners and employees naturally search for and consider risks while making effective operational decisions.

In order the case study company to have a standard risk management system or improve level of practicing project risk management system in its engagement of EM projects for their success in perspective of project quality, schedule and cost; At least the problems identified through this study must be rectified. Such as: the company should have established risk policy or strategy; history documentation system for registering risks of past projects must available; regular training regarding PRM should be provided for the staffs of the company who are involved in projects of the organization;

and there should have support and involvement from the top management etc. Generally, PRM should be considered continually and in a proper way through out project life cycle with applying of standard tools and techniques of five core risk process (risk planning, risk identifying, risk analysis, risk response and risk monitoring and control) in the case study company. Hence the following points are recommended to be developed for enhancing the level of practicing PRM in the case study organization.

- Project Risk Management Policy or strategy has to be formulated to provide clear and strong basis for informed decision making at all levels of the organization. JTP recognizes that it has been exposed to a number of uncertainties, which is inherent from construction of different EM projects. This has been affecting the financial and non-financial results of the business. Hence JTP should develop Risk Management Policy to increase confidence in the achievement of organization's objectives in in project success and to remain a competitive and sustainable organization and enhance its operational effectiveness in construction of EM projects.

The policy statement is recommended to be as given below:

- To establish an integrated Risk Management Framework for identifying, assessing, mitigating, monitoring, evaluating and reporting of all risks.
- To provide clear and strong basis for informed decision making at all levels of the organization.
- To continually strive towards strengthening the Risk Management System through continuous learning and improvement and to achieve the objectives of this policy through proper implementation and monitoring.
- To ensure that new emerging risks are identified and managed effectively.
- To put in place systems for effective implementation for achievement of policy objectives through systematic monitoring and effecting course corrections from time to time.

Generally, the main objective of the policy has to ensure sustainable business growth with stability and to promote a pro-active approach in identifying, evaluating, reporting and managing risks associated with the business. In order to achieve the key business objectives, the policy should establish a structured and disciplined approach to RM including the development of the Risk Register, in order to guide decisions on risk related issues.

- Role and Responsibilities of the Risk Management stakeholders should be clearly defined in the risk policy.
- JTP have to use RM as an effective tool to manage its business and project risks.RM activities at the company have to be governed by its developed risk management policy.
- Risk management framework that facilitates the deployment of risk management policy through procedures, guidelines, formats and checklists is recommended to be developed. The risk register of each risk have to contain the list of root causes and mitigation plans.
- For all major projects of JTP, a structured project risk management plan has to be prepared by a project risk management team guided by the policy. This team has to be led by the project manager with members drawn from various disciplines like process, safety, piping, machinery equipment division, instrumentation, electrical and cost engineering as JTP is EM contractor.
- A project risk report has to be issued periodically containing all identified risks controls and mitigation plan. The project group/team should implement the mitigation action.
- Typical categories of project risk that have to be monitored by JTP should covers health, safety & environment, Engineering, Legal, statuary/Regulatory approvals, construction, financial, and procurement.
- The common tools and techniques for risk identification which are brainstorming, checklist and expert judgment which are used mostly in construction industry have to be implemented in an organized way through out project life cycle.
- There should be transparency between top management and lower project teams to avoid the main challenge of implementing PRM.

In summary, to enhance the degree of practicing PRM in JTP during its engagement in EM projects and to improve the effectiveness of tools and techniques as per standard with confronting the identified challenges, the above listed points including risk policy is recommended to be established and considered in JTP.

5.5 Suggestion for Future Research

The study in this master of art project work aimed on learning the degree to which an EM contractor JTP practices project risk management. This research revealed that there is a lack of awareness or knowledge about project risk management, according to the result of more respondents, even though most of them believe they know about PRM. Further research on project risk and knowledge management from the perspective of JTP or another EM contractor is recommended to examine the perception, attitude and realistic execution of RM within the company or another EM contractor in order to clear out such a void. This helps to understand the comprehensive cause of PRM's unstandardized practice. In addition, studying how the combination of risk management and knowledge dissemination is implemented in JTP, promoting the establishment of standardized concepts and principles in the organization.

References

Adina, L., & Carmen, N. (2017). Challenges in implementing risk management: a review of the literature. *PROCEEDINGS OF THE 11th INTERNATIONAL MANAGEMENT CONFERENCE "The Role of Management in the Economic Paradigm of the XXIst Century"* (pp. 972-980). BUCHAREST, ROMANIA: Bucharest University of Economic Studies. Retrieved from http://conferinta.management.ase.ro/archives/2017/pdf/5_9.pdf

Ahmed, A., Kayis, B., & Amornsawadwatana, S. (2007). A review of techniques for risk management in projects. *An International Journal, 14*(1), 22-36.

Akintoye, A., Hard castle, C., Beck, M., Chinyio, E., & Asenova, D. (2003) Achieving best value in private finance initiative project procurement, *Construction management and economics, 21*(5), 461-470

Alfredo, F., Ximena, F., Rodolfo, H., & Larissa, R. (2014). Risk management in construction projects: a knowledge-based approach. *Procedia - Social and Behavioral Sciences, 119*, 653-662.

Altheide, D. L., & Johnson, J. M. (1994). *Criteria for Assessing Interpretive Validity in Qualitative research.* Thousand oaks, CA: Sage Publications, Inc.

Assbeihat, J. M. (2016). Factors affecting the performance of electromechanical subcontractors in construction projects (Jordan case). *European International Journal of Science and Technology, 5*(2), 32-40.

Aziz, K., Yazid, A., Mahmod, M., Rashid, N., Salleh, F., Ghazali, P., & Mahmood, S. (2018). Enterprise Risk Management Practices among Malaysian SMEs: The Three Steps Process to Identify Adopters and Non-adopters of ERM. *International Journal of Academic Research in Business and Social Sciences, 8*(11), 1231 – 1245.

Bahamid, R., & Doh, S. (2017, November). A review of risk management process in construction projects of developing countries. *IOP Conference Series: Materials Science and Engineering, 271*(1), pp. 1-8.

Banaitiene, N., Banaitis, A., & Norkus, A. (2011). Risk management in projects: Peculiarities of Lithuanian construction companies. *International Journal of Strategic Property Management, 15*(1), 60–73.

Berenger, Y., & Justus, N. (2016). Risk management in the construction industry: a new literature review. *MATEC Web of Conferences. 66*, p. 8. Johannesburg, South Africa: EDP Sciences.

Boehm, B. (1991). Software risk management: principles and practices. *IEEE software, 8*(1), 32-41.

Bufaied, A. (1987). *Risks in the Construction Industry: their Causes and their Effects at the Project Level, Ph.D. Thesis.* Manchester: University of Manchester, UMIST.

Carbone, T., & Tippet, D. (2004). Project risk management using the project risk FMEA. *J Manage Engineering, 16*(4), 28–35.

Cervone, H. (2006). Project risk management, managing digital libraries: The view from 30,000 feet, OCLC Systems and Services. *International Digital Library Perspectives, 22*(4), 256-262.

Cooper, D. F., Grey, S., Raymond, G., & Walker, P. (2005). *Project risk management guidelines: Managing risk in large projects and complex procurements*. John wiley & sons, Inc.

Choudhry, R., & Iqbal, K. (2012). Identification of risk management system in construction Industry in Pakistan. *Journal of Management in Engineering, 29*, 42-49.

Ciocoiu, C. N. (2015). Implementation of an Integrated Risk Management Framework: A Multicriteria Approach for Romanian SMEs. *The Best Romanian Management Studies 2013-2014*, 85-102.

Cooper, D. F., Grey, S., Raymond, G., & Walker, P. (2005). *Project risk management guidelines: Managing risk in large projects and complex procurements.* West Sussex, England: John wiley & sons, Inc.

Crnković, D., & Vukomanović, M. (2016). Comparison of trends in risk management theory and Practices within the construction industry. *Electronic Journal of the Faculty of Civil Engineering Osijek-e-GFOS, 7*(13), 1-11.

Dale, A. & Newman, L. (2005). Network structure, diversity, and proactive resilience building: a response to Tompkins and Adger. *Ecology and society*, *10*(1)

Debela, B. K., Bouckaert, G., Ayenew Warota, M., & Terefe Gemechu, D. (2020). *Public Administration in Ethiopia: Case Studies and Lessons for Sustainable Development (Key Factors Contributing to Time and Cost Overrun in Mega Sugar Construction Projects in Ethiopia).* Leuven: Leuven University Press.

Dieter, F. (2013) *Project risk governance: Managing uncertainty and creating organizational value*, Routledge

Durenberger, K., Oberlehner, S., & Zadrazil, N. (2014). Challenges in implementing Enterprise Risk Management. *ACRN Journal of Finance and Risk Perspectives, 3*(3), 1-14.

Dvir, T., Eden, D., Avolio, B. J., & Shamir, B. (2002). Impact of transformational leadership on follower development and performance: A field experiment. *Academy of management journal*, *45*(4), 735-744.

Ebrahimnejad, S., Mousavi, S. M., & Seyrafianpour, H. (2010). Risk identification and assessment for build–operate–transfer projects: A fuzzy multi attribute decision making model. *Expert systems with Applications, 37*(1), 575-586.

Emmanuel, R. (2019). Evaluation of Risk Management Practices in Construction Projects in Rwanda.

Eskesen, S. D., Tengborg, P., Kampmann, J., & Veicherts, T. H. (2004). Guidelines for tunnelling risk management: international tunnelling association, working group No. 2. *Tunnelling and Underground Space Technology, 19*(3), 217-237.

Fabricius, G., & Büttgen, M. (2015). Project managers' overconfidence: how is risk reflected in anticipated project success? *Business Research, 8*(2), 239-263.

Fewings, P. (2005). Construction Project Management: An Integrated Approach. Taylor & Francis, London, United Kingdom

Fraser, R., & Simkins, B. (2016). The challenges and solutions for implementing enterprise risk management. *Business Horizons, 59*(6), 689-698.

Ghahramanzadeh, M. (2013). *Managing risk of construction projects: A case study of Iran, PhD Thesis.* London: University of East London.

Goh, C. S., & Abdul-Rahman, H. (2013). The identification and management of major risks in the Malaysian construction industry. *Journal of Construction in Developing Countries, 18*(1), 19.

HEUFT. (1978 to date). *HEUFT SYSTEMTECHNIK GMBH Profile*. Retrieved from https://heuft.com/en: https://heuft.com/en/about-us/heuft-company-profile

Hilda, M.(2018). Risk Management Practices and Performance of Construction Projects in

Nairobi city county government, Kenya

Hillson, D., & Murray-Webster, R. (2005). *Understanding and managing risk attitude* (2nd ed.). Burlington, VT.: Gower: Publishing Ltd.

Holt, R. (2004). Risk management: The talking cure. *Organization*, *11*(2), 251-270.

Howard, R., & Serpell, A. (2012, September). Procurement management: analyzing key risk management factors. In *Proceedings of the RICS COBRA 2012 Conference* (Vol. 1, pp. 1461-1469).

Hwang, B., Zhao, X., & Toh, L. (2014). Risk management in small construction projects in Singapore: Status, barriers and impact. *International Journal of Project Management, 32*(1), 116–124.

Iqbal, S., Choudhry, R. M., Holschemacher, K., Ali, A., & Tamošaitienė, J. (2015). Risk management in construction projects. *Technological and Economic Development of Economy, 21*(1), 65-78.

ISO 3100. (2018). Risk management. In ISO, *INTERNATIONAL STANDARD ISO 31000* (2nd ed., p. 16). Vernier, Geneva: ISO copyright office.

Jarkas, A., & Haupt, T. (2015). Major construction risk factors considered by general contractors in Qatar. *J. Eng. Des. Tech., 13*(1), 65-94.

Junying, L., Bingguang, L., Binshan, L., & Vanthuan, N. (2007). Key issues and challenges of risk management and insurance in China's construction industry: an empirical study. *Industrial Management & Data Systems, 107*(3), 382-396. Retrieved from https://doi.org/10.1108/02635570710734280

Kamski, B. (2016). The Kuraz Sugar Development Project (KSDP) in Ethiopia: between 'sweet visions' and mounting challenges. *Journal of Eastern African Studies, 10*(3), 568-580.

Karim, E. (2012). *Project risk Management.*

Karimi Azari, A., Mousavi, N., Mousavi, S. F., & & Hosseini, S. (2011). Risk assessment model selection in construction industry. *Expert Systems with Applications, 38*(8), 9105-9111.

Karlotta, T. (2018, November 16). *Impact and probability in risk assessment*. Retrieved from http://wiki.doing-projects.org/index.php/Main_Page http://apppm.man.dtu.dk/index.php/Impact_and_Probability_in_Risk_Assessment: http://apppm.man.dtu.dk/index.php/Impact_and_Probability_in_Risk_Assessment

Kartam, N. A., & Kartam, S. A. (2001). Risk and its management in the Kuwaiti construction Industry: a contractors' perspective. *International journal of project management, 19*(6), 325-335.

Kyungmo, P., Sanghyo, L., & Yonghan, A. (2017). Construction Management Risk System (CMRS) for Construction Management (CM) Firms. *Future Internet, 9*(1), 5.

Lee, C., & Azlan, S. (2012). Implementation of Risk Management in the Malaysian Construction Industry. *Journal of Surveying, Construction & Property, 3*.

Lester, A. (2007). *Project management, planning and control* (5th ed.). Oxford: Elsevier Ltd Light Press.

Lewis, J. P. (2011). *Project Planning, Scheduling and Control* (5th ed.). New York: McGraw-Hill companies Inc.

Loosemore, M., Raftery, J., & Reilly, C. (2006). *Risk management in projects*, Taylor & Francis

Mills, D.A. (2001). Rising to the Challenge, *Journal American Water Works Association,93*(11), 40-40.

Mohajan, H. (2017). Two Criteria for Good Measurements in Research: Validity and Reliability. *Annals of Spiru Haret University, Economic Series, 17*(4), 59-82.

Monteiro, C. M. & Rabechini, J. R. (2013). Understanding the impact of project risk management on project performance: An empirical study. *Journal of technology management & innovation*, *8*, 6-6

Monsberger, M. (2019). Challenges and risks relating to MEP engineering in large building construction projects. *10th International Structural Engineering and Construction Conference (ISEC-10)* (pp. 1-10). Chicago, IL, USA: ISEC Press.

Mugenda, O., & Mugenda, A. (2003). *Research Methods, Quantitative and Qualitative Approaches.* Nairobi: ACT.

Mulcahy, R. (2003). *Risk Management: Tricks of the Trade for Project Managers.* Minnetonka, MN: RMC Publications Inc.

MURAD, M. H. (2018). *Risk management in relation to project success on the construction projects in UAE (Doctoral dissertation).* Dubai: The British University in Dubai (BUiD).

Musyoka, B. S. (2012). *Project risk management practices and success of capital projects in Kenya (Doctoral dissertation).* Nairobi: University of Nairobi.

National Planning Commission. (2016). *Growth and Transformation Plan II (GTP II) (2015/16-2019/20).* Addis Ababa: The Federal Democratic Republic of Ethiopia.

National Research Council (US). (2005). Committee on Physical Activity, Land Use, Transportation Research Board, & Institute of Medicine. *Does the Built Environment Influence Physical Activity? Examining the Evidence--Special Report 282* (Vol. 282). Transportation Research Board.

National Research Council (U.S.). (2005). *The Owner's Role in Project Risk Management.* Washington, DC: National Academies Press.

Njogu, P. M. (2015). *Assessment of effects of construction risks on project delivery among contractors in Kenya (Doctoral dissertation).* Nairobi, Kenya: Jomo Kenyatta University of Agriculture and Technology.

Olsson, R. (2008). Risk management in a multi-project environment: An approach to manage portfolio risks, *International journal of quality & reliability management*.

Palma, M. (2007). *Causas de reclamos en proyectos de constructions y formas de reducir su ocurrencia (Causes of claims in construction projects and ways to reduce their occurrence)* (Doctoral dissertation, M. SC Thesis, Pontificia Universidad Católica de Chile)

Parker, D., & Mobey, A. (2004). Action research to explore perceptions of risk in project management. *International Journal of Productivity and Performance Management*, 18-32.

PM4DEV. (2019). *Managing for development series: Project risk management for development organizations.* Retrieved from www.pm4dev.com: https://www.pm4dev.com/resources/free-e-books/137-project-risk-management/file.html

PMI. (2007). *Construction extension to the PMBOK® Guide* (3rd ed.). Newtown Square, PA: Project Management Institute, Inc.

PMI. (2017). *A Guide to The Project Management Body of Knowledge (PMBOK guide)* (6th ed.). Newtown Square, PA: Project Management Institute.

Raz, Z., Shenhar, A., & Dvir, D. (2002). Project success and technological uncertainty: Risk management. *R & D Management, 32*(2), 101-109.

Renault, B., Agumbaa, J., & Balogun, O. (2016). Drivers for and obstacles to enterprise risk management in construction firms: a literature review Paper presented at Creative Construction Conference 2016. *Creative Construction Conference 2016, CCC 2016. 164*, pp. 402 – 408. Budapest, Hungary: Procedia Engineering.

Roque, R., & Marly, M. (2013). Understanding the Impact of Project Risk Management on Project Performance: an Empirical Study. *Journal of Technology Management & Innovation, 8*, 64-78.

Rostami, A. (2016). Tools and techniques in risk identification: A research within SMEs in the UK construction industry. *Universal journal of management, 4*(4), 203-210.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research Methods for Business Students.* New York: Pearson education.

Sayegh, M. (2014). Project risk management practices in the UAE construction industry. *International Journal of Project Organisation and Management, 6*(1-2), 121-137.

Sayegh, M., & Mansour. (2015). Risk assessment and allocation in highway construction Projects in the UAE. *Journal of Management in Engineering, 31*(6), 1-11. doi:04015004

Schatteman, D., Herroelean, W., Vandvonder, S., & Boone, A. (2008). Methodology for integrated risk management and proactive scheduling of construction projects. *Journal of construction engineering and management*, *134*(11), 885–895.

Schwalbe, C. S. (2007). Risk assessment for juvenile justice: A meta-analysis. *Law and human behavior*, *31*(5), 449.

Serpella, A., Ferrada, X., Howard, R., & Rubio, L. (2014). Risk management in construction projects: a knowledge-based approach. *Procedia - Social and Behavioral Sciences, 119*, 653-662.

Sivagami, M., & Sarath, I. (2018). Risk management in construction: a literature review. *International Research Journal of Engineering and Technology*, *5*(11), 510-514.

Smith, N., Merna, T., & Jobling, P. (2009). *Managing Risk in Construction Projects.* Oxford: John Wiley & Sons.

Tadayon, M., Jaafar, M., & Nasri, E. (2012). An assessment of risk identification in large construction projects in Iran. *J. Constr. Dev. Counter 17:* , 57-69.

Taylan, O., Bafail, A., Abdulaal, R., & Kabli, M. (2014). Construction projects selection and risk assessment by fuzzy AHP and fuzzy TOPSIS methodologies. *Appl. Soft Computer*, *17*, 105-16.

Tesfaye, E., Berhan, E., & Kitaw, D. (2016). A Comprehensive Literature Review on Construction Project Risk Analysis. *Int. J. Risk Contingency Manage*, *5*, 1-15.

Thomas, D. (2006). A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation*, *27*(2), 237-246.

Thomas, T. (2005). *Risk analysis and management for projects (RAMP)* (2nd ed.). Institution of Civil Engineers and the Actuarial Profession.

Tipili, L., & Ibrahim., Y. (2015, September 1-3). Identification and assessment of key risk factors affecting public construction projects in Nigeria: Stakeholders' perspectives. *2nd Research Conference*, pp. 707-721.

Tom, K. (2015). *Essential Tools for Failure - Proofing of Projects: Identifying and Managing Project Risk* (3rd ed.). New York: American Management Association.

Wang, M., & Chou, H. (2003). Risk allocation and risk handling of highway projects in Taiwan. *J Manage Engineering*, *19*(2), 60–68.

Wang, S., Dulaimi, M., & Aguria, M. (2004). Risk management framework for construction projects in developing countries. *Construction Management and Economics*, *22*(2), 237-252. Retrieved from https://doi.org/10.1080/0144619032000124689

Williams, C. Arthur. Jr., Smith. Michael. L., Young. Peter. C., 1998. Risk management and insurance. 8th ed. New York: McGraw-Hill.

Wolbers, M. C. (2009). *Application of risk management in Public Works organizations in Chile* (Bachelor's thesis, University of Twente).

Yazid, A., Mohd, J., Jusoh, M., D., W., Salleh, F., A., E., . . . H., A. (2017). Islamic Personal Risk Management from Islamic Perspective. *World Applied Sciences Journal*, 1885-1892.

Zayed, T., Amer, M., & Pan, J. (2008). Assessing risk and uncertainty inherent in Chinese highway projects using AHP. *International Journal of Project Management, 26*, 408–419.

Zichan, H. (2020). Application of Electromechanical Installation Construction Technology in Practical Engineering. *Frontiers of Mechatronical Engineering*, 58-61.

Zwikael, O., & Ahn, M. (2011). The effectiveness of risk management: An Analysis of project Risk Planning across Industries and Countries. *Risk analysis, 31*(1), 25-37.

Zou, Y., Kiviniemi, A., & Jones, S. (2015). BIM-based risk management: challenges and opportunities.

Annex A: Data collection Instruments

Dear Participants,

My name is Michael Hailu; I am studying towards a master's degree in project management at Addis Ababa University, School of commerce. As part of my MA thesis work, I am conducting research on the assessment of Project risk management practice in Jehoiachin techno plc during its construction of electro-mechanical projects.
As this research is aimed for academic purpose, the information you provide will be hold confidentially, hence I would like to request you to fill this questionnaire genuinely to the best of your knowledge.

Instructions

- Section A includes the general information that will help to know the biographical information of the participant. In section A, please respond to the questions by placing a check mark (√) or cross mark (X) in the answer box that corresponds to your response and/or fill in the blank where indicated.

- Section B and C includes the questions that will help to realize the extent of applying and techniques of project risk management practices in the company. Please respond to the questions by placing a check mark (√) or cross mark (X) in the answer box that corresponds to your response of risk management practice corresponding column from strongly agree to strongly disagree (i.e. Strongly Agree=5, Agree=4, Not sure=3, Disagree=2, strongly Disagree=1),and Circle the letter of the best answer for the close-ended questions and put your answer on the space provided for the open-ended questions that you believe best describes the company regarding the project risk management system.

Section A: General Information

Age in Years	Educational background	Years of Experience in projects	Job Title
☐21-30 ☐31-40 ☐41-50 ☐above 50	☐Bachelor ☐ Master ☐ PHD ☐ Specify, if any other---------- ----------	☐ < 3 ☐3-5 ☐ 6-9 ☐≥ 10	☐Project Manager ☐Project engineer ☐ Designer ☐other, specify please - ----------

Section B: General Knowledge enquiries of Project Risk Management

S/N	Questions	Strongly Disagree	Dis agree	Not sure	Agree	Strongly agree
1	There are strategies or guidelines used by Jehoiachin Techno Plc that illustrate how to deal with unexpected uncertainties that may available during its construction of Electromechanical projects.					
2	The company applies a defined or standard risk management techniques					
3	There is a responsible person or department in the company to handle or manage the risk in the projects.					
4	The company applies Project risk management system throughout the project life cycle.					
5	The company provides continuous training regarding the project risk management system to the Project team members and to the organization staff in general.					

6	The company has a history documentation system for registering risks of past projects to learn for future projects.					

7. Are there any challenges that makes difficult to implement a risk management system in Jehoiachin Techno Plc?

A. Yes B. No

If your answer is Yes please describe the challenges_____

_____

_____

_____

_____

Section C: Project Risk Management Process

Risk Management Planning

S/N	Questions	Strongly Disagree	Dis agree	Not sure	Agree	Strongly agree
7	Jehoiachin Techno plc considers risk management plan during planning phase of projects.					
8	Relevant stakeholders of the company participate in the risk planning phase of projects					
9	The company clearly defined the role and responsibilities of stakeholders in the risk planning phase.					

10. Tools and techniques used by the company in projects during risk planning stage**.**

A. Expert judgment B. Meetings

C. Data analysis technique D. Interpersonal and team skill

E. specify if any other_____

11. Is there any written document that details the organization's risk management planning?

A. Yes B. No

If your answer is yes, what are the elements included in risk planning of your company?

_____

_____

_____

_____

Risk Identification

S/N	Questions	Strongly Disagree	Dis agree	Not sure	Agree	Strongly agree
12	Risk is identified in the company from the lessons learned of similar past projects					
13	The company uses checklist in risk identification					
14	The company uses expert judgment in risk identification.					
15	The company uses brainstorming for risk identification					

16. Tools and techniques used by the company during project identification

A. Expert Judgment B. Brainstorming

C. Checklist D. Document Analysis

E. specify if any other_____

17. Does your company specify the stakeholders that should participate in risk identification?

A. Yes B. No

If your answer is yes, who are the stakeholders?

_____

_____

_____

_____

Risk Analysis

S/N	Questions	Strongly Disagree	Dis agree	Not sure	Agree	Strongly agree

18	Jehoiachin techno analysis risks based on their probability of occurrence.					
19	The company analysis risks based on their impact.					
20	the company uses Qualitative risk analysis					
21	the company uses Quantitative risk analysis					

22. The tools and techniques used by the company in risk analysis are:

A. Risk probability and impact assessment B. Interpersonal and team skills

C. Representation of uncertainty D. Expert judgment

E. specify if any other_____

Risk Response

S/N	Questions	Strongly Disagree	Dis agree	Not sure	Agree	Strongly agree
23	Planning charts is applied by the company for risk response process					
24	The company gives high priority to the risks which has high negative impact on the objectives of project					
25	Clearly defined strategies are established by the company to avoid the identified risks in project					
26	The company have construction insurance for coverage of property damage and/or personnel injury during project construction					

27. Does your company have any construction risk retention or insurance which provides coverage for personnel injury and/or property damage during construction?

A, Yes B, No

If your answer is yes, specify and discuss its

coverage_____

_____

_____

_____

_____

Monitoring and controlling risks

S/N	Questions	Strongly Disagree	Dis agree	Not sure	Agree	Strongly agree
28	Any developments of uncertainty in the projects of the company are analyzed and reported periodically.					
29	The identified and reported risks of the company projects are controlled with considering of project objectives					
30	Risk mitigation status in the projects of the company is reported periodically.					
31	Critical risks are reported to the top Management					
32	The company evaluates the effectiveness of risk management process in the life cycle of projects.					

33. Tools and techniques used by the company in monitoring and control of risks:

A. Technical performance analysis B. Reserve analysis

C. Auditing D. Risk reassessment

E. specify if any other_____

Interview Questions

1. What is your position/responsibility in Jehoiachin Techno Plc? For how long have you been in this responsibility? What are the project/s you have participated?
2. Does Jehoiachin Techno plc has polices and strategies to handle risks that may available during construction of electromechanical projects? If yes, to what extent is supportive in practical risk management process of projects?
3. Does your company use standard risk management system (risk planning, risk identification, risk analyzing, risk response and risk monitoring and control) in construction of electromechanical projects? If yes, are they applicable throughout the project life cycle? Is there a responsible department to handle project risks?
4. Does your company provide a continues based training on project risk management system for project teams and other stakeholders? If yes, to what extent is supportive for the project teams and other stakeholders of the company?
5. Is risk management plan applied in your company of constructing electromechanical projects? If yes, does it considered during planning phase of projects? Do the project stakeholders participate in risk management planning?
6. How is implemented project risk planning in your company? What are the inputs, tools and techniques used by your company during construction of electromechanical projects?
7. How does your company identify and analysis project risks? What are the tools and techniques used?
8. How the qualitative and quantitative risk analysis process is implemented in your company? What are the tools and techniques used?
9. Does your company implement project risk monitoring and control in projects? If yes, what are the tools and techniques the company used? Does your company apply risk monitoring and control throughout project life cycle?
10. Are there any challenges that restrict implementation of project risk management in your company? If yes, what are they?