ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

PROJECT RISK MANAGEMENT PRACTICES AND CHALLENGES: THE CASE OF ADDIS ABEBA CITY ROAD CONSTRUCTION PROJECTS

BY

KIDUSE FIKIRU

JANUARY 2023

ADDIS ABEBA, ETHIOPIA

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ID. NO. SGS/0441/2013A

ADVISOR

CHALACHEW GETAHUN (PhD)

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ST. MARY'S UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIRMENTS FOR THE DEGREE OF MASTER OF ARTS IN PROJECT MANAGEMENT

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APPROVED BY BOARD OF EXAMINERS

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DECLARATION

I, Kiduse Fikiru, the undersigned, declare that, this thesis entitled: “Project Risk Management Practices and Challenges: the Case of Addis Abeba City Road Construction Projects” is my original work and it is prepared under the guidance of the Advisor Challachew Getahun (PhD). All sources of materials used for the Thesis acknowledged duly. It further confirmed that the Thesis has not submitted, either in part or in full to any other higher learning institution for earning any accreditation.

Kiduse Fikiru ----------

Name Signature

St. Mary’s University January 2023

ENDORSEMENT

This is to certify that Kiduse Fikiru carried out his thesis on “Project Risk Management Practices and Challenges: the Case of Addis Abeba City Road Construction Projects” and submitted in partial fulfillment of the requirements for the award of the degree of Masters of Art in Project Management at St. Marry University with my approval as university advisor.

Signature_____ Date_____

Challachew Getahun (PhD- Advisor

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LIST OF ACRONYMS AND ABBREVIATIONS

PMI	Project Management Institute
APM	Association for Project Management
PMBOK	Project Management Body of Knowledge
ISO	International Organization for Standardization
RM	Risk Management

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Abstract

This research focus on the study of project risk management Practices and challenges on road construction Projects in Addis Ababa city. The objectives of the research are assessment of project risk management challenges, identifying the Probability of occurrence of project risk factors in Addis Ababa city road construction projects and investigating their impact on cost, time project goals their response method for each risk factor. A structured questionnaire survey comprising 47 potential risk factors was distributed to a statistically representative sample of contractors and consultants. Mean scores and ranking mechanism are used to rate the probability of occurrence of various risks and their impact on cost and time. Based on contractors and consultants view, the prevalent trend of attitudes towards project risk management challenges and risk response factor is investigated, quantified and expressed as a percentage, based on the number of respondents who selected a specific option, in relation to the total number of respondents. This research work revealed that inflation is the highest significant risk factor along with defective design and payment delays, which are ranked second and third respectively. The outcomes further show that risk avoidance, risk transfer, risk mitigation, risk acceptance and risk share are most frequently used response method for high impact risk factors. In addition the research revealed that lack of policy and procedures, lack of proper risk models, lack of practical experience, were the top three challenges faced in the implementation of project risk management practice. Generally based on the findings the research concluded that risk identification should be considered as the single most significant activity of the risk management on a project and should be tackled in a systematic way. The identification and analysis of risks, as well as the enhancement of the processes for managing road projects and the efficient use of resources, are all advantages of the risk management process. in an effort to handle uncertainty and unforeseen events efficiently and successfully complete projects, risk analysis and management are still a key component of project management for road construction project. The study recommended that, Periodic training programs offered by construction firms to technical personnel to keep them informed of the latest technology available for improving the quality level of the workforce, may yield considerable savings in time, efforts, and costs associated with the project. Having in place a well-documented procedure for risk identification and management should be a one stop solution to all threats that are likely to occur during project life cycle. Implementing effective policies and programs that increase accuracy and proper identification and management of risk can assist in risk reduction and management.

Keywords Construction project, Risk, Risk identification, Risk analysis and Risk response

CHAPTER ONE

INTRODUCTION

1.1 Background

The construction sector is one of the vast and basic constituents that lead to growth in the economy of any country. According to (Flanagan, 2006), construction project is a set of non-repetitive activities with unique specifications for instance long duration, complicated procedures, and unfavorable environment, financial/investment issues, and changing organizational structure. Among different construction sector, road construction is one of essential element to be picked out. Road projects are constructed to be able to accommodate and facilitate attaining of the fast changing human needs and improve economic and social lives of peoples. Risk can be defined as an event of known uncertainty, and this uncertainty is assessed in terms of its probability of happening. Risk management is the activity of identification, assessment and responding to risk events, and it should be mixed with project team from the starting phase, to identify and expeditiously deal with risks when they originate (Potts, 2008). The Project Management Institute defines project risk as an uncertain event or condition that, if it occurs, has a positive or negative effect on project goals such as scope, schedule, cost and quality (Project Management Institute [PMI], 2013). Projects function in a condition composed of uncertainty. Risk is involved in every prospect, and the constructions of Road Projects are no exclusion. There is unpredictability in project financing, the availability of resources, client interest, performance of construction parties and environmental issue and so on. These conditions have the ability to badly weaken the success of construction projects.

Construction activities are by and large plagued with intricate and various risks (Deng, 2013 and Zhao, 2013). A Road construction project constitutes numerous risks and this is mainly due to involvement of many contracting parties including owners, designers, supervision consultants, contractors, subcontractor and suppliers. Previous studies showed that implementing project risk management practices can contribute to a number of advantages. It was revealed by (Simister, 1994) that the benefits of applying project risk practices and management includes the preparation of more realistic plans, an enhanced identifying, interpreting and understanding of the risks factors in a project, the assessment of contingencies that actually speculate the risks, the enhanced advantages from more rational risk taking, as well as the identification of the party best

able to take care a risk. In addition, (Mok, 1997), mentioned that project risk management improved decision-making process, helping to face up risks in a more realistic manner. In addition to helping projects to be completed on planned time and within planned budget, according to (Ali, 2000), implementing project risk management could develop different scenarios with different impacts, elaborate the importance of project risks, and make organization conscious of possible project results. By carrying out risk management activities, projects can reduce unplanned events and efficient allocation of resources could be meeting their final goals.

The complexity nature of a project is undoubtedly a major source of risk in projects, since the project organization may not be able to cope with it. Construction projects are enormously complex activities and full of uncertainty. These conditions have the ability to badly weaken the success of projects. Projects are unique and risks raise from different Sources (Oyegoke, 2006). According to (Emran Hassen Abdu, 2017) putting through appropriate project risk identification techniques can diminish unanticipated and costly changes and efficient allotment of resources could be more effective. This improves communication and allows for a brief summary of threats, which can be confronted by the project, thus finally helping them in better decision-making. Risk and uncertainty have the ability for destructive results of construction projects (Flanagan, 2006). According to (APM, 2006), most projects are basically risky since they are unique, constrained, complex, based on assumptions, and performed by people. As a result, project risk management must be established into the management of projects and should be used during the project implementation. It has also been believed by (Godfrey, 1996), that everyone should be concerned with risk management, because different risk factors with potentially damaging consequences are underlying in construction projects. (Kangari R. and Riggs, 1989) agreed that construction projects necessitate a great deal of time and capital, so efficient project risk management knowledge are called for if the projects are to be realized within the established timeline to meet cost limitations and quality requirements. Project delays, poor quality and cost overrun in the construction industry are common and taken as a global phenomenon (Mahamid, 2014).

As mentioned earlier, the construction sector is extremely exposed to a wide variety of risk factors from different perspective and to achieve the project goals there is an urgent need to implement appropriate risk management measures from all participants' side to identify and properly respond to those risks that could disturb the overall project efficiency. Based on (PMI, 2004) the purpose of identifying risk is to obtain a list of potential risks to be managed for a project. Furthermore, according to (Tchankova, 2012), if appropriately carried out, risk

identification guarantees productive risk management as unknown sources of losses change into uncontrollable occurrences with unforeseen outcomes.

1.2 Statement of the Problem

Owing to the complex and interconnected nature of its activities, successes and implementation in construction projects depends on the level of risk (Paslawski, 2013). The Road construction project sector is full of risks that could have either a negative or positive effect on progress towards achieving project objectives. Along with the project life cycle, there is a big uncertainty, which can be translated into known and unknown risk. According to ERA midterm review 2005, the participation of local contractors and consultants in donors financed Road projects is limited. Most of the participated local contractors and consultants running the project find themselves in risk of financial ability, experience, and unprepared site condition and resource management during initiation and throughout the project. Moreover, the project risks may arise at somewhere of its life cycle from different sources of the project members or other key stakeholders of the project. According to (PMI 2004), road Construction projects are understood to have more inherent risks because of involvement of many contracting parties, such as owners, designers, contractors, subcontractors, suppliers. These Risks have a significant impact on a road project's performance in terms of cost, time and quality. Road Construction industry and its clients are widely associated with high degree of risks due to the nature of micro-, meso- and macro-environments particular to construction (Zavadskas, 2010). In general, according to (Shevchenkoet, 2008), road construction sector has poor reputation in dealing with risks as many projects fail to meet deadlines and cost targets.

As a consequence of inadequate and inefficient risk management practice, such as failing to plan and insufficient know-how on subsequent risk identification steps through to developing risk response systems for critical risks, delay of a project and cost overruns are still prominent difficulties that affects our road projects greatly. (M. Abubeker J., 2015) conducted a desk study on 10 completed road projects in Addis Ababa and from the study it was revealed that all of them had experienced time overrun and cost overrun. These road projects take more time and cost than what had been planned. For successful project completion, a conscious choice should be made at all levels of the project members and stakeholders to actively participate in identifying different major and critical risks the project could face and pursue effective risk for management for those risks during the life cycle of the project. Construction projects are incomparable to previous projects and risks raise from a number of the different sources (Oyegoke A, 2006). Construction

projects involve different kinds of temporary stakeholders such as designers, clients, consultants, contractors, suppliers, beneficiaries and donors. According to (Sterman JD, 1992), a lot of participants, individuals and organizations are actively engaged in construction project. These actively participating different stakeholders in the project increase the probability of the project facing different risks and uncertainty that probability will hinder the achievements of the pre-planned project goals.

Despite that construction risk factors may be comparable across different projects, several variables, such as socioeconomic, environment, cultural issues and current situations, can further contribute to unknown or unpredictable risks. According to (Zhi, 1995), Similar projects, moreover, may have totally different risk characteristics in different regions. The fast growth economy of the Addis Ababa demands for massive growing of infrastructures such as roads. While this brings chances to project stakeholders, utilizing efficient risk management technique to properly identify and plan response methods for major current risks factors associated with variable construction activities is still a problem and vital to implement in align with time, cost and other project objectives. Furthermore, most recent studies done by researchers have been focusing on the management of project risks factors rather than identifying the critical risks factors involved in road construction projects. Little information exists on the identification of risk factors in developing countries (Hameed, 2007).

Identification of risks factors is a fundamental phase in the process of risk management. The benefit of addressing and identifying major risk factors in depth allows to remove risks factors from the project or to develop solutions for mitigating them. Identification of risk factor allows creating a comprehensive understanding that can be leveraged to influence stakeholders and create better project decisions. Good risk identification produces good project connection between project management members, which leads to good outcomes. Through identification phase, our primary objective is to determine as many as possible risk events that could negatively affect the performance of our project and at the sometime use any opportunities those risks could bring to the project. Identification of risks in the early stages of a project will help project managers to diminish its treats and complete the project in a better and more efficient manner for present and future projects. Among a wide variety of risks, road construction is exposed, it is most beneficial to identify the most crucial risk factors unique to Road construction projects as early as possible during the preconstruction phase of the project, and failing to do so means we are essentially accepting the risk should it present during our project. For effective management of project risks, primarily, it is important to determine and identify each project risk factors could

face. The additional motive for conducting this study was more of personal observation of the poor performance of our road construction projects in the City to find the main reasons behind this poor performance. As anyone can observe and understand that, most of our road projects progresses presently in Addis Ababa are far from behind our expectation, causing big problems to the residents of the city day-to-day life.

Hence, this research going to focus on the study of current risk management challenges on road construction projects in Addis Ababa city. The main purpose of this paper is to identify the major risks factors associated with road construction projects that expected to affect project performance during the project life cycle in Addis Ababa. In addition, the paper will also investigate challenges in implementing project risk management in practice and suggest the type of response to be used for a those risk factors with high probability of affecting the performance of our Road Construction Projects. The critical risk factors for severely disturbing the road construction performance are going to be identified through a literature review and the probability their occurrence, their risk rating and the risk responses will be identified by distributing questioner to project management members of Grade One contractors, consultants.

1.3 Research Questions

A Research question sums up the essential areas that the research looked into. The following are some of the research questions that the study attempts to answer.

1. What are the challenges of the existing project risk management practices in Addis Ababa city road construction projects?

2. What are the critical project risks factors influencing the Road construction projects?

3. Which project risk factors have the highest probability of occurring?

4. Which project risk factors have the highest impact on project time and cost objectives?

1.4 Research Objectives

1.4.1 General Research Objectives

The general objective of this study is to determine how risk in a road construction project can be managed effectively by applying the risk management process, which is risk identification, analysis, and risk response methods.

1.4.2 Specific Research Objectives

1. To identify major risks factors, their risk rating and probability of occurrences for road construction and response plan projects via questioner.

2. To discuss the challenges of the existing project risk management implementation in Addis Ababa road construction projects.

1.5 Significance of the Research

The study outlined critical risk factors in Road construction projects in Addis Ababa city and recommended effective risk response measures to those discovered project risk factors. The study, therefore, will have substantial contribution particularly to stakeholders who are involved in the construction sector like contractors and consultants. This study assists for the improvement of risk management practice through minimizing the negative effects of project risk that may occur in road construction projects. The research will also be important to serve as an input for future studies on the topic. It contributes in adding value to the prevailing body of knowledge, particularly to management of project risk in road construction projects in Addis Ababa city.

1.6 Scope and Limitations of the study

1. The study will only focuses on Road construction projects in Addis Ababa city and does not cover other cities of the country. As a result the conclusion of this study might not work to the other cites of the country.

2. As a major influencers in the construction sector among different stakeholders participating in the road construction sector, this study is going to use only Consultants and Contractors as a major inputs for the study purposes.

3. Since the purpose of this paper is to assess the current project risk management practices of the city road projects, among different stakeholders in the construction sector this study is going to focus on Consultants and Contractors currently working under ongoing and unfinished road projects in Addis Ababa city.

4. Because of their experience working for major road projects and limited time, among different consultants and contractors the study is limited to Consultants and Contractors with the rank of Grade One.

5. From the wide variety type of risks this study will only tries to identify and present risks that are very critical to road construction projects. Therefore it is hard to conclude that all risks are identified and the responses recommended for the risks are sufficient for the successful completion of the projects.

1.7 Organization of the Study

This study consists of five chapters. The first chapter contains the introduction part comprising of background, statement of the problem, the general and specific objectives of the study, research questions & significance of the study, scope and limitations of study. Chapter two focus on review of related literature regarding project management, risk and project risk management, risk management system. Chapter three is about research approach and design, study design, sampling technique, data collection method, data analysis techniques and communication of the findings. Chapter four covers the result or study findings and discussion. Chapter five contains Conclusions drawn from the study findings and its recommendation. The other miscellaneous part includes reference, questionnaires.

CHAPTER TWO

2 Literature Review

2.1 Conceptual Literature

Project: A project is defined as a "temporary endeavor with a beginning and an end, and it must be used to create a unique product, service or result". (PMBOK Guide, 2017)

Project management: "Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements" (Ibid, p.10).

Risk: The PMBOK Guide (2017, p.3) defines project risk as "an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one project objective".

Project Risk: Project Risk includes all those risks that might affect the cost, schedule, or quality of the project (Cooper, Grey, Raymond, and Walker 2005, p.3).

Project Risk Management: Project risk management as the process which includes the process of conducting risk management, planning, identification, analysis response planning and monitoring and control on a project. According to the book, the goals of project risk management are to increase the probability and impact of positive events, and decrease the probability and impacts of negative events in the project. (PMBOK Guide)

Risk mitigation: a risk treatment that deals with a negative consequence. (ISO Guide 73:2009)

Risk Planning: is about defining how to implement and practice the risk management framework's sub process. (PMI, 2009)

Risk Identification: is the process of determining what, how and why things may happen. (Project Risk management guidelines, Dale F. Cooper, Stephen Grey, Geoffrey Raymond and Phil Walker, 2005)

Risk Analysis: is systematic use of available information to determine how often specified events may occur and the magnitude of their consequences. (Project Risk Management guidelines, Dale F. Cooper, Stephen Grey, Geoffrey Raymond and Phil Walker, 2005). According

to this book, risk analysis may use any of a wide variety of mathematical and other models and techniques.

Risk Response: it is the process of developing options and actions to enhance opportunities and to reduce threats to project objectives. (PMBOK Guide)

Risk Monitoring and Control: is the process of implementing risk response plans, tracking identified risks, monitoring residual risk identifying and evaluating risk response effectiveness throughout the project. (PMBOK Guide)

Contractor – a performing organization whose employees are most directly involved in doing the work on the project (PMI, 2000)

Consultant-the role of consultants is to evaluate a client's needs and provide expert advice and opinion on what needs to be done.

Project success: Project success is a completion of a project with all the expectation and requirement of the stakeholders and others involved in it is fulfilled. (Atikinson, 1999)

2.2 Theoretical literature

2.2.1 Project and Project Management

The Definitions of a project have been instituted in many ways by various authors. However, these definitions contain the same key elements. Unlike business activities, the nature of a project is temporary, with preset or defined starting and ending points. A project is not an ongoing business procedure. It has typical characteristics which are consecrated to assure that it is finished at a determined point. A project creates products that have not existed or never been done previously. A project is hence said to be unique. But, when we say "unique" in defining a project was criticized by (Raftery, 1996), who suggested that projects have similarities in operations, components and materials, management styles and structures and physical elements that form an equivalent function. According to (Winch, 2002), a project is all about creating value, which includes the interpretation of ideas and missions into physical activities and end products.

According to Dr. J. M. Juran, a project is a problem planned for solution. This definition shows that every project is implemented to solve some kind of problem for someone who is in need of. Projects unlike other activities, operations and tasks, being temporary and unique activity, show

its identifiable aspects that differentiate itself from other activities. A project is a temporary effort undertaken to make a unique product or service. Temporary means that every project has a definite starting and a definite end. Unique means that the product or service is distinct in one way or other from other products or services.

The PMBOK Guide, 2008 define of project management as "application of knowledge, skills, tools, and techniques to project activities to achieve the project needs". Project management is carried out through the usage and integrating the 42 classified project management processes making up the 5 Process Groups: initiating, planning, executing, monitoring and controlling, and closing. As a project is unique, the ultimate objective of project management is therefore to make sure that the project is delivered towards achieving its definitive context and goals, within the thresholds of time, cost and quality (Maytorena, 2013). The project management institute (2004) characterizes project management as the application of knowledge, skills, tools, and techniques to project activities to conform to project requirements. (APM, 2006) define project management as "the process through which projects are defined, planned, monitored, controlled and delivered so that the planned performances are completed". The ISO-10006, 2003 also defines project management as a process of planning, organizing, monitoring, controlling and reporting of all features of a project. Although project management has been defined differently, the universal understanding is relatively similar through identified keywords: planning, organizing, monitoring, controlling, deliver, knowledge, skills, manage, and achieving objectives.

2.2.2 Project Management Knowledge Areas

The Project Management Knowledge areas are areas that describe project management knowledge and practice in terms of the various component processes. These processes have been organized into nine knowledge areas, as illustrated in figure below.

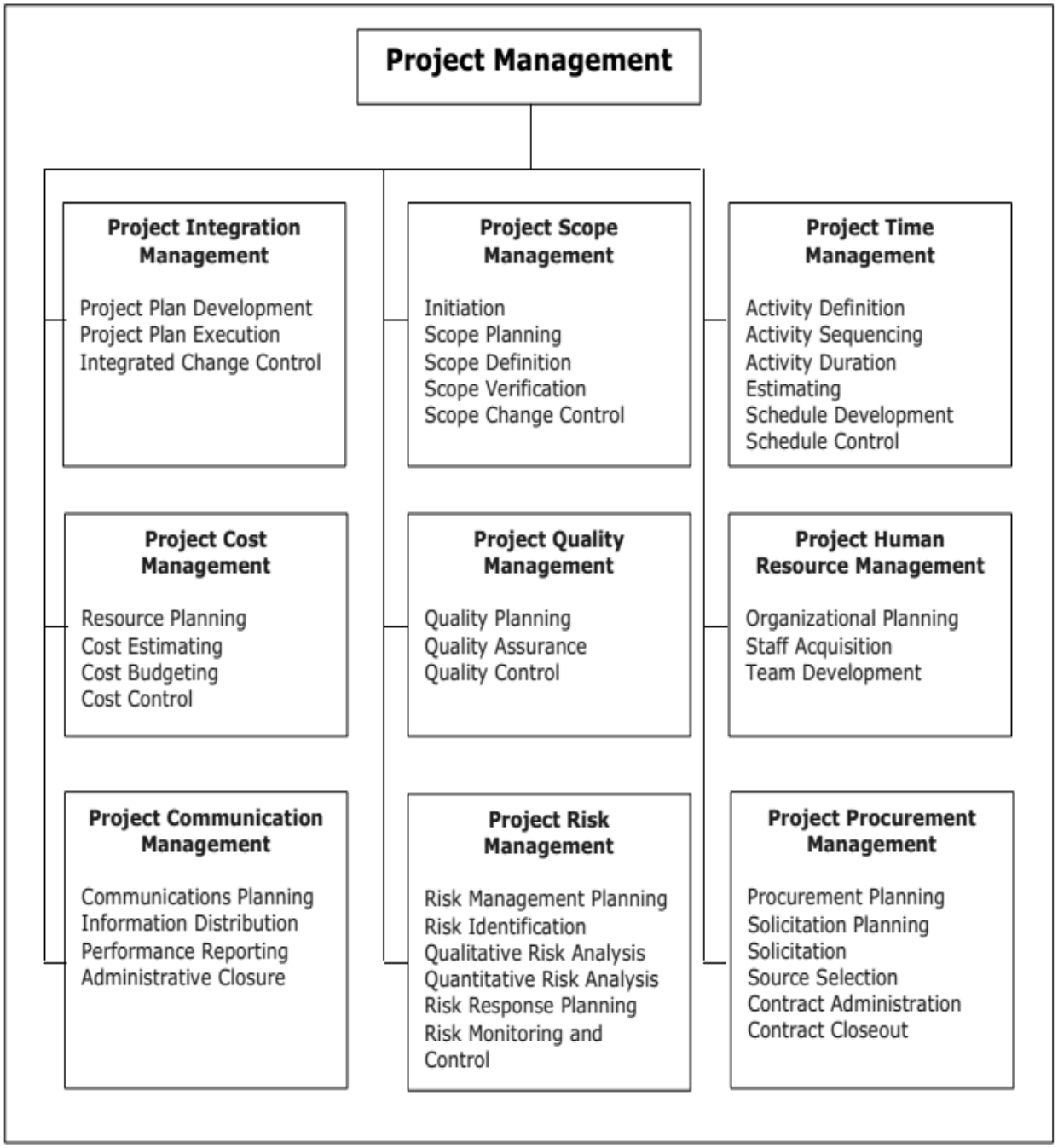

Figure 2-1: Project Management knowledge areas overview (ITC InfoTech India Ltd)

2.2.3 Project Risk Management

Project risk management, which has been practiced since the mid-1980s, is one of the nine main knowledge areas of the project management institute's project management body of knowledge (Tuysuz, 2006). The Project Management Institute characterizes project risk as "an uncertain

circumstance that, if it happens, has a positive or negative result on one or more project goals". This definition is important because, unlike in the past when project risk was exclusively assumed to direct to negative results, it is now recognized as the source of either possibilities or threats.

According to the Project Management Institute (PMI, 2004), project risk management is one of the nine most crucial parts of project commissioning. This reflects a firm relation between dealing risks and a project success. While RM is set forth as the most difficult area within construction management, its usage is promoted in all projects in order to keep negative consequences (Potts, 2008).

Project Risk Management is the processes concerned with identifying, analyzing, and responding to project risk. It comprises risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning, and risk monitoring and control.

Project risk

Event Risk = (Probability of Event) (Consequences of Event)

All risk has two components. These are the likelihood that the event is going to happen, and the impact, of its happening.

2.2.4 Basics of Project Risk Management

Most of the time, risk in construction projects is conducted with in an arbitrary way (Potts, 2008). However, in recent years, risk control has been the main influential factor of project management (Serpella, 2014). Thevendranet (2004) defined the idea of powerful risk control as a constantly supervised coordinated system for defining purposes, identifying reasons of uncertainties, evaluating them and prepare responses to make suitable balance between risk and opportunities. This involves maximizing the probability and effect of positive activities and lowering the probability and consequences of unwanted activities to project goals (PMI, 2000).

2.2.5 Risk and Risk Management

Some studies argue that the concept of risk is understood in different ways, to the extent that certain definitions of risk can be disputed. According to (Keynes, 1921), risk is an uncertainty where matter of importance is defined as relative to the particular objectives of the project to be achieved. Risk is constantly available during decisions making on idea of possibility, expectations and estimates of the future. It characterizes conditions in which the result for a particular activity

is likely to differ from the predicted value (Raftery, 1994). The definition of risk is various and could be assessed in phrases of causalities and accidents, pattern of a population, in phrases of like hood and reliability or in phrases of the possible consequence on a project. Risk is regularly defined in phrases of results, or effect on project goals. Risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objective (PMI, 2000).

PMBOK Guide (2000) defines risk management is as the organized process of identifying, analyzing and responding to project risk. It contains increasing the chance and aftermath of advantageous activities and lowering the chance and aftermath of disadvantageous activities to the project objectives. A risk has a cause and if it occurs an effect. The book stated that project risk includes both treats to the project's objective and opportunities to improve those objectives. The book recommends that the organizations must be committed to addressing risk management throughout the project. One measurement of the organizational commitment is its devotion to collecting data on project risks and characteristics.

Edwards & Bowen (1998) defines risk management as a systematic approach to dealing with risk. According to the above co-authors, "A risk management system should establish an appropriate context; set goals and objectives; identify and analyze risks; influence risk decision-making; and monitor and review risk responses". Cooper (2005) defines risk management as the culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects.

From the above two definitions, we can understand that the former was found to concentrate on the approaches and processes of managing risk, whereas the latter was focused on the process as well as the culture of managing the risk effectively. The project management body of knowledge (PMI, 1996), put risk management as one of nine parts of project management areas. Risk management composed of predicting, at the start of the project, unplanned events that may come up beyond the project manager's control. These events have the ability to undermine the achievement of project objectives. Process of risk management for a project manager responsibility includes

- Determine what is likely to happen, their probability and impact.
- Determine what should be done to minimize the probability or impact of these events.
- Determine the likely outcomes of events and the anticipated reactions.

2.2.6 Risk Management Process

There are many techniques or models used to dealing the risks in several projects but however the main system of risk control is composed of five stages in the construction industry. The technique used in risk management support to detect and find out all the risks to which the project is exposed. An implementation of the procedures during the lifecycle of the project, from planning to completion, for the construction project is required for the practice to be helpful (Loosemore, 2006). The risk assessment incorporates qualitative and quantitative risk analysis procedure. Between all phases, tracking and inspection guarantees the organization improvement on risk performance and learning ability from experience. The rationale of risk management is identical, however the steps might distinguish based on users, but the components illustrated in fig 2.2 are usually present.

Figure 2-2: The Repetitive process of risk management (Hillson, 2014)

2.2.6.1 Risk Planning

PMBOK Guide (2017, p.401) defined plan risk management as the process of describing how to conduct risk managing activities for a development. Kerzner (2009) also describes risk planning as the Procedure of evolving and recording a prearranged, complete, and collaborative plan. It approaches for recognizing and examining risks, evolving risk, counteraction strategies,

monitoring and controlling how risks have transformed. The fundamental benefit of this process is that it insures that the extent, type, and visibility of risk management are proportionate to both threats and the significance of the project to the organization and other stakeholders.

2.2.6.2 Risk Identification

As (Banaitene, 2012) stated that risk identification is the most crucial step. The purpose of this step is to recognize of possible risk sources with high consequence on a specific project activity, if they occur. It is unimaginable to pick out all possible risks, and the goal must not be to do so (Smith, 2006). Therefore, what we have to do is to figure out and assessing the risks to make certain that possible risks are assessed and controlled in a way, which permits for the general goals to be accomplished. The primary step at the early phase of the project should form the basis by which strategies, policies, uncertainties and risks are devised when it comes to management and allocation (Potts, 2008). But, given that all risks are not completely recognizable before the beginning of a project and additional more risks might emerge throughout the implementation of the project, the identification of risk must be undergone in a way that is in accordance with the buildup of the project

In identifying and categorizing various project risks, one effective instrument is the risk breakdown structure. It is defined as "a source-oriented grouping of project risks that manages and defines the total risk exposure of the project. With the use of risk break down structure, we can create a hierarchical representation of the project's risks, starting at the higher, general level and breaking the risks down to more specific risks at lower levels.

The different techniques for risk source identification normally consist of checklists, brainstorming, workshops, expert interviews and analysis of different scenarios as well as analysis of historical data and project plans. The technique of using experience or data from related projects allows for insights about common factors in a comparison among the projects. Checklist is a helpful instrument, which discuss risks recognized in past projects and the responses to those risks (Mhetre, 2016).

The PMBOK describes the significance of an iterative approach to the process of risk identification, and the development and implementation of simple and effective responses as soon as risks are recognized. According to PMI, (2013), the following methods can be used for identifying risks.

Risk register a tool used in risk management for monitoring the risk management process. The layout of the register relies upon on the organization, the kind of projects and the people involved. It is fundamental that the organization creates a customized model of the register that best to them for it to be fully used as planned. All the recognized risks and outcome of their evaluation, related to action plans and assessment in addition the status of the particular risk are registered within this list. There should be update activities and reviews on risk register. Risk register eases monitoring and correcting progress on risk mitigation measures, it helps identify new risks and close expired risks as well as adjusting the assessment of existing risk.

Documentation Reviews: a structured review of project documentation which includes plans, assumptions and contracts of previous project files. The accuracy of the plans, consistency between those plans and the project needs can be signals of risk in the project.

➢ Checklist Analysis: it is prepared from historical information and knowledge that has been accumulated from previous similar projects and from other sources of information. During using checklist, care should be taken to verify it is not used to avoid the effort of right risk identification. It should be reviewed during project closure to add new factors and improve it for future projects.

- Interviewing: To identify major risk factors interviewing experienced project members, stakeholders, technical individuals.
- Root cause analysis. It is a method used to distinguish a problem, find out the basic causes that lead to it, and generate preventive action.

➢ SWOT Analysis: This process examine projects strengths, weaknesses, opportunities, and threats perspectives. The technique starts with identification of strengths and weaknesses of the project. It then identifies any opportunities for the project that arise from its strengths, and any threats arising from its weaknesses. The analysis also examines the degree to which project strengths offset threats, as well as identifying opportunities that may serve to overcome weaknesses.

- Delphi technique: It is a way to reach an agreement of Project risk experts. Questionnaires are used to gather ideas about the major project risks factors.

- Brain storming: The purpose of brainstorming is to get a general list of project risks. The project team carries out brainstorming with a set of experts. Views about project risk are brought on under the leadership of a project facilitator, with ideas contributed by participants. Risk breakdown structure, can be used as a framework to categorize risks.

• Root cause analysis: It is a method used to distinguish a problem, find out the basic causes that lead to it, and generate preventive action.

➢ Expert Judgment: identifying risks by experts with related experience with similar projects. Such suggest possible risks based on their previous experience and areas of expertise.

➢ Assumptions Analysis: every project is made up of hypotheses and assumptions. It looks into the validity of assumptions as they apply to the project. It Analyzes project risk factors in terms of inaccuracy, instability, inconsistency and incompleteness of assumptions in a project.

2.2.6.3 Risk Assessment and Analysis

This is the stage where the identified risks are going to be further analyzed. The identified risk's implication is defined quantitatively, before the response management stage. The goal of risk assessment and analysis is to set up the risk situations as absolutely as viable and rate them (Schieg, 2006).

There are two major categories distinguished on risk assessment. The qualitative analysis is a process that consists of interviews, checklists and brainstorming, while the quantitative analysis is acted through a data driven methodology. (Banaitene & Banaitis, 2012).

Qualitative risk assessment includes the evaluation of impact and the preparation of lists in order to additionally examine the recognized risks. (X.W Zou, 2007). Risk assessment using quantitative analysis displays the effect of each risk within high, low and the probability of occurrence.

The first step in risk analysis and evaluation process is to gather data to the risk exposure. This data might be past data gathered through past project experience by the contractor. In addition, the modeling of uncertainty of a risk exposure where the likelihood of happening is presented is described in terms of probability and potential consequences in financial monetary terms. The next thing to do is to assess the impact of those identified risks, using different methods like Monte Carlo simulation. The quantification of risks is the magnitude and frequency of each event could be a collection of happenings. Risks are divided in terms of their probability of happening and the magnitude of their impact. This permits a prioritization of the risks on the project in terms of them being possible to manage or not.

Qualitative Methods

Qualitative method can be applied to assess the probability of a specific risk to happen. The risk impact on project goal is evaluated in terms of opportunities and positive effects, as well as

threats and negative effects. It is crucial to adapt and define the probability and consequence to the specific project. Risk classification is used as a way to systematize the problems based to their sources, to identify areas with the highest vulnerability to those risks. This procedure analyzes activities into small units and creates different series of activities.

Quantitative Methods

The purpose is to examine at the sensitivity of different factors of the risk model on project result, by converting the values of one variable at a time and then displaying the effect on the project. Probabilistic evaluation is a way used to display the potential effect of various stages of uncertainties on project result. Monte Carlo Simulation is best example for this type of analysis.

2.2.6.4 Risk Response

The third step in the process of risk management indicates what actions need to be taken for the different risks and threats already distinguished (Mhetre, 2016). PMBOK define the planning process of risk response as a preparation of alternatives and deciding activities to improve possibilities in addition to minimize threats to the project. Literatures provide that there are mainly four risk mitigation strategies that can be implemented in order to reduce exposure to the risks associated with a project.

Risk Avoidance

Risk response is justified if the risk is estimated to have extreme outcome on a level that could warrant a reappraisal of the overall project (Potts, 2008). One can use avoidance to address the risk by altering project plans in a manner that makes the risk irrelevant. This method promotes changing project plans to facilitate the elimination of the risk or to protect the project goals from the possible negative impact.

Risk Transfer

This method uses transferring the risks and consequences for third parties who are willing to accept responsibility for its management and the liability of the risk (Mhetre, 2016). It includes the use of both contracts and insurance to transfer liability to other parties. The main purpose is to ensure that the risk is owned and managed by the party best able to handle the task successfully.

Risk Mitigation and Reduction

The purpose of this technique is to mitigate the risk by changing the scope of the project to minimize the likelihood of the damaging event occurring (Winch, 2010). Enforcing risk management early in the project to lower the probability of the risk event happening is more effective than trying to repair the damage and consequences of the risk has passed. The mitigation of risk may be done by adopting less complex processes so that the probability of impact is lowered, other forms of action is adding resources and extra time to the schedule (PMI, 2000). Flanagan (2007) proposes enforcing an altered construction strategy and the use of other materials to minimize possible risks,

Risk Acceptance

In fact, it is impossible to take benefit of all possibilities and dispose all threats of the project; however it is possible to be conscious of the threats and opportunities via documentation and identification of them. Risk response is applied when it is not feasible to respond to the risk by the other strategies. This stage is all about taking a conscious risk and to handle with the results as they occur. The decision not to change any project plans to handle with the risk or engaging in any other response strategies (Cooper, 2005).

2.2.6.5 Risk Monitoring and Control

According to (Winch, 2002) this process is significant because the data and information collected should be monitored and documented for eliminating past risks from emerging again and to control identified risks. Continuous monitoring and inspection of capable risks is essential for the implementation of the risk management process. Risk monitoring assures new risks are noticed and controlled. The project manager should monitor a list of the risks that have been identified for risk treatment action.

2.2.6.6 Approaches to PRM Process

1. AS/NZS 4360

The AS/NZS 4360 is a general standard that can be easily applied to a variety of fields or businesses, including the defense industry (Gaidow and Boey, 2005). However, it simply outlines a general approach to risk management; project-specific challenges are not covered (Cooper, 2005a).

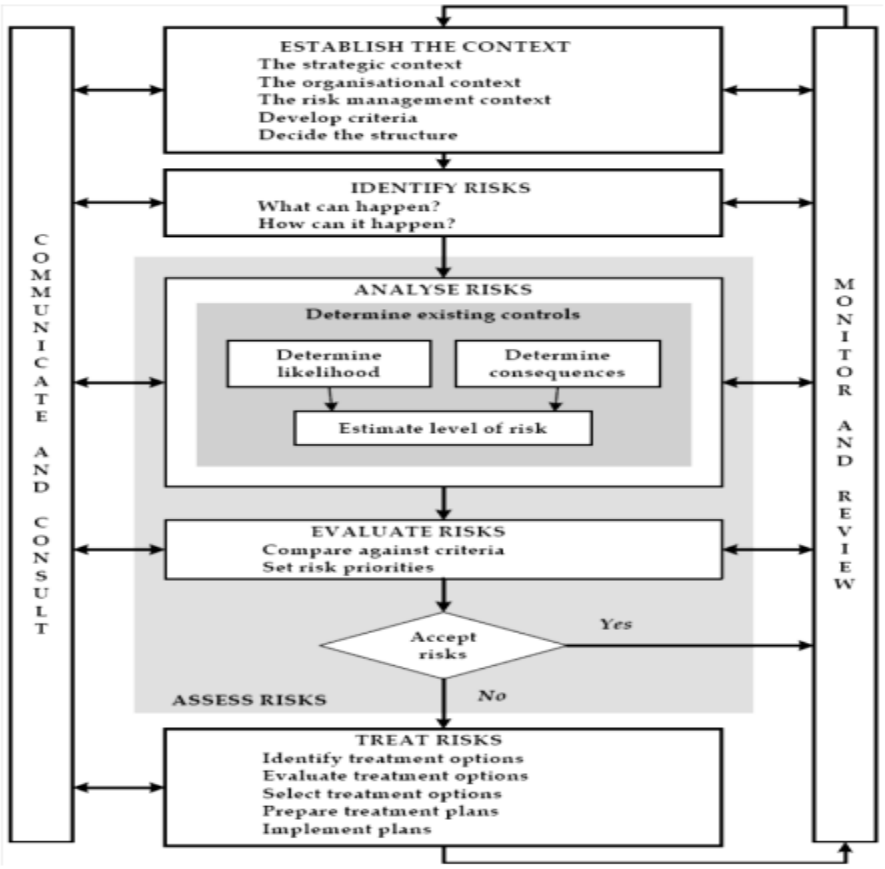

Figure 2-3: AS/NZS 4360:1999-Risk Management Process (Flyvberg, 2005, AS/NZS-4360.1999)

2. PRAM Guide

Consistent with Cooper (2005), the PRAM guide is a stand-alone guideline which connects the risk management process with detailed techniques or methods. The PRAM guide (APM, 2004) clearly states that although the method can be implemented at different levels of detail, it all depends on the degree of maturity of organizational risk capability.

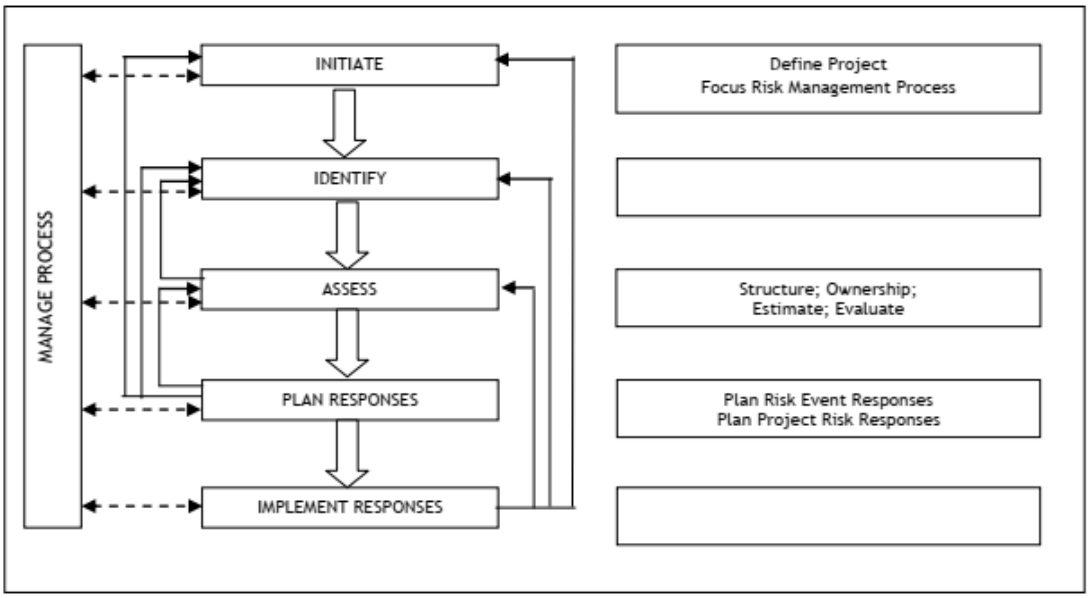

Figure 2-4: PRAM Guide Risk Management Process (APM, 2004)

3. PMI PMBOK®

A set of project management best practices and standards called PMBOK®, which places a focus on PRM, may be used to direct project managers with regard to specific methods and procedures. It is a component of the project management knowledge domains that combines management process and risk into thorough and precise approaches that serve as a roadmap for all projects. The process entails six steps: risk identification, qualitative and quantitative risk analysis, planning for risk response, and risk monitoring and control.

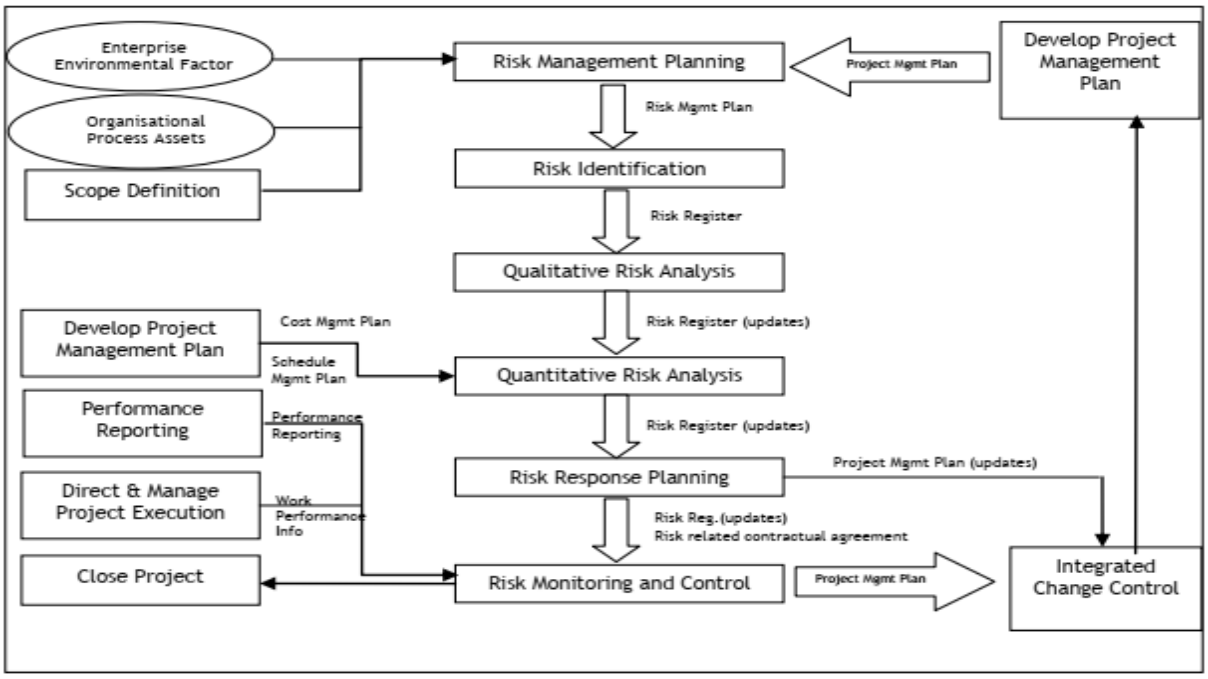

Figure 2-5: PRM Process Flow (PMI, 2004)

4. MoR – Management of Risk Framework

Given that governance is a part of any organization's internal control; it is a strategic approach to risk management (OGC, 2007a). The four essential steps of the MoR development process—identify, analyze, plan, and implement—are shown as circling arrows. Since effective communication is essential to implementing MoR successfully (OGC, 2007a), all activities and conclusions must be conveyed to the higher level.

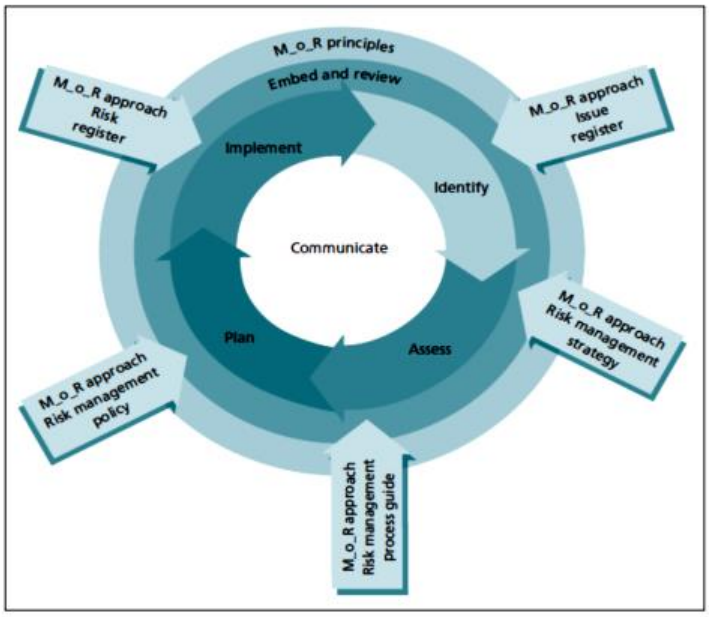

Figure 2-6 : MoR Frame work [(OGC, 2007a) p.4]

2.2.6.7 Project Risk factors in Road Construction Projects

From the starting phase, road construction projects are vulnerable to risks (Schieg, 2006). Therefore, from the early stages of a project the effectuation of risk control is fundamental because of the reality that decisions such as choice of alignment and selection of production techniques could be stimulated at some point of the stage (Eskesen, 2004). Looking into risk activities in the planning stage of the project life cycle is effective because information about the risks might come forth, helping the implementation of a strategic approach to be defined and adopted from the very beginning of the project cycle. This will in turn assist clarify project objectives and priorities, in addition bring an improved cost, schedule cost for the project (Reilly & Brown, 2004).

By incorporating risk management into the planning phase, one can facilitate the identification and reduction of possible risks for the project achievement of its objectives. Construction with unique nature of characteristics and specific participants of stakeholders working together is full of unpredictability. One Construction projects differ from the other in one way or other. The appropriate way of reducing risk in construction projects is to be fully organized for everything that might go against the plan. Previous studies of several authors try to identify different risk factors and categorize them in to internal and external risks which will occur in construction projects. From their study, we can understand that external risks are risks that are outside the

control of the project team. These kinds of risk are like political risks, economic risks, legal risks, social risks, and nature risks. But internal risks are risks the project faces because of its unique characteristics. These risks could be design risks, construction risks, financial risks, management risks and maintenance risks. According to the PMBOK Guide, the risks are categorized into such groups: technical, external, organizational, environmental, or project management. According to Bhavsar, (2014) risk associated with construction industry can be broadly categorized into:

1. Design related: are risks associated with the Incomplete Design, Inadequate specification, inadequate site investigation, change in scope, construction procedures and insufficient resource availability etc.

2. Construction related: are risks which include labor productivity, labor disputes, site condition, equipment failures, design changes, too high-quality standard and new technology.

3. Physical related: are risks arising from the damage to structure, damage to equipment, labor injuries, equipment & material fire and theft etc.

4. Organizational related: consist of contractual relations, contractor's experience, and attitudes of participants, inexperienced work force and communication.

5.Financial related: are related to increased material cost, Low market demand, exchange rate fluctuation, payment delays and improper estimation taxes etc.

6. Socio-Political related: changes in laws and regulations, Pollution and safety rules, bribery/corruption, language/cultural barrier, law & order, war and civil disorder and requirement for permits and their approval.

7. Environmental related: natural disasters and weather implications

8. Logistics related: Unavailable labor and material and equipment

2.3 Empirical literature

The study carried out by Adhikari R, Roshan & Mishra AK, Anjay (2020) entitled with "Strategic Risk management practice in urban Road Construction project of Nepal" was a journal of advanced research conducted to analyze the risk management practice in road construction project for the cities of Shiddharthanagar Municipality, Rupandehi, Nepal from contractor's and client's position. The research prepared questionnaire survey to collect the primary data using

convenient sampling of the partially or fully completed project. The findings of the research revealed that from the contractor's side, more than 60 % of the respondents believe that top management are not aware of risk management. From client's perspective, 80 % of the respondents believe that their top management is fully aware of risk management. This result shows us that relatively top managements are aware of risk management practice. Up on their research result, they concluded that risk should be implemented by one who is capable of managing the specific risk by managing contractual responsibility with appropriate contract administration practices for ensuring the project goals. There should be a risk register at the site and frequent meetings should be conducted to identify the risks. The identified risk should be documented decently to assure knowledge for projects in the future. Clients and contractors should conduct continuous training programs to advance managerial and financial practices to explain the internal and external risk affecting the road construction industry and to initiate the proper ways to deal with such factors. The government, non-government, clients as well as contractors should develop a risk management manual so that probable risks are mitigated before and during construction. We can understand the study was limited to those cities only; as a result the findings might not work for other cities of the country.

(Kishk, Mohammed, Ukaga & Chioma, 2008) conducted a study aiming to assess the impact of Effective Risk Management on Project Success Association of researchers in construction management. The article was written with the primary purpose of investigating the impact of effective risk management processes on project success. The article identified some factors which are critical for success of a project. These include definition of clear goals, management support, detailed project plan, a defined control mechanism, competent and technically able project team. The outcome of the study demonstrated that there was actual and direct relation between the efficient risk management and project achievement of its objective up on the relation. Likewise, it can be indicated that the more effective continuous risk management implemented in a project, the higher the chances of project success. Besides, it can be argued that effective continuous risk management leads to the higher the opportunities of achievement of its goals. In addition, the study revealed that viewing a project only in terms of cost, time and quality objectives is not only proper to conclude that the project is successful. A project has to have its own predetermined and accepted success criteria to evaluate each project milestones and the overall result of the project.

(Okate Anmol, Kakade and Vijay, 2019) performed a research study which focuses on Management of Risk on Road Construction Projects. Roads for the study purpose are divided high or low, depending up on the number of commercial vehicles they entertain per day. The

identification of risk is done through a questionnaire survey and the five point likert scale was used twice for the purpose of determining probability and impact of the risk factor. The Preliminary results of the study indicated that the top five most significant risk factors in road construction projects are (1) Delay in payments (93.33%) (2) Owner Bankruptcy (91.11 %) (3) Unclear definition of the project scope (91.11%) (4) Lack of leadership quality of project manager (88.89 %) and (5) Poor site management and supervision by the contractor (86.67%). In the study, it was stated that the above results may differ if the parameter of probability of the risk factors is also included. As a limitation, the study was unable to reveal what results we could get if probability of the risk factors included.

(Emran Hassen Abdu, 2017) conduct a study with purpose of developing conceptual risk Management Framework for AACRA. The study was approached with questionnaire to major stakeholders that play predominant roles in the road projects. This includes Contractors, Consultants and Clients. The inputs data are analyzed using risk register response validity testing, mean square, cumulative mean square and correlations and ranking. According to the study, the construction industry has had a very poor reputation for coping with these, with many projects failing to meet deadlines, and cost and quality targets. The questioner survey revealed that the respondents are aware of risk management only through earlier university learning. Scope, and Design Change and Bad weather conditions in their ranking order are the most critical risk factors attacking the AACRA. The risk factors are ranked based on their effect on overall project goals and objectives. The technical risk factors are the major sources to the authority. As it was already mentioned, stakeholder's knowledge about risk management is limited to their previous university learning and this creates a discontinuity in the practice of using risk management practice in the authority. The study also tries to develop Conceptual Risk Management Frame work for AACRA with the goal to minimize the impact of various project risks through proper mitigation plans for achieving project success.

The purpose of a case study done by (Ewelina Gajewska and Mikaela Robel, 2011) was to assess how the risk management process is applied in the construction industry and how professionals are dealing to risks in project activities. The authors discovered that risk is understood in relation with a negative event, even though in theory it can have two dimensions. Professionals in the construction industry are using methods described in the literature concerning risk management, but are not aware of it. The study is limited as it does not provide the best possible ways for professionals to understand and implement risk management tools. In addition, the study was

unable to provide reasons why risks are being managed every day in the industry, but not in such a structured way as the literature dictates.

(R A. Bahamid, 2019) wrote the article focused on the determination of critical risk factors that affect the construction projects in the developing countries. To reach this objective, a literature review on risk management of the construction projects was carried out. The authors showed that the inadequate understanding of risks factors that affect construction projects, which must utilize the risk management in achieving the project's goals. Accidents/safety and requirement or delay for permits and approvals are major factors that affect the developing countries construction projects. According to the article, the findings of the study can be considered as the main risk factors influencing the construction industry in the developing countries' because all these factors were in accordance with the past studies conducted in the different developing countries. But the finding of this study only works for developing countries.

(Dr. Mohammed Seid, Saravanan Devadoss and Girma Fekadu, 2019) conducted a study for determining the probability of happening of risk elements in road construction projects, looking into their effect on project goals and measuring the level of importance of the pre-identified risk elements. This research work focus on the risk management practices of construction firms engaged in road construction projects. Based on the results of the questioner, we can understand that even though the majority of the respondents have average knowledge about risk management, the outlook and dedication of senior staffs towards risk management is very low. This research work disclosed that delay in possession of site is the highest significant risk factor among with delay in payments and defective design, which are ranked second and third respectively in the study. The study recommends that construction firms should implement well established risk management system in which project risk identified, analyzed and appropriate response applied in order to decrease the bad effect of risks on the project goals, size and increase the opportunities as well.

In the study conducted by Mohajeri Borje Ghaleh, Reza, and Towhid Pourrostam (2021), risks have been identified by structured interviews with experts. Qualitative risk analysis by a survey of specialists and quantitative risk analysis by analytical hierarchy process method have been conducted. Research results show that financial and credit problems, lands' funding, management problems, technical problems, and natural disasters have the highest risk. The study established that it is a powerful method for prioritizing delays because it provides a plan to respond to the critical criteria. However, in the prioritization, the risks that are of high importance may be low

cost in the project. Whereas, the risks that are of low importance may be very costly to the project. Therefore, there should be a way to develop a method to quantify the cost-effectiveness of risks.

In the study conducted by Abdulaziz M. Jarkas and Theodore C. Haupt (2015), for the purpose of distinguishing, exploring, ranking the relative importance and determine the prevalent allocation response trends of the major construction risk factors considered by general contractors operating in the State of Qatar, a structured questionnaire survey comprising 37 potential risk factors was distributed to a statistically representative sample of contractors. The influence ranks of the factors explored were determined using the "Relative Importance Index (RII)" technique. The results of the study implied that risks related to the "client" group are perceived as most critical, followed by the "consultant", "contractor" and "exogenous" group-related factors, respectively. This shows that these two parties have an essential role in controlling the negative ramifications of the associated factors. The findings of the study propose that increasing designers' consciousness of the significant effect of utilizing the constructability concept can substantially help to reduce the risks' of occurrence of the construction operation.

2.4 Synthesis

Risk management is one of the nine knowledge areas popularized by the Project Management Institute (PMI). Risk management consists of anticipating; at the beginning of the project, unexpected situations that may come forth beyond the project manager's control. Risk management in the construction project management context is a comprehensive and systematic way of identifying, analyzing and responding to risks to achieve the project objectives.

Project risk management is an important part of the decision-making process in any construction industry. Just as any other economic activity, construction project is risky. Project systems are in essence complex (Vidal and Marle, 2007). Road construction projects are exposed to a wide variety of hazards and complex risks. This is because of the involvement of series and interconnected nature of its activities and different contracting parties and stakeholders. These stakeholders play their own distinct role to protect their own interest rather than the project overall objective depending on what they need and expect from the outcome of the project, which leads to higher probability of the project facing different challenges or risks and a less efficient risk management practice.

To have a successful project, that means to achieve the project quality plans with planned time and budget, all the project management team members and contracting team members should be committed to address all risk management actions proactively and consistently throughout the project. (Zuo, J., Zhao, X., Nguyen, Q. B. M., Ma, T., & Gao, S. (2018).

Most of the studies on project management agree that, the delays and cost over runs, most of the problems we are witnessing in our road construction projects presently are believed to be the result of lack of effective risk management practices. The benefits of the risk management process include identifying and analyzing risks, and improvement of construction project management processes, effective use of resources and fundamentally achieving the project cost, time and scope objectives.

According to PMI 2004, project cost management and project time management are the two most basic project management knowledge areas that ultimately affect the overall performance of any project. Projects that require more cost and time beyond the planned cost and time cannot be taken as a successful project. A conscious choice should be made at all levels of the members of all stakeholders to purposely participate in identifying risks and engage in efficient risk management practice during the life of the project. Correct risk identification ensures risk management effectiveness. Thus, the role of this study is to assess the current project risk management challenges in terms of identifying the critical risk factors that contribute to the possible occurrence of risk in of road construction projects in Addis Ababa city. Therefore, these findings can contribute to the knowledge database for the use of project management members of road construction projects to identify the major risks that frequently occur in road construction and suggestions on how to treat these risks to minimize cost and time overrun due to these risks.

CHAPTER THREE

3 Research Methodology

The general objective of this study to identify the existing risks factors and their impacts. This chapter addresses the methodology which is utilized to achieve the research Objectives. It will be viewing the research approach and design, sampling techniques, data collection techniques and procedures, description of study variables and measurement and finally data analysis and techniques.

3.1 Research Approach and Design

According to Redman and Mory (1923) research is an organized, scientific and systematic effort to gain new knowledge on a particular subject. (Kothari, 2004) explains the plan, roadmap and blueprint strategy of investigation conceived so as to obtain answers to research questions make up a research design. It constitutes the plan for the collecting, measuring and analyzing of data.

In order to accomplish the research objective, this study going to use mixed method research approach used in the study. It helped to gain the best of both quantitative and qualitative approaches which is a concurrent embedded research design that were used within a single phase of data collection and analysis.

Among different research designs, a descriptive research design method is selected for the purpose of this research. According to (Sileshi, 2009) descriptive research sets out to describe and to interpret what is the current state of the study area. Descriptive research is selected to deal with the research questions because it was believed to be appropriate approach in identifying various characteristics of risk in the road construction sector. Descriptive approach is carried out to describe and assess probability of risk factors with high probability of occurrence and highly affect the objectives of the project success. With this research approach the state of current risk management practice of road construction projects is going to be studied through a process of data collection that enables to describe and evaluate the challenges in risk management practice more completely, develop hypothesis and propose associations.

3.2 Source Population and Target population

Despite the fact that all participants that are participated in the road construction projects play a significant role for the completion of the project, consultants, Designers, Suppliers, clients and contractors are more related with high degree of risk owing to the characteristic of the road construction industry. The end aim of this paper is to figure out a way in which the contractors and consultants can both minimize the occurrence of risk factors and their negative impact. To achieve this objective, Grade One road construction contracting companies (RC-1) and Grade One road construction consulting companies in Addis Ababa who are currently (at the time of the study) engaged in unfinished road projects are selected as a targeted population. The reason behind for choosing these specific consultants and contractors is because of their monetary resource, capacity in terms having different quality and quantity equipment's, resources and professionals participated in major road construction projects with more working experience in the sector compared to lower grade of consultants and contractors that could help to achieve the research objective. Professional Engineers, Technical Managers, Project Managers, Technical supervisors and Risk Supervisors are selected from the Target population.

Sample Size

According to Addis Ababa City Road Construction Authority, presently the total number of grade one road construction companies and road construction consulting companies who have already signed a contract with the city road construction authority and currently working under ongoing road projects in the city are as the following.

Total number of Grade One Road contractor companies (N) = 18

Total number of Grade One Road Consultant companies (N) = 11

3.3 Sampling Techniques

The sampling design that will employ for this study is a non-probability sampling. A nonprobability sampling provides with an information-rich case study in which it enables to explore the research question and gain theoretical insight (Saunders, Lewis & Thornhil 2009). Purposive sampling would best fit for this study, as our sample size is relatively small. Purposive / judgmental sampling is often used when working with small population and enables us to select cases that best fit to answer the research questions and meet objectives (Saunders et al., 2009)

3.4 Data Collection Techniques and Procedures

This research focus on the study current Risk management practices on Road Construction Projects in Addis Ababa city. To achieve the research objectives, relevant data were collected from both primary and secondary data sources. First of all, the primary data were collected from primary data source which was acquired questionnaires. A questionnaire survey was conducted on AACRA's projects, involving the consultant, and contractor. According to Sileshi (2009) questionnaire is a type of survey where number of respondents are asked identical questions in order to gain information. The information gathered going to be analyzed to found out patterns and any comparisons in the result of the questioner.

The questionnaire was mainly used as an instrument to collect data. The questionnaires are adapted from researcher (Rediat, 2020) whose validity and reliability tested and conducted by the researcher. The reliability of the questioner was checked by checking the Cronbach‟s alpha in SPSS 20. Cronbach's alpha (α) is the most common measure used to check the reliability of a Likert scale question. The Cronbach's alpha, for the questioner used in this research, was determined by running reliability analysis in SPSS. As shown in the table below, the alpha value of the reliability analysis is above 0.554 and according to (Taber, 2018) alpha value between 0.45 to 0.98 is satisfactory which makes this questioner reliable.

Table 3-1 : Reliability Test: Cranach's alpha result

Risk Factors	Number of questions	Probability of occurrence	Impact on project cost	Impact on project completion time
Design Risk	5	0.794	0.678	0.767
Construction Risk	11	0.783	0.665	0.871
Physical Risk	5	0.72	0.678	0.692
Organizational and Managerial Risk	7	0.793	0.822	0.783
Financial Risk	6	0.642	0.711	0.621
Socio-political and legal risk	7	0.554	0.765	0.766
Logistic Risk	3	0.569	0.675	0.714
Environmental risk	2	0.58	0.594	0.506

The questioner used for this study is made up of four parts: the first part investigates the overall information of the participant; the second part uses Likert scaled questions to find out the probability of occurrence of risk and the effect of risk on cost and completion time of the project. The third part compromised of questions to investigate the challenges in implementing project risk management implementation. Finally, the forth part of the questioner which is a multiple-choice type question to see which type of responses is preferable for each type of risk.

Secondly, the secondary data sources; which include desk studies, books, previous researches, publications, and journals are used to distinguish critical risk factors that influence the performance of the road construction sector.

3.5 Data Analysis Techniques

The research was conducted using a questionnaire survey to validate the findings of the study. The questionnaire was compiled on the basis of a compiled list of risks involved in road construction projects for quantitative study. The quantitative study was conducted to measure the variables identified from the literatures.

Data collected through questionnaires were analyzed using quantitative descriptive statistics with the help of IBM SPSS Statistics version 20 statistical computer software. Descriptive analysis is used to reduce raw data collected through questioner into a meaningful summary and graph.

The respondents were asked to rate the all the risk factors related to road construction projects on a 5-point scale to determine their probability occurrence. The collected data are going to be analyzed using quantitative data analysis techniques. The data collected from close-ended questions of the questionnaire is analyzed by descriptive data analysis methods using Statistical Package for Social Science (SPSS). The respondents were requested for each factor to rate using five point scale of 1 to 5 was adopted. It was categorized as follows 5=very high; 4=high; 3=medium; 2=low; and 1=very low. Secondly, the secondary data sources; which include desk studies, books, previous researches, publications, and journals are used to distinguish critical risk factors that influence the performance of the road construction sector. Probability of occurrence of various risk factors their rating are generated based on contractors and consultant's responses are going to be calculated using statistical results mean score and percentages will be displayed in a tabular format followed by discussions. The outcomes displayed by means of tables, graphs, and charts.

3.5.1 Descriptive Analysis

Central tendency: mean

Mean is a descriptive method used to explain a set of data in a single number. It is used to measure the middle or center of a data. The response of the 29 participants was summarized by averaging the rating of each participant for each risk factor. In this paper, the mean value of the ratings was calculated using SPSS which are used to rate the probability of occurrence of various risks based on contractors and consultants view and from this analysis, the risk factors that have high probability of occurrence and high impact on project cost and completion time was identified.

To analyze the forth part of the questioner, the percentage of answers given for each risk response methods corresponding to each risk factor was calculated. The one with highest frequency is, then, identified for each risk factor.

3.6 Validity and Reliability

Questioners in a research are used as a means of collecting relevant and reliable in a valid manner. Thus, the validity and reliability of the questioner/ survey is essential. Validity assures the area of investigation is explained by the collected data while reliability checks whether the questioner provides a stable and consistent result. Therefore, the validity and reliability of the questioner was checked.

The face validity of the questioner was checked by distributing the questioner to managers in construction companies. The questionnaires are adapted from researcher (Rediat, 2020) whose validity and reliability tested and conducted by the researcher. The Face validity involves the expert looking at the items in the questionnaire and agreeing that the test measures the characteristics or traits of interest (Bolarinwa, 2015). Cronbach's alpha (α) is the most common measure used to check the reliability of a Likert scale question. The Cronbach's alpha, for the questioner used in this research, was determined by running reliability analysis in SPSS.

3.7 Ethical Issues

All of the participants that responded to the questioner of the research were properly informed about the purpose of the research. Their identity as well as the names of the company they belong to has been kept confidential. Additionally, all the secondary data used in this paper have been

properly cited all the information collected throughout this research will only be used for the purpose of this study.

CHAPTER FOUR

4 Results and Discussion

4.1 Introduction

Overall, 29 questioners were distributed for General Managers, Deputy Managers, Technical Managers, Project Managers and others, working for 29 contractors and consultants sectors and out of the 29 questioners, all questioners were responded. In this chapter, the results gained from the responses were discussed as follows. First, the risks that have a high probability of occurrence, impact on project cost and completion time was distinguished. Then, based on part three of the questioner, the risk response methods with high ratings from participants are identified for each risk factor.

i. **Questionnaire**

The questioner used for this study is made up of three parts. The first part investigates the overall information of the participant. The second part uses Likert scaled questions to find out the probability of occurrence of risk. Finally, the third part of the questioner which is a multiple-choice type question to see which type of responses is preferable for each type of risk. Respondents divided in to two groups, i.e. contractors and consultants. Table 4.1 shows 29 questionnaires distributed to respondents. Out of which, 18 were contractors and 11 were consultants. A valid response of 18 and 11 returned respectively and used in the analysis that constituted 29 respondents and this represented a 100% response rate, which considered as a very good response.

Table 4-1 : Respondents Response Rate

Sample Size	Company	No of Respondents	Percentage
11	Consultant	11	100%
18	Contractor	18	100%
Total		29	100

Source: Own Survey (2022)

General Profile of Respondents

This section of the questionnaire considered to obtain the general profile of respondents. It includes respondent's job position the company, educational level, and years of experience on a project and field of specialization.

i. Respondents job position the company

Table 4-2: Respondents Job Position in the company

		Frequency	Valid Percent	Cumulative Percent
Valid	General Managers	6	20.7	20.7
	Deputy Managers	3	10.3	31.0
	Technical Managers	8	27.6	58.6
	Project Managers	10	34.5	93.1
	Others	2	6.9	100.0
	Total	29	100.0	

Source: Own Survey (2022)

Respondents selected from a wide range of professions that include General Manager to Project Managers. The overall groupings of respondents presented according to their job positions; General Manager 20.7%; Deputy General Manager 10.3%; Technical Manager 27.6%; Project Manager 34.5%; and others 6.9% are project coordinators. (Table 4.2) The above table shows that all of the participants are top company managers and project leaders which make sure that respondent are in a good position and have good insights about the projects the company runs.

ii) Respondents educational level in the company

Table 4-3: Respondents educational level in the company

		Frequency	Valid Percent	Cumulative Percent
Valid	Diploma	2	6.9	6.9
	B.Sc.	7	24.1	31.0
	M.Sc.	20	69.0	100.0
	Total	29	100.0	

Source: Own Survey (2022)

Table 4.3 displays the general groupings of participants according to their educational status. 6.9% of respondent's educational status Diploma holders, 24.1% were holding second degree and 69.0% are holders of Master degree. So the level of education of the respondents is a bachelor's degree and above. This implies the majority of the workforce has enough educational background and understandings to easily understand about project risk management concepts and practices which helps research to achieve its objective.

iii) Respondents working experience on a project

Table 4-4: Respondents Working experience on a project

		Frequency	Valid Percent	Cumulative Percent
Valid	less than 2 years	1	3.4	3.4
	2-5 Years	1	3.4	6.9
	5-10 Years	11	37.9	44.8
	above 10 Years	16	55.2	100.0
	Total	29	100.0	

Source: Own Survey (2022)

As indicated in Table 4.4 from all of respondents 55.2 % constituted above 10 years of experience, where as 37.9 % constituted from 5 up to 10 years. The experiences the respondents have on projects and relevant works is a good advantage to identify possible risk factors and allocation of response strategies in road construction projects in particular. This makes them as dependable and credible sources of information, which is vital to realize the research objective.

iv) Respondents Project Risk management training

Table 4-5 : Respondents Project Risk Management Training experience in their company

		Frequency	Valid Percent	Cumulative Percent
Valid	Yes	10	34.5	34.5
	No	19	65.5	100.0
	Total	29	100.0	

Source: Own Survey (2022)

As indicated in Table 4.5, only 34.5 of the respondents have a history of project risk management training in their company. The above table shows that the companies are not too good in giving project risk management training to their employees and updating their knowledge about project risk management which possibly weakens their efficiency in dealing with project problems.

v) Respondents field of specialization

Table 4-6: Respondents field of specialization

		Frequency	Valid Percent	Cumulative Percent
Valid	Engineering	8	27.6	27.6
	Project Management	10	34.5	62.1
	Construction Management	7	24.1	86.2
	Other	4	13.8	100.0
	Total	29	100.0	

Source: Own Survey (2022)

As the above table entails, staffs with different field of specialization in the project contributes to improving project performance and help to lessen risk as the different perspective have a positive impact.

4.2 Risk identification

Risk management is composed of mainly four steps: risk identification, risk analysis, risk response and monitoring risk. In this paper, we are going to focus on the 1st three parts. In this section, the results of descriptive analysis done via SPSS 20 of the rating of the risks identified through literature review are discussed.

Mean scores and ranking mechanism are used to rate the probability of occurrence of various risks based on contractors and consultants view.

As indicated in Table 4.6 above, risk factors rated based on the assessment and probability of occurrence and their impact on project cost and time from the overall insight of respondents.

Table 4-7 : Probability of risk factors occurrence, impact on cost and completion time of project generated based on contractors, consultants responses

Descriptive Statistics								
			Probability of occurrence		Impact on cost of the project (budget)		Impact on completion time of the project	
	Risk Factors	N	Mean	Rank	Mean	Rank	Mean	Rank
	1. Design Risks							
1.1	Defective design	29.00	4.21	2	4.03	3	3.59	7
1.2	Not coordinated design (structural, mechanical, electrical, etc.)	29.00	3.62	15	3.72	10	2.79	31
1.3	Inaccurate quantities	29.00	3.41	22	3.34	26	2.76	32
1.4	Lack of consistency between bill of quantities, drawings and specifications	29.00	3.66	13	2.90	39	2.59	38
1.5	unqualified designers	29.00	3.76	9	3.76	8	3.14	17
	2. Construction risks							
2.1	Rush bidding	29.00	3.03	34	3.55	16	2.55	40
2.2	Gaps between implementation and Specification	29.00	3.59	17	3.69	12	2.59	38
2.3	Labor productivity	29.00	3.59	17	3.24	32	3.62	6
2.4	Design change	29.00	3.79	8	3.76	7	3.55	8
2.5	Labor disputes	29.00	2.83	36	3.38	23	2.69	33
2.6	Site condition	29.00	2.97	35	2.48	45	3.14	17
2.7	Equipment failures	29.00	3.83	7	3.76	8	3.14	17
2.8	Lower work quality due to time constraint	29.00	3.38	24	3.34	26	3.28	15
2.9	Lower work quality due to workman ship	29.00	3.69	11	2.97	38	3.03	21
2.10	Construction procedures	29.00	3.66	13	3.69	12	3.41	13
2.11	Actual quantity differs from the contract	29.00	2.72	38	2.76	43	2.48	43
	3. Physical risks							
3.10	Damage to structure	29.00	2.69	40	3.38	23	3.00	22
3.20	Damage to equipment	29.00	3.93	5	3.28	30	3.31	14
3.30	Labor injuries	29.00	3.28	29	2.86	40	2.83	29
3.40	Supplies of defective material	29.00	3.41	22	3.17	35	2.90	27

3.50	Theft	29.00	3.10	33	2.83	41	2.45	44
	4. Organizational & Managerial risk							
4.10	Contractual relations	29.00	3.69	11	3.41	19	3.14	17
4.20	Contractors experience	29.00	3.72	10	3.59	15	2.62	36
4.30	Attitudes of participants	29.00	3.55	20	3.41	19	3.00	22
4.40	Inexperience work force	29.00	3.45	21	3.24	32	2.69	33
4.50	Ambiguous Planning due to project complexity	29.00	3.28	29	3.41	19	2.69	33
4.60	Resource management	29.00	3.59	17	4.28	1	3.69	4
4.70	Poor communication between involved parties	29.00	3.38	24	3.28	30	2.86	28
	5. Financial Risk							
5.10	Inflation	29.00	4.31	1	4.10	2	3.66	5
5.20	Payment delays	29.00	4.10	3	3.72	10	3.72	3
5.30	Material cost	29.00	4.03	4	4.03	4	3.76	2
5.40	Exchange rate fluctuation	29.00	3.38	24	3.97	5	3.48	11
5.50	Low market demand	29.00	2.83	36	3.21	34	2.93	26
5.60	Financial failure of the contractor	29.00	3.86	6	3.45	18	3.83	1
	6. Socio- political and legal risks							
6.10	Changes in laws and regulations	29.00	3.14	32	3.34	26	2.83	29
6.20	Pollution and safety rules	29.00	2.31	43	3.14	36	3.00	22
6.30	Bribery/Corruption,	29.00	2.72	38	3.31	29	2.45	44
6.40	Language/Cultural barrier	29.00	1.86	45	2.55	44	2.55	40
6.50	Law & order	29.00	1.97	44	3.38	23	2.62	36
6.60	War and civil disorder	29.00	1.45	46	2.00	46	1.62	47
6.70	Requirement for permits and their approval	29.00	2.55	42	3.55	16	3.52	9
6.80	Legal disputes among the parties in the contract	29.00	3.38	24	2.83	41	3.00	22
	7. Logistics Risks							
7.10	Unavailable labor, material and equipment	29.00	3.62	15	3.69	12	3.52	9
7.20	Undefined scope of working	29.00	3.24	31	3.83	6	3.28	15
7.30	High competition in bids	29.00	3.38	24	3.03	37	2.55	40
	8. Environmental risks							
8.10	Natural disaster	29.00	1.45	46	1.86	47	2.00	46
8.20	Adverse weather condition	29.00	2.66	41	3.41	19	3.48	11

Source: Own Survey (2022)

In road construction industry, as seen in literature review, there are eight main risk factors. Within these risks there are 47 risk factors. In this section, we analyze which risks have the highest probability of occurrence from the 5-point Likert scaled questioners gathered. The scale ranges from 1 to 5: 1= Very Low probability, 2= Low probability, 3 = probability of occurrence, 4= highly probability and 5= Very Highly probability and 0= No Probability 1= Very Low Probability, 2= Low Probability, 3 = Probability, 4= High Probability and 5= Very High Probability.

It is displayed that " inflation ", "site condition", "defective design", "payment delays", "material cost", "damage to equipment", "financial failure of the contractor", "equipment failures " and "unqualified designers" were the 10 major risk factors identified according to their hierarchy. Nevertheless, in this study, top 4 critical risk factors with highest frequent occurrence are discussed.

From Table 4.7 above, the finding shows that at present time inflation is the first ranked risk factor with high probability of occurrence and most critical in the road construction industry, with a mean value of (4.31).

Inflation is a measure of the rate of rising prices of goods and services in an economy. Inflation can happen as prices rise owing to increases in manufacturing costs, such as raw materials and wages. Inflation is also the decline of purchasing power of a given currency over time.

According to the study done by Solomon Melaku Belay, Seifu Tilahun, Mitiku Yehualaw, Jose Matos, Helder Sousa and Endalew Temesgen Workneh (2021) the second delay risk factor with a Mean Score of 4.48 is inflation. It was showed that unexpected fluctuations in prices of construction materials including equipment and fluctuations in foreign currency exchange rates interrupt the performance of infrastructure construction projects, which in turn leads to project delays and controversies among stakeholders.

The outcomes achieved from this study were in alignment with the findings of the study done by Z. Rachid, B. Toufik, and B. Mohammed, vol. 19, no. 5, pp. 371–381, 2019, Whose research studies have determined that the top risks factors causing cost overrun in the building and road projects are inflation.

Defective design with a mean value of 4.21 observed by contractors and consultants as the second critical risk with high probability of occurrence among the factors examined (Table 4.7)

Ali Ahmad Jibran Khattak , Rehman Akhtar , Muhammad Abas , Qazi Salman Khalid , Sahar Noor , AbdurRehman Babar and Shakir Azim , 2019 performed a research to come upon and study the key risk factors, risk prevention and mitigation techniques and risk analysis techniques from insight of contractors and owners in Pakistan. To accomplish research goals, the data was gathered from 311 contractors and 190 owners. The analysis reveals that the most dangerous risk factors according to owner are defective design.

In addition, Santoso (2003) carried out a questionnaire survey to find out the prevalent risk factors in high rise building construction and his research disclosed that design issues problems are the second highest risk factor after site management.

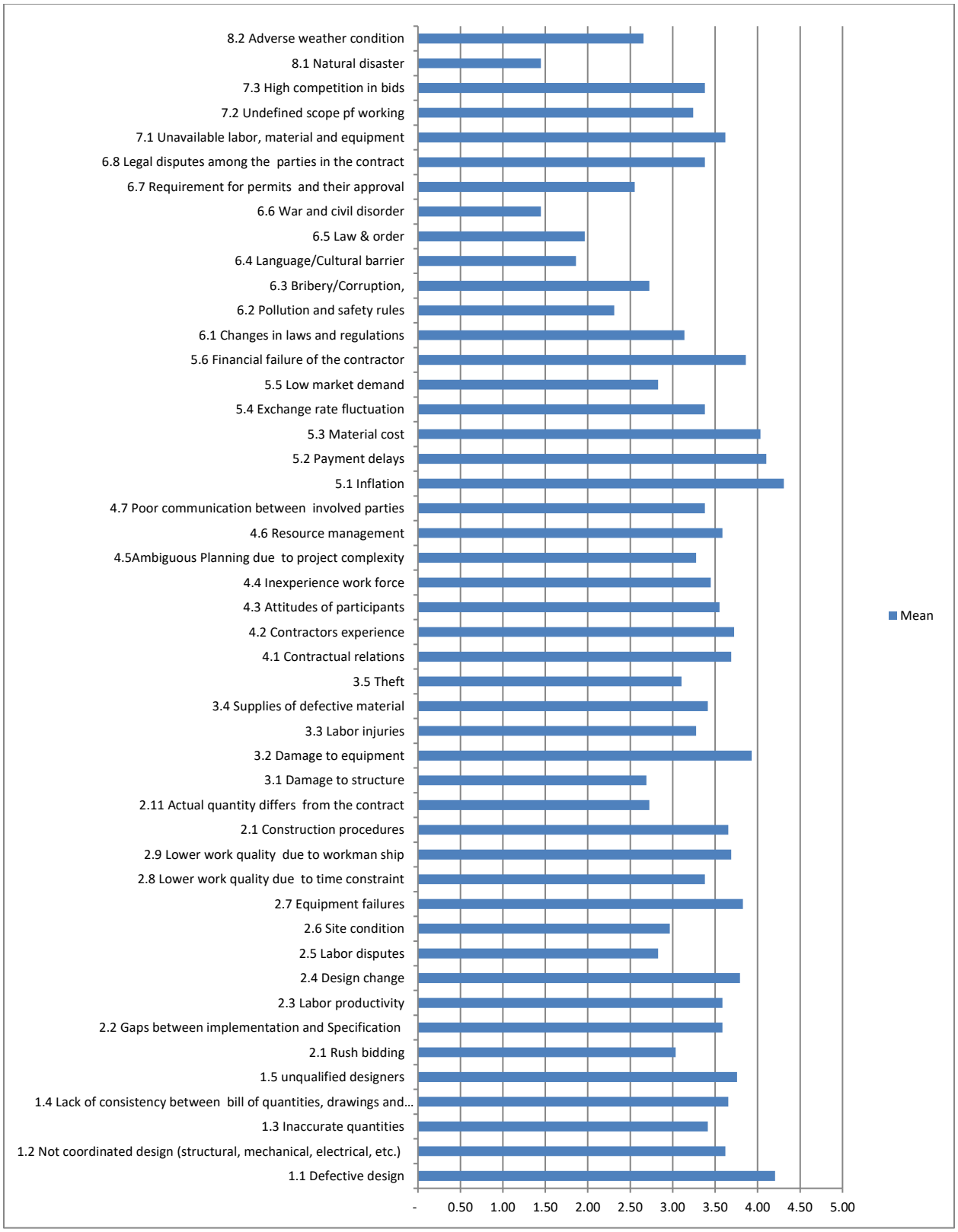

Figure 4-1 : Probability of occurrences of risk factors

According to Zeina Hazem (2021), from the very several risk factors the construction sector confronts, design errors were the most often observed risk factor. Respondents of the research also felt that these risk factors were the reason for the poor quality of projects delays. Scott Wiguna and (2005) also examined that the risk factors affecting the performance of construction projects in Indonesia. According to their work, defective design is one the most critical risk factor affecting the performance of construction projects.

Payment delays with a mean value of 4.1 observed by contractors and consultants as the third critical risk, among other factors examined. (Table 4.7)

Enshassi, Adnan & AbuHamra (2015) performed study to name the reasons of delayed payment and nonpayment issues in construction projects in Gaza Strip from subcontractors' perspective. Delayed variation orders payment was found as the most frequently problem faced by subcontractors which has led to disputes. The results revealed that most disputes were resolved through negotiation within three months. The findings showed that the inclusion of the arbitration clause in the contract is the most significant effective way to solve the payment and dispute issues in construction projects in Gaza Strip.

Based on a research conducted by Thanuja Ramachandra (2012) to propose feasible solutions that will assure payments to construction parties on construction projects in New Zealand construction industry, his study revealed that the payment delays and losses are experienced by contractors (10-40%) and subcontractors (10-80%) on the total projects undertaken by them since the Construction Contracts Faces payment delays. Contractors and subcontractors pointed that payment bonds, direct payments and the use of trust accounts were favored solutions to the payment problems experienced by industry.

Abdul-Rahman (2013) carried out a survey to determine the risk factors in the Malaysian construction industry. Their study revealed that late payment by client is the leading risk factor the Malaysian construction industry encounter.

The study also ranked "material cost" with the mean value of 4.03 as the fourth critical risk factor with highest probability of occurrences as of contractors and consultants observation. Material cost is the cost of raw materials available to proceed with the project. Material cost rises are the increases in the prices of a raw materials and commodities.

The combination of logistical problems and increased global demand in the construction industry has resulted in huge shortages and delays, leading to increased materials prices.

4.3 Impact on cost of the project (budget) and Impact on completion time of the project

During the questionnaire survey respondents are asked to rate the impact of the identified risks factors. Their responses are generated in respect of mean scores and they were ranked.

Among forty seven risk factors the top four critical risk factors with highest impact on project cost and completion time are discussed. According to the research resource management was perceived as the top rank risk factor affecting project cost. Inflation and defective design materials cost are assessed as the second, third and fourth most important factors affecting project cost.

From **Table 4.7** above, the finding show that at present time Resource management is the first ranked risk factor with high impact on project cost or budget among other risk factors construction, with a mean value of 4.28 and the fourth risk factor with a mean value of 3.69 affecting project completion time

According to Nagaraju (2012), resources are items used to carry out the whole project properly, namely, labor, material and equipment. Material resources comprise shortages and changes in material, late delivery, and damage of material.

Labor force involves scarcity of labor, and inadequate skills. Furthermore, equipment related like failure and lack of equipment. In addition, Kermanshachi, (2018) found that the schedule performance was severely affected by resource risk. Moreover, Zubaidi (2008) pointed out that the availability of labor, materials and equipment and the decline in labor productivity are the main reasons for failure to complete the project on time.

According to this research the second risk factor with highest impact on project cost with the mean score of 4.10 is inflation.

Financial aspects of projects include financial necessities and making payments on time. Wu et al. (2017) found that the problem of inflation was the key risk which had an impact on project cost. Another study by Anton (2011) indicated that price escalation of material and inflation can lead to the cost overrun of construction projects. Furthermore, Zailani (2016) reported that inflation was the foremost cause of risk in construction projects that generate effect on performance of construction projects.

According to this research the third risk factor with highest impact on project cost with the mean score of 4.03 is defective design.

Andi (2006) reported that defective design was the most serious and common risk followed by incorrect and insufficient design information, inconsistent information among design documents, and unrealistic design (constructability issue). In addition, Wu (2017) found out that risk related to design such as inadequate site information resulting in improper design had an effect on project performance.

Santoso (2003) in his study found that in Indonesia, the limited design fee allotted by the owner would cause the designer to provide defective design.

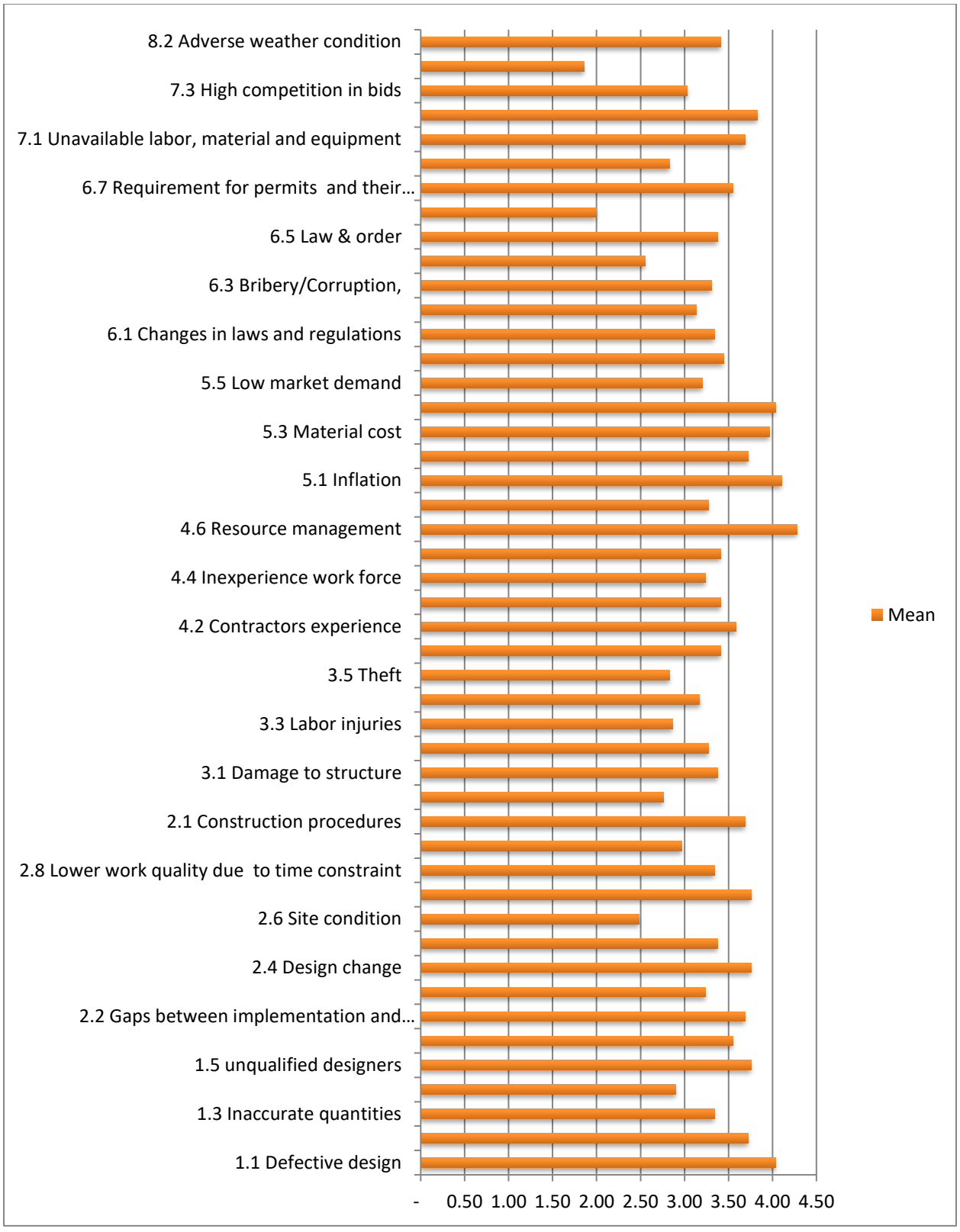

Figure 4-2: Impact on cost of the project (budget)

The findings by the study of Ogunlana (1996) also showed that most project delay (on 75% of the projects studied) was caused by incomplete design. According to the study Unqualified or shortages of personnel involved in project design due to work overload in the firm designing the project were recognized as the most important reasons causing defective construction drawings.

Inconsistency between specifications and drawings are main reason for defective design. These were the most frequent problems perceived by contractors resulting from defective design. They were thought to have probably arisen because of lack of coordination between designers and lack of supervision among draftsmen in the design phase.
Deviations found between the various construction drawings and specifications needs interaction to designers to solve these problems. Nevertheless, this process would take time waiting for responses from the designers.

In addition to more draftsmen might be needed to identify variances in the drawings and to propose their own detailed and improved drawings. These still required time to coordinate with the main designers. In addition, defective design may lead to rework, and consequently these conditions could lead to cost overruns.

From **Table 4.7** above, the finding shows that at present time material cost is the fourth ranked risk factor with high impact on project cost or budget among other risk factors with a mean value of 4.03 and Based on this research the second risk factor with highest impact on project completion time with the mean score of 3.76 is material cost.

In Indonesia, the findings from the survey conducted by Kaming (1997) on high-rise building projects showed that increased material cost and inaccurate material estimation were the factors most affecting project cost overrun.

The prices of steel, Ferro, cement and other raw materials required for road construction had increased dramatically over a few months. These materials are usually used in road projects, indeed, steel, Ferro, cement are intensively used at the early stage of such projects in the form of reinforcing bars and frame work for the building structure. As indicated, most of the construction projects were in the early stages, and consequently, most of them were influenced by these bad effects. These materials are also used to a lesser intent for finishing components, so other contracts, which were surveyed in the middle and final stages of construction, were inevitably influenced by this impact.

Projects managers who had such problems would usually try to find distributors who can supply these materials at a lower price or renegotiate with their suppliers to get a more reasonable price. This reaction would not fully solve the problem of increased costs, and would also create project delays as a result of renegotiation.

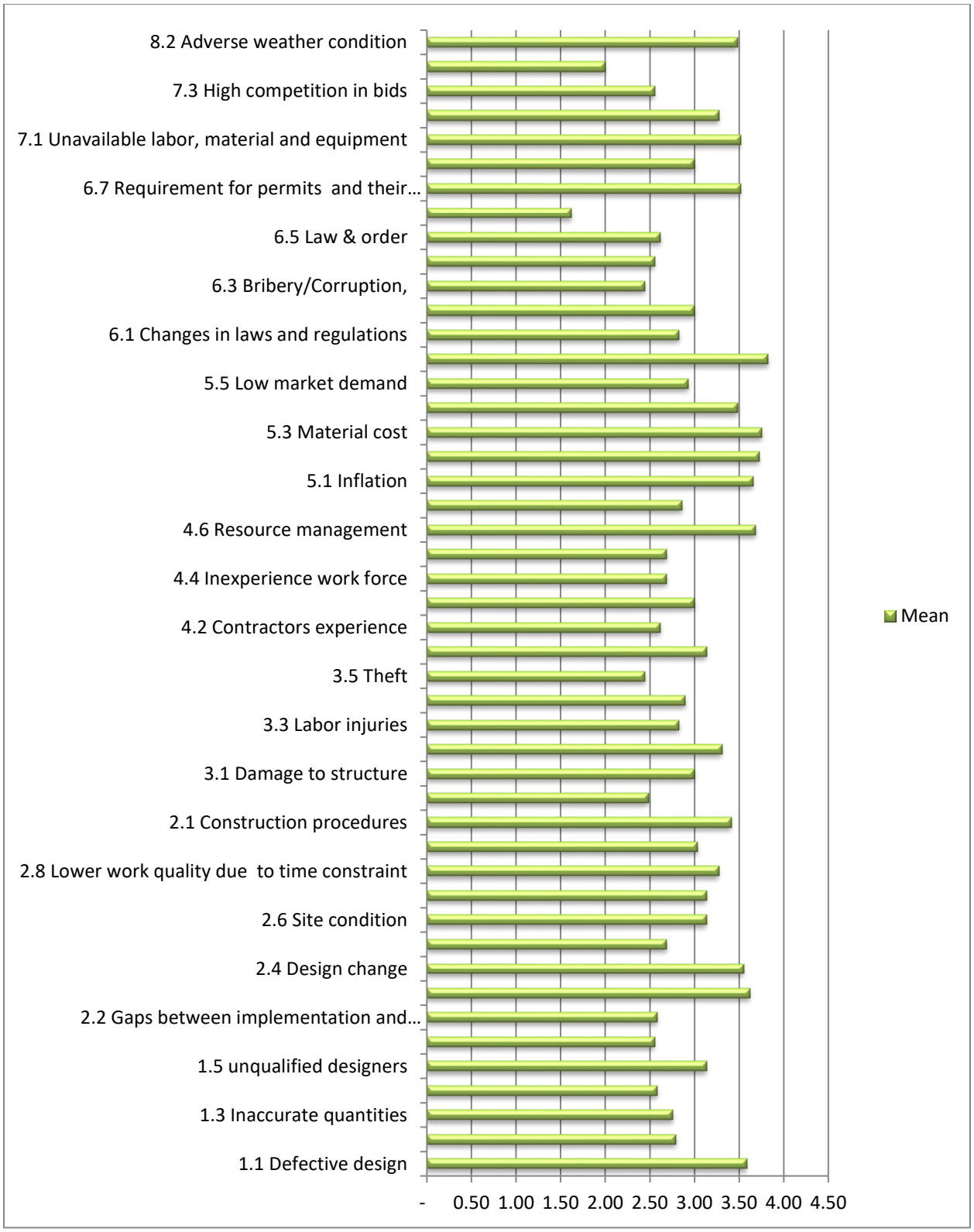

Figure 4-3 : Impact on completion time of the project

Among forty seven risk factors the top 4 critical risk factors with highest impact on project time are discussed. According to this study financial failure of the contactor was perceived as the top rank risk factor affecting project completion time. Material cost, payment delays and materials cost resource management are assessed as the second, third and fourth most important factors affecting project completion time.

From **Table 4.7** above, the finding shows that at present time financial failure of the contractor is the first ranked risk factor with high impact on project completion time among other risk factors in road construction, with a mean value of 3.83.

According to Shash and Qarra (2022) contractors' financial difficulties (ineffective cash flow management) was ranked as the first major risk factor. Their study revealed that 40% of contractors in Saudi Arabia experience financial failure due to poor cash flow management. Consequently to deal with problem, some contractors use the cash flow of one project to finance different project deficits. Effective cash flow management practices that require planning, monitoring, and controlling cash inflow and outflow at both the company and project levels to achieve financial success and avoid project deficits could be the best solution to solve this kind of problem for once and for all.

From **Table 4.7** above, the finding shows that at present time payment delays is the third ranked risk factor with high impact on project completion time among other risk factors in road construction, with a mean value of 3.72.

Payment delays include difficulties obtaining regular progress payment from the owners. According to Frimpong (2003) this problem was faced on construction projects in Ghana, where the most critical problem faced by contractors was monthly payment difficulties for the completed work.

Delayed progress payments would affect their project's cash flow of contractors and consultants as a result of delayed income. Contractors usually have limited capital for executing a project and when the capital provided is exceeded, consequently, the contractors may postpone payments to subcontractors and suppliers. As a result, they will also reduce their performance. These multiple problems will eventually cause construction delays.

Unless the contractor is capable financially, Delayed progress payments and high expenses of construction project leads to delaying construction work progress and increasing the project costs

Approval process and bureaucracy are the primary reasons for delays in owners' progress payments

According to Santoso (2003), owners will manage their cash flow effectively by minimizing cash out and maximizing cash in when funds are borrowed from banks. If they fail to generate funds, they will postpone project progress payment to the contractors to minimize cash out.

4.4 Challenges in implementing project Risk management implementation

The findings of the survey indicate the low level of risk management implementation in in Addis Ababa road construction project. To better understand the challenges to risk management, some possible factors that may affect risk management implementation were further investigated. Respondents were asked to identify from their experience the most important challenges to risk management. To do these professionals were asked whether they agreed with a number of suggested challenges, by responding on a scale 1-5, where 1=negligible and 5= highly significant Based on survey results presented in Table 4.8.

As it can be seen that lack of policy and procedures, lack of proper risk models, lack of practical experience, lack of trained people for risk analysis and lack of organizational support were top five challenges faced in the implementation of risk management practice.

In contrast, insufficient ongoing project information for decision making, insufficient and lack of history, lack of cooperation and commitment among construction team members, lack of money and lack of time were considered as least challenges faced in the implementation of risk management practice.

Table 4-8: Challenges in project risk management implementation

Challenges in project risk management implementation		Mean	Rank
lack of policy and procedures	29	4.276	1
lack of proper risk models	29	4.241	2
lack of practical experience	29	4.172	3

lack of trained people for risk analysis	29	4.000	4
Lack of organizational support	29	3.966	5
lack of resources	29	3.931	6
lack of indicators	29	3.897	7
no guidelines on the standard procedure for managing risk	29	3.897	8
lack of formal risk management	29	3.793	9
insufficient ongoing project information for decision making	29	3.759	10
insufficient and lack of history	29	3.724	11
lack of cooperation and commitment among construction team members	29	3.414	12
lack of money	29	3.000	13
lack of time	29	2.931	14

Source: Own Survey (2022)

4.5 Risk response

As discussed in the literature review, after identifying probability of occurrence of risks with highest probability of occurring and their impact on project objectives, the next step is developing a strategy that helps minimize the negative effects of the risks through the identified risk response methods. In this section, the response choice of the participants for the risks were analyzed and summarized in the table below.

Table 4-9 : Risk response

	Risk Avoidance	Risk Transfer	Risk Mitigation	Risk Acceptance	Risk Exploit	Risk Share	Risk Enhance	Contingency Plan
Defective design	8.80%	70.00 %	8.50%	2.00%	2.90 %	3.60 %		4.20%
Not coordinated design (structural, mechanical, electrical, etc.)	20.80%	10.30 %	40.90%	5.60%	9.30 %	4.90 %	7.90%	0.30%
Inaccurate quantities	12.30%	21.70 %	20.80%	11.60%	5.80 %	20.00 %	4.90%	2.90%
Lack of consistency between bill of quantities, drawings and specifications	7.80%	40.00 %	14.70%	7.90%	9.10 %	4.80 %	12.60 %	3.10%
unqualified designers	30.30%	20.30 %	9.00%	24.50%	12.40 %	3.50 %		
Rush bidding	8.10%	4.20%	16.70%	19.40%	15.90 %	9.30 %	4.20%	22.20%
Gaps between implementation and Specification	26.30%	5.00%	15.20%	5.00%	35.00 %	2.20 %	8.80%	2.50%
Labor productivity	12.80%	8.60%	15.70%	15.70%	22.90 %	1.40 %	14.30 %	8.60%
Design change	10.40%	15.70 %	13.00%	12.90%	10.40 %	20.80 %	10.30 %	6.50%
Labor disputes	15.70%	1.40%	30.00%	15.70%	4.30 %	15.90 %	4.30%	12.70%
Site condition	10.40%	5.20%	40.40%	15.10%	10.50 %	5.80 %	4.80%	7.80%
Equipment failures	10.70%	4.30%	5.40%	50.00%	4.30 %	1.90 %	2.40%	21.00%
Low quality due to time constraint	24.90%	2.50%	20.70%	11.40%	12.70 %	7.60 %	6.30%	13.90%
Low quality due to workman ship	64.00%	1.40%	5.00%	18.10%	5.90 %			5.60%
Construction procedures	10.50%	2.60%	33.00%	10.00%	4.10 %	6.80 %	30.30 %	2.70%
Actual quantity differs from the contract	6.00%	17.20 %	13.10%	8.00%	35.60 %	7.00 %	10.70 %	2.40%
Damage to structure	32.00%	8.00%	9.00%	30.90%	6.10 %	10.00 %		4.00%
Damage to equipment	30.30%	9.20%	10.10%	12.00%	1.30 %	9.20 %	2.10%	25.80%
Labor injuries	50.70%	7.40%	10.80%	7.60%	9.90 %	2.50 %	2.50%	8.60%
Supplies of defective material	42.70%	6.00%	26.20%	10.10%	6.10 %	2.60 %		6.30%
Theft	50.30%	9.10%	16.00%	5.00%			9.20%	10.50%
Contractual relations	23.60%	3.70%	20.20%	16.00%	10.60 %	17.30 %		8.60%

Contractor‟s experience	35.50%	5.60%	10.50%	16.00%	8.70 %	6.20 %	6.20%	11.30%
Attitudes of participants	36.40%	1.40%	10.00%	4.60%	11.10 %	26.70 %	5.60%	4.20%
Inexperience work force	50.60%		14.10%	7.00%	2.80 %			25.50%
Ambiguous Planning due to project complexity	14.10%	4.20%	28.90%	8.30%	18.10 %	15.30 %	6.90%	4.20%
Resource management	42.80%	1.30%	13.30%	25.60%	1.80 %	15.20 %		
Poor communication between involved parties	35.50%	1.30%	33.80%	15.30%	8.00 %	6.10 %		
Inflation	2.50%	7.40%	23.80%	10.60%	2.50 %	39.90 %	2.50%	10.80%
Payment delays	2.50%	10.60 %	50.50%	27.60%	4.70 %	4.10 %		
Material cost	1.20%	6.10%	50.00%	16.20%	1.20 %	10.00 %	1.00%	14.30%
Exchange rate fluctuation	1.30%	12.80 %	44.00%	17.10%	5.40 %	12.90 %	2.60%	3.90%
Low market demand	5.30%	6.70%	8.00%	32.70%	23.30 %	2.70 %	8.00%	13.30%
Financial failure of the contractor	14.10%	2.10%	26.80%	29.20%	5.10 %	3.00 %		19.70%
Changes in laws and regulations	5.10%	17.50 %	10.10%	55.40%	5.10 %	5.50 %	1.30%	
Pollution and safety rules	15.50%	5.60%	15.50%	46.00%	2.00 %	12.60 %		2.80%
Bribery/Corruption Language/Cultural barrier	20.20%	4.10%	22.90%	34.00%	4.10 %		12.00 %	2.70%
Law & order	10.50%	5.60%	10.50%	56.30%	1.40 %	10.10 %	2.80%	2.80%
War and civil disorder	10.10%	10.20 %	9.00%	14.40%		25.60 %		30.70%
Requirement for permits and their approval	4.00%	18.00 %	34.00%	30.70%	4.00 %	9.30 %		
Legal disputes among the parties in the contract	24.70%	8.10%	28.30%	6.80%	5.60 %	23.70 %		2.80%
Unavailable labor material and equipment	30.70%	4.40%	15.40%	16.10%	5.90 %	5.90 %	10.90 %	10.70%
Undefined scope of working	11.00%	15.10 %	14.90%	25.10%	9.60 %	3.80 %	20.50 %	
High competition in bids	5.40%	10.00 %	46.50%	20.10%	4.50 %			13.50%
Natural disaster	4.40%	10.10 %	6.40%	20.80%	10.80 %	25.50 %	4.40%	17.60%
Adverse weather condition	10.30%	10.00 %	12.00%	7.30%	10.70 %	31.00 %		18.70%

Source: Own Survey (2022)

In the above table the percentage of the responses of the participants for risk response is shown. In the previous section, the risks that have a high probability of affecting the project objectives are identified. The graph below will summarize the recommended response methods by participants for the risks that have high effect on road construction project objectives.

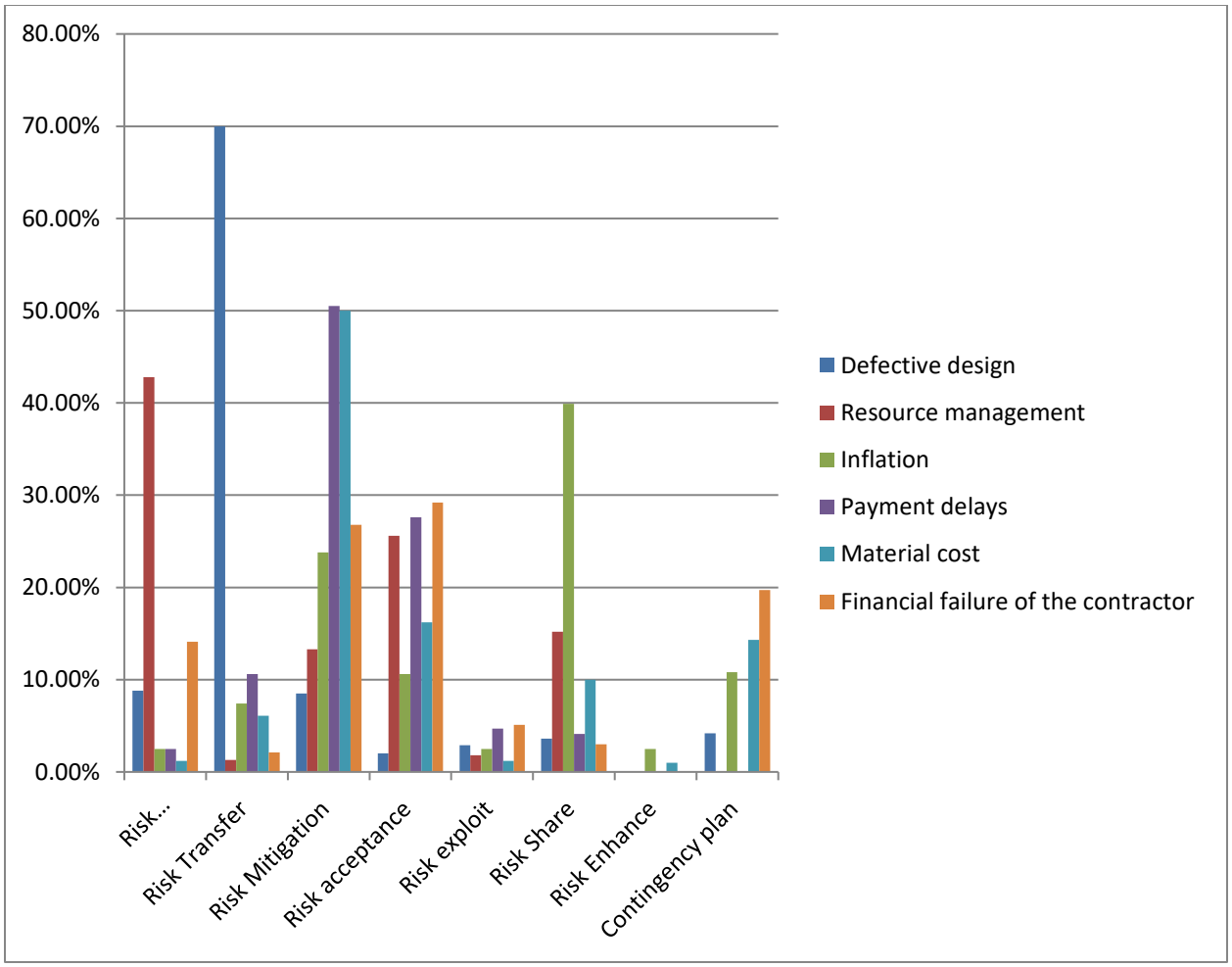

Figure 4-4 : Risk response for risk factors with high impact on project cost and time

CHAPTER FIVE

5 Summary, Conclusions and Recommendation

5.1 Summary

Several studies on the risk factors affecting project performance in road construction projects have been published. On the basis of all acknowledged risk and project performance factors, this study focuses on current project risk management practices and challenges for Addis Ababa city road construction projects. The principal aim of this paper was to identify the major risks factors associated with road construction projects that expected to affect project performance during the project life cycle in Addis Ababa. In this study, the most critical risk factors which have a considerable effect on road construction projects performance are distinguished through a comprehensive literature review. A total of 47 risk factors were analyzed statistically using a ranking mechanism. Questionnaire survey using Likert-scale was used to collect the responses from the respondents. 29 valid responses collected from the construction professionals were used to analyze the data. The finding showed that the inflation, defective design, payment delay and material cost, are currently the top four major risk factors in road construction projects in Addis Ababa. The finding indicated that the above major risk factors are from design and financial risks. In addition, this research indicated that, resource management, inflation, defective design and material cost, payment delays and financial failure are risk factors are top four major risk factors which have high impact on both project cost and time objective. Moreover, lack of policy and procedures, lack of proper risk models, lack of practical experience and lack of trained people for risk analysis are currently major challenges in project risk management implementation. Finally, risk avoidance, risk transfer, risk mitigation, risk acceptance and risk share are proposed as risk response methods to deal with identified major risk factors.

5.2 Conclusion

Construction is a risky operation and risk identification is a challenging task as evidenced by projects exceeding budget, going beyond schedule, and having compromised specifications (Hillson, 2002). Construction projects can be very complicated and fraught with uncertainty. Construction projects may suffer negative effects from risk and uncertainty. One of the nine knowledge areas promoted by the Project Management is risk management. Additionally, risk

management in the context of road construction project management is a thorough and organized method of detecting, evaluating, and dealing with risks in order to meet project objectives. According to literature, risks must identify before they can be controlled or mitigated. Accordingly, this study concludes that risk identification should be considered as the single most significant activity of the risk management on a project and should be tackled in a systematic way. Risk identification techniques as concluded from this study includes the following techniques namely: Brainstorming, Interviews/Expert Opinion, Questionnaires, Delphi technique, Expert systems, Checklists and Documentation review. The identification and analysis of risks, as well as the enhancement of the processes for managing road projects and the efficient use of resources, are all advantages of the risk management process. Road projects frequently experience cost overruns and schedule delays because the road construction sector is highly risk-affected by complex and changing project conditions that increase uncertainty and risk. Therefore, risk analysis and management are still a key component of project management for road construction projects today in an effort to handle uncertainty and unforeseen events efficiently and successfully complete projects. This study, therefore, has identified, ranked their probability of occurrence, determined their impact, the prevalent response trends for the major road construction risk factors considered by grade one contractors consultants operating in Addis Ababa city.

5.3 Recommendations

Based on the findings of the study, it recommended that consultants, contractors, Government and other stakeholders consider the following areas of improvement in managing risk for road construction projects in Addis Ababa.

- Improving communication between the construction parties on the same site is very significant for any construction cost and time controlling. The sharing of information regarding risks on projects, as well as having a common priority of project can ensure that everything possible is done to reduce the chance of time delay and cost overrun.
- A realistic and accurate estimate could be helpful in developing an active strategy for controlling the overruns of both time and cost of the construction projects.
- Consultant and contractors should strive to ensure effective management of time, cost and quality management in road construction industry.

- To address the cost overrun problem, it is necessary to develop a technique for formulating the budget at the start of the project by considering the inflation aspect before finalizing the budget estimation.
- An efficient and effective materials procurement strategy to preclude potential late deliveries.
- Direct involvement of clients in the design phase of projects for minimizing change orders, especially during the construction stage.
- Periodic training programs offered by construction firms to technical personnel to keep them informed of the latest technology available for improving the quality level of the workforce, and may yield considerable savings in time, efforts, and costs associated with the extensive training and development, which may otherwise be required for unskilled operatives and poorly trained technical staff.
- it is recommended to explore and quantify the "effects" of the risk factors explored, especially those perceived as most significant
- Implement effective policies and programs that increase accuracy and proper identification and management of risk. This is because proper risk identification policies can assist in risk reduction and management.
- Stronger financial policies that can assist in keeping inflation rates at levels that are as low as possible are needed in order to counter the problem of material increases and other price related matters.
- Having in place a well-documented procedure which should be a one stop solution to all threats that are likely to occur during project life cycle.

References

Abyad, A. (2018). Project management, motivation theories and process management. *Middle East Journal of Business*, 13(4), 18-22.

APM (2006), APM Body of Knowledge. 5ed, ISBN-1-903494-25-7

Association for Project Management. (2004) Project risk analysis & management (PRAM) guide (2nd ed.). High Wycombe, Bucks, UK: APM Publishing.

Atikinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International Journal of Project Management, 17*(6), 337-342.

B.A.K.S. Perera , Indika Dhanasinghe & Raufdeen Rameezdeen (2009) Risk management in road construction: The case of Sri Lanka, *International Journal of Strategic Property Management*, 13:2, 87-102, DOI: 10.3846/1648-715X.2009.13.87-102

Befrouei, M. A. R., & Taghipour, M. (2015). Identification and management of risks in construction projects. American Journal of Civil Engineering, 3(5), 170-177.

Carbone, T. A., & Tippett, D. D. (2004). Project risk management using the project risk FMEA. Engineering management journal, 16(4), 28-35.

Dalgleish, F., & Cooper, B. J. (2005). Risk management: developing a framework for a water authority. Management of Environmental Quality: An International Journal.

Durdyev, Serdar & Hosseini, M. Reza. (2018). Causes of Delays on Construction Projects: A Comprehensive List. *International Journal of Managing Projects in Business.* 10.1108/IJMPB-09-2018-0178.

Edwards, P. J., & Bowen, P. A. (1998). Risk and risk management in construction: a review and future directions for research. Engineering Construction and Architectural Management, 5(4), 339-349.

El-Karim, M. S., Nawawy, O. A., & Abdel-Alim, A. M. (2016). *Identification and assessment of risk factors. HBRC Journal, 13*, 202-216.

Erstu, L. (2017). *An Assessment On The Risk Management Practice Of construction Projects; Case*

Flanagan, R., & Norman, G. (1993). *Risk management and Construction.* Blackwell Science Ltd.

Hillson, D., & Murray-Webster, R. (2004, November). Understanding and managing risk attitude. In Proceedings of 7th Annual Risk Conference, held in London, UK (Vol. 26, pp. 1-11).

Hintsay, H. (2016). *Integrated Risk Management Practice in the Construction Industry.* Addis Ababa University College of Business and Economics, Addis Ababa.

Hwang, B. G., Zhao, X., & Toh, L. P. (2014). Risk management in small construction projects in Singapore: Status, barriers and impact. *International journal of project management*, 32(1), 116-124.

Iqbal, Shahid & Choudhry, Rafiq & Holschemacher, Klaus & Ali, Ahsan & Tamosaitiene, Jolanta. (2015). Risk management in construction projects. Technological and Economic Development. 21. 65-78. 10.3846/20294913.2014.994582.

ISO 31000. (2009). *Risk management — Principles and guidelines.*

ISO/Guide 73. (2009). *Risk Management—Vocabulary.* Geneva, Switzerland: International Organization for Standardization.

Jarkas, A. M., & Haupt, T. C. (2015). Major construction risk factors considered by general contractors in Qatar. Journal of Engineering, Design and Technology.

Jayasudha, K., & Vidivelli, B. (2015). An Assessment and Analysis of Major Risks in Construction Projects. *Asian Journal of Applied Sciences, 3*(05), 846-857.

Jayasudha, K., Vidivelli, D. B., & Surjith, E. G. (2014, August). Risk Assessment and Management in Construction Projects. *International Journal of Scientific & Engineering Research,, 5*(8), 387396.

Juran, J. M. (2003). Juran on leadership for quality. Simon and Schuster.

Kirira, D. K., Owuor, B., Liku, C. N., & Mavole, J. N. (2019). Risk management strategies influence on road construction project performance: implementer insights of Kenya National Highway Authority (KENHA), Coast region projects. International Academic Journal of Information Sciences and Project Management, 3(4), 655-671.

Mok, C. , Tummala, V. & Leung, H. (2006). Practices, barriers and benefits of risk management process in building services cost estimation. Construction Management & Economics. 15. 161-175. 10.1080/01446199700000004.

Potts, G. & Schultz, B. (2008). The freshman seminar and academic success of at-risk students. College Student Journal, 42(2).

Project Management Institute. (2013) A guide to the project management body of knowledge (PMBOK Guide) - Fifth edition. Newtown Square, PA: Author.

R. Kangari and L. S. Riggs, "Construction risk assessment by linguistics," in IEEE Transactions on Engineering Management, vol. 36, no. 2, pp. 126-131, May 1989, doi: 10.1109/17.18829.

Raftery, J. (2003). Risk analysis in project management. Routledge.

Rodrigues, A. G., & Alexandre, D. (2001, June). Managing and modeling project risk dynamics a system dynamics-based framework. In Fourth European Project Management Conference (pp. 1-7).

Sarkodie-Poku, I. S. A. A. C. (2019). Analysis of Risk Management Practices of Small and Medium Enterprises (SMEs) in the Construction Sector of Ghana (Doctoral dissertation, University of Ghana).

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

Sterman, J. D. (1994). Learning in and about complex systems. System dynamics review, 10(2-3), 291-330.

Steve J Simister, Usage and benefits of project risk analysis and management, International Journal of Project Management, Volume 12, Issue 1, 1994, Pages 5-8, ISSN 0263-7863, https://doi.org/10.1016/0263-7863(94)90003-5.

Study Of Addis Ababa Saving Houses Development Enterprise. Retrieved from Addis Ababa University: http://etd.aau.edu.et/handle/123456789/13929

Tchankova, Lubka. (2002). Risk identification – Basic stage in risk management. Environmental Management and Health. 13. 290-297. 10.1108/09566160210431088.

Winch, G. M. (2009). Managing construction projects. John Wiley & Sons.

Yadeta, Andualem. (2020). CRITICAL RISKS IN CONSTRUCTION PROJECTS IN ETHIOPIA. International Journal of Civil Engineering. 8. 30-40.

Appendix

Questionnaire

Part I General information

1. Name of the company_____
2. Year of establishment_____
3. Job position in the company

   1.G/Manager ☐ 2.Deputy G/Manager ☐ 3.Technical Manager ☐ 4.Project Manager ☐ 6.Other Specify_____

4. Educational level 1. Diploma ☐ 2.Degree ☐ 3.Master ☐ 4.other ☐
5. Experience for working on a project 1. 2-5 years ☐ 2. above 10 years ☐

   3. Less than 2 years ☐ 4. 5-10 years ☐

6. Project Risk Management Training in the company 1.Yes ☐ 2. No ☐
7. Field of specialization

1. Engineering ☐ 2.Project Management ☐ 3.Construction Management

4. Other Specify_____

Part II Risk management practices

The following list of risks factors associated to road construction projects identified from literature review. The aim of the questions below is to evaluate the probability of occurrence and their impact on cost and time projects objectives. Please think in terms of your organizations experience and your knowledge to identify from the list in the following table and rank their probability of occurrence and impact by indicating your response using ticking “X” in the appropriate spaces.

Part 2: Risk identification

Rate the occurrence of the listed factors and their effect on cost and duration of a project

The rating is from 1-5, Probability 1= Very Low Probability, 2= Low Probability, 3 = Probability, 4= High Probability and 5= Very High Probability

	Risk Factors	Probability of occurrence					Impact on cost of the project (budget)					Impact on completion time of the project				
	Risk Factors	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	1. Design Risks															
1.1	Defective design															
1.2	Not coordinated design (structural, mechanical, electrical, etc.)															
1.3	Inaccurate quantities															
1.4	Lack of consistency between bill of quantities, drawings and specifications															
1.5	unqualified designers															
	2. Construction risks															
2.10	Rush bidding															
2.20	Gaps between implementation and Specification															
2.30	Labor productivity															
2.40	Design change															
2.50	Labor disputes															
2.60	Site condition															
2.70	Equipment failures															
2.80	Lower work quality due to time constraint															
2.90	Lower work quality due to workman ship															
3.10	Construction procedures															
3.11	Actual quantity differs from the contract															
	3. Physical risks															
3.10	Damage to structure															
3.20	Damage to equipment															
	Labor injuries															

3.30																
3.40	Supplies of defective material															
3.50	Theft															
	4. Organizational & Managerial risk															
4.10	Contractual relations															
4.20	Contractors experience															
4.30	Attitudes of participants															
4.40	Inexperience work force															
4.50	Ambiguous Planning due to project complexity															
4.60	Resource management															
4.70	Poor communication between involved parties															
	5. Financial Risk															
5.10	Inflation															
5.20	Payment delays															
5.30	Material cost															
5.40	Exchange rate fluctuation															
5.50	Low market demand															
5.60	Financial failure of the contractor															
	6. Socio- political and legal risks															
6.10	Changes in laws and regulations															
6.20	Pollution and safety rules															
6.30	Bribery/Corruption,															
6.40	Language/Cultural barrier															
6.50	Law & order															
6.60	War and civil disorder															
6.70	Requirement for permits and their approval															
6.80	Legal disputes among the parties in the contract															
	7. Logistics Risks															

7.10	Unavailable labor, material and equipment															
7.20	Undefined scope of working															
7.30	High competition in bids															
	8. Environmental risks															
8.10	Natural disaster															
8.20	Adverse weather condition															

Part III Risk Management Challenges

Please rate the following possible challenges in risk management application based on their significance at your organization. "X" (please rate from 5 to 1 where,

5=highly significant, 4 = significant, 3= moderately significant, 2= low significant and 1= negligible)

	Challenges in project risk management implementation	1	2	3	4	5
1	Lack of use of indicators					
2	Lack of organizational support					
4	Lack of formal risk management					
5	Lack of policy and procedures					
6	Lack of trained people for risk analysis					
7	Lack of proper usage risk models					
8	Insufficient and lack of history					
9	Lack of cooperation and commitment among construction team members					
10	Insufficient ongoing project information for decision making					

11	No guidelines on the standard procedure of managing risk					
12	Lack of practical experience					
13	Lack of resources					
14	Lack of cooperation and commitment among construction team members					

Part IV: Risk response Method

Choose which method/ methods of risk response can be used if the listed risks occur or might occur

a) Risk avoidance: is when the project team acts to eliminate the threat or protect the project from its impact by removing the cause of the risk of executing the project in a different direction while still aiming to accomplish project objectives.

b) Risk transfer: involves shifting ownership of a threat to a third party to manage the risk and to bear the impact if the threat occurs.

c) Risk mitigation: action is taken to reduce the probability and/or impact of an adverse risk event to an acceptable threshold.

d) Risk acceptance: acknowledges the existence of a threat, but no proactive action is taken.

e) Risk exploit: The exploit strategy may be selected to capture the benefit associated with a particular opportunity by ensuring that it definitely happens, increasing the probability of occurrence to 100%.

f) Risk share: allocate risk ownership of an opportunity to another party who is best able to maximize its probability of occurrence and increase the potential benefits if it does happen.

g) Risk enhance: aims to alter the “size” of the positive risk. The opportunity is enhanced by increasing its probability and/or impact, thereby maximizing the benefits gained from the project.

h) Contingency Plan: This involves the use of a fallback plan if a risk occurs.

	Risk Factors	Risk Avoidance	Risk Transfer	Risk Mitigation	Risk Acceptance	Risk Exploit	Risk Share	Risk Enhance	Contingency Plan
	1. Design Risks								
1.10	Defective design								
1.20	Not coordinated design (structural, mechanical, electrical, etc.)								
1.30	Inaccurate quantities								
1.40	Lack of consistency between bill of quantities, drawings and specifications								
1.50	unqualified designers								
	2. Construction risks								
2.10	Rush bidding								
2.20	Gaps between implementation and Specification								
2.30	Labor productivity								
2.40	Design change								
2.50	Labor disputes								
2.60	Site condition								
2.70	Equipment failures								
2.80	Low quality due to time constraint								
2.90	Low quality due to workman ship								
2.10	Construction procedures								
2.11	Actual quantity differs from the contract								
	3. Physical risks								
3.10	Damage to structure								
3.20	Damage to equipment								
3.30	Labor injuries								
3.40	Supplies of defective material								
3.50	Theft								

	4. Organizational & Managerial Risk								
4.10	Contractual relations								
4.20	Contractor‟s experience								
4.30	Attitudes of participants								
4.40	Inexperience work force								
4.50	Ambiguous Planning due to project complexity								
4.60	Resource management								
4.70	Poor communication between involved parties								
	5. Financial Risk								
5.10	Inflation								
5.20	Payment delays								
5.30	Material cost								
5.40	Exchange rate fluctuation								
5.50	Low market demand								
5.60	Financial failure of the contractor								
	6. Socio- political and legal risks								
6.10	Changes in laws and regulations								
6.20	Pollution and safety rules								
6.30	Bribery/Corruption								
6.40	Language/Cultural barrier								
6.50	Law & order								
6.60	War and civil disorder								
6.70	Requirement for permits and their approval								
6.80	Legal disputes among the parties in the contract								
	7. Logistics Risks								
7.10	Unavailable labor material and equipment								

7.20	Undefined scope of working								
7.30	High competition in bids								
	8. Environmental risks								
8.10	Natural disaster								
8.20	Adverse weather condition								