

**ADDIS ABABA UNIVERSITY**  
**COLLEGE OF BUSINESS AND ECONOMICS**  
**SCHOOL OF COMMERCE**



**ASSESSMENT ON PROJECT RISK MANAGEMENT  
PRACTICES IN RAILWAY CONSTRUCTION PROJECTS: THE  
CASE OF ETHIOPIAN RAILWAYS CORPORATION**

By

Aminu Juhar

A Project Work Submitted to Addis Ababa University School of Graduate Studies  
in Partial Fulfillment of the Requirements for the Degree of Master of Arts (MA)  
in Project Management

Advisor: Dereje Teklemariam, PhD

June, 2018

Addis Ababa

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## Declaration

I, the undersigned, declare that this project work entitled “**Assessment on Project Risk Management Practices in Railway Construction Projects: The Case of Ethiopian Railways Corporation**” is my original work. This project work has not been presented for any other university and that all sources of material used for the thesis have been duly acknowledged.

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## Statement of Certification

This is to certify that Aminu Juhar has carried out this project work entitled **“Assessment on Project Risk Management Practices in Railway Construction Projects: The Case of Ethiopian Railways Corporation”** under my supervision. This work is original in nature and it is sufficient for submission as the partial fulfillment for the award of Degree of Masters of Art (MA) in Project Management.

Dereje Teklemariam, PhD

Signature \_\_\_\_\_

Date \_\_\_\_\_

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Thank you all.

## **Dedication**

I dedicate this project work to my Mom who laid the foundation of my prospect and carried me all the way to where I'm now.

Love you Mom

## ABSTRACT

*The history of the railway sector in Ethiopia has been dominated by the story of Ethio-Djibouti Railway Company for more than a century. However recently Ethiopia is investing billions of dollars, which is highly indebting the country, to construct railway infrastructures throughout the country and their successful completion and operation is a must. To be successful, a project organization should be committed to address risk management proactively and consistently throughout the project. This study tries to assess and shade light on the current project risk management practices of railway construction projects undertaken by Ethiopian Railways Corporation. To address the research objective review of related literatures is made; questionnaires were prepared and distributed to selected respondents to collect necessary data. After collecting and analyzing data the study has identified that due to different factors the level of risk awareness in ERC is low. In addition it is pointed out by the study that the corporation is not giving proper emphasis for risk management practices indicated through not assigning adequate resources for the risk management activities, poor communication, lack of experience in risk management practices, no training and development programs, not structuring a well-organized specific department for managing risks and having no handy risk policy. The research further identified financial risks as a type of risk which is highly probable to occur and with a relatively high impact on project cost. Access to construction site and material risks are further recognized by the study as having relatively high impact on project time and quality respectively. Finally, based on the findings and conclusions made, the research ends by providing recommendations which will help to enhance the project risk management practices of ERC.*

**Key Words:** risk, risk management, risk awareness, railway projects

## Acronyms

AA.....	Addis Ababa
BC .....	Before Christ
CREC .....	China Railway Group Limited
CCECC .....	China Civil Engineering Construction Corporation
ERC .....	Ethiopian Railways Corporation
ETB .....	Ethiopian Birr
Exim Bank .....	Export-Import Bank
IMCA .....	International Marine Contractors Association
ISO .....	International Organization for Standardization
KMs .....	Kilometers
LRT .....	Light Rail Transit
MA .....	Master of Arts
MS .....	Mean Score
PEST .....	Political Economic Social and Technological
PM .....	Project Management
PMI .....	Project Management Institute
PRM .....	Project Risk Management
RII .....	Relative Importance Index
RM .....	Risk Management
SHAMPU .....	Shape, Harness & Manage Project Uncertainty
SPSS .....	Statistical Package for Social Sciences
SWOT .....	Strengths Weaknesses Opportunities & Treats
USD .....	United States Dollars

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

Rail transport, one of the most commonly used means of transportation, is a means of conveyance of passengers and goods, by way of wheeled vehicles running on rails. It is also commonly referred to as train transport. In contrast to road transport, where vehicles run on a prepared flat surface, rail vehicles are also directionally guided by the tracks on which they run. Track usually consists of steel rails, installed on ties (sleepers) and ballast, on which the rolling stock, usually fitted with metal wheels, moves. The earliest evidence of a railway was a 6 kilometer Diolkos wagon way, which transported boats across the Corinth isthmus in Greece during the 6<sup>th</sup> century BC. Trucks pushed by slaves ran in grooves in limestone, which provided the track element (Lewis, 2001).

Mun (as cited in Profillidis, 2007) discussed that the present form of railways, in which rolling stock is guided by the metal contact between rail track and rolling stock wheels, made an appearance in the mining industry of the United Kingdom in the early 19th century. The high technical effectiveness of rolling stock's metal contact and its exclusive running on the rail track without any interruption provided many excellent competitive advantages, compared to other forms of transportation, for example, high speed operating, long distance driving, large capacity transport, low energy consumption, environmentally friendly impact, high safety, consistent punctuality etc. Thus, the advantages of railways have provided a great opportunity for the massive growth of railway transport all over the world.

The history of the railway sector in Ethiopia has been dominated by the story of Ethio-Djibouti Railway Company for more than a century. Ethio-Djibouti railway is amongst the oldest railways established in Africa. This railway which is 1000mm gauge has a total length of 781 km running from Addis Ababa to port Djibouti, of which 681 km is in Ethiopia and the rest 100 km in Djibouti. The ownership has been shared by the governments of the Federal Democratic Republic of Ethiopia and the Republic of Djibouti (Ethiopian Railways Corporation, 2014).

Project risk is an uncertain event or condition that, if it occurs, will cause a positive or negative effect on one or more project objectives such as scope, schedule, cost and quality (Project Management Institute [PMI], 2013). According to the PMI (2013), project risk management is one of the nine most critical parts of project commissioning. This indicates a strong relationship between managing risks and a project success.

The most important definition of Risk Management (RM) for this study purpose is the one given by PMI (2013) which defines risk management as systematic processes of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project. The objectives of project risk management are to increase the likelihood and impact of positive events, and decrease the likelihood and impact of negative events in the project. A good RM procedure will support better decision-making concerning risk, as there will be a better understanding of the risks, how these risks will affect the project and the responses to these risks if they should occur.

Since the process of taking a project from initiation to completion and bringing it into operation a complex process, the construction industry is subject to more risk and uncertainty than many other industries (Flanagan and Norman, 1993).

## **1.2 Background of the Organization**

Ethiopian Railways Corporation (ERC) is a public enterprise which was established in 29<sup>th</sup> November/2007 based on Ethiopian council of Ministers regulation N<sup>o</sup> 141/2007 (Federal Negarit Gazeta, 2007). Ministry of Transport is the supervising authority of ERC. The main purposes of the corporation are to build railway infrastructure, to operate cargo railway transport services, to operate passenger railway transport services and to engage in other related activities necessary for the attainment of its purposes.

### **Vision**

- To see modern railways infrastructure and services and an efficient railway company that supports Ethiopia's endeavor in building a globally competitive economy, that uses electricity and connects the country's development centers and links with ports of neighboring countries.

## **Mission**

- To support the fast growing economy of the country through constructing modern railways infrastructure which is cost effective and that transports bulk freight within short period of time and
- To expand passenger railways transport services and enhance public mobility.

On the official website of the corporation it has been declared that to establish a national railway network ERC has identified eight railway corridors for study, design and subsequent implementation.

The Addis Ababa light rail project has two line rail tracks extend 17.35kms from east to west direction stretching from Ayat Village to Tor Hailoch passing through Megenagna, Legehar and Mexico. In the north to south direction, a 16.9 kms rail track will pass through Menelik Square, Merkato, Lideta, Legehar, Meskel Square, Gotera and Kaliti. The two directions will have a common track of about 2.8 kms. The project will have a total of 41 rails each with a capacity to carry 286 passengers. This will enable the light rail transit to provide transportation service to 15,000 people per hour in one direction and 60,000 in all four directions (The Ethiopian Herald, 2013).

The construction of Addis Ababa LRT (Light Rail Transit) has been completed and operation has been launched. Trial operations were begun on 1 February 2015, after several months of testing the project begun its operation on 20<sup>th</sup> September 2015.

On the other hand the corporation, on its official website, declared that the Addis Ababa/Sebeta-Meiso (317kms) and Mieso-Dewanle (339kms) railway projects have been completed started operation. The performance of the other two active projects namely; Awash-Woldia/Haragebya (390kms) and Mekelle-Woldia/Haragebya(260kms) has become more than 50% and 40% consecutively. The rest of strategically planned projects are on the way to be launched.

## **1.3 Statement of the Problem**

To be successful, a project organization should be committed to address risk management proactively and consistently throughout the project. A conscious choice should be made at all levels of the organization to actively identify and pursue effective risk management during the life of the project. Project risk could exist at the moment a project is initiated. Moving forward

on a project without a proactive focus on risk management is likely to lead to more problems arising from unmanaged threats (PMI, 2013).

Now days, Ethiopia is investing billions of USD to construct railway infrastructures throughout the country. Among the investments made the following are the major ones:

- Addis Ababa light rail construction project with a total project cost of 475 million USD among which 85% will be covered from the loan offered by Exim Bank of China and the rest by the Ethiopian government (Contract Agreement Document between ERC and CREC, 2009).
- Addis Ababa/Sebeta-Meiso railway construction project with a total cost of around 1.8 Billion USD to be covered by a loan from Chinese government (Contract Agreement Document between ERC and CREC, 2011).
- Mieso-Dewanle railway construction project with a total cost of around 1.4 Billion USD to be covered by a loan from Chinese government (Contract Agreement Document between ERC and CCECC, 2011).
- Awash-Woldia/Haragebya railway construction project with a total cost of 1.7 Billion USD (Ethiopian Railways Corporation, 2018, Para. 2).

Looking into the above figures and facts one can easily consider how the country is becoming indebted to undertake these railway construction projects. Therefore the successful completion and operation of these railway construction projects is a very significant and great achievement to the country.

Ewelina and Mikaela (as cited in Smith, Merna and Jobbling, 2006) outlined that at the completion of each phase in the project life cycle there is a decision point where risk assessment takes place and based on the risk assessment, an appropriate decision is made regarding further actions or proceeding to the next phase.

As stated above, to successfully complete railway construction projects, like any other project endeavors, strong emphasis should be given to the overall project risk management practices and the project organization should be committed to address risk management proactively and consistently throughout the projects. In addition vigilant and watchful risk management practices should be made at all levels of the organization to actively identify risks and follow effective risk management practices during the life of the projects.

Since according to Flanagan et al. (1993) the process of taking a project from initiation to completion and bringing it into operation a complex process, the construction industry is subject to more risk and uncertainty than many other industries. So the proposed study aims to assess the project risk management practices of the railway construction projects undertaken by ERC so that important lessons will be drawn and recommendations will be made for future project endeavors.

#### **1.4 Research Questions**

The drive for undertaking the research is to provide evidence-based responses to the following three questions:

1. What is the current status of employee awareness about risk and project risk management practices in ERC?
2. What types of risks are faced by ERC in the course of undertaking railway construction projects?
3. What type of risk management practices and techniques are applied by ERC in its project undertakings?

#### **1.5 Objective of the Study**

The main objective of this study is to assess the project risk management practices of railway construction projects undertaken by ERC. The research also has the later specific objectives:

- Assessing the current level of employee awareness regarding risk and risk management practices in ERC.
- Identifying the major types of risks involved in undertaking railway construction projects and ranking the risks based on their probability of occurrence and impact on project objectives.
- Determining the project risk management practices and techniques applied by ERC.

#### **1.6 Significance of the Study**

Even if there are plenty of studies carried out to assess project risk management practices of the road construction sector, the number of studies undertaken regarding risk management practices of Ethiopian railway construction projects is hardly any. Therefore the study and the resulting lessons drawn from the analysis, by assessing the project risk management practices of railway

construction projects, are likely to benefit ERC and different stakeholders which are very much involved in the emergent railway sector. In addition the study's findings and recommendations are well important to management of ERC's future project undertakings to take corrective actions based on the identified possible ways of improving project risk management practices in the corporation. Finally, as well as outlining plans for implementing results from this research project, this document could also be used as a reference for future researches in the area.

### **1.7 Scope of the Study**

The research did merely focus on railway projects undertaken by Ethiopian Railways Corporation as it is the only railway projects developer in the country. Among other planned and under construction railway projects, the proposed research will be limited to assess the project risk management practices of the corporation on the three completed railway construction projects namely; Addis Ababa light rail, Addis Ababa/Sebeta-Meiso and Mieso-Dewanle railway construction projects at ERC's head office in Addis Ababa.

### **1.8 Limitations of the Study**

Even if ERC has a prospect strategic plan of constructing nationwide railway lines estimated around 5000kms, this paper will only assess the project risk management practices of ERC on three completed railway construction projects namely; Addis Ababa light rail, Addis Ababa/Sebeta-Meiso and Mieso-Dewanle railway construction projects. Lack of credibility of data collected from the secondary data sources could also be considered as another limitation of the research.

### **1.9 Organization of the Study**

The research paper is organized in five chapters. The first chapter will present introductory basic research information including the background of the study, problem statement, research objective, research questions, significance, scope and limitations of the study. The reviewed related literatures are immensely illustrated in chapter two. The third chapter will cover the research design and methodology used in order to achieve the objectives of the study. The study presents analysis and interpretation of the data gathered in the fourth chapter. Finally, the report concludes with the conclusions of the study and recommendations that are made based on the major findings of the study.

## **CHAPTER TWO**

### **REVIEW OF RELATED LITERATURES**

This chapter contains the first feature of the research; the theoretical and empirical fundamentals of the research. It consists of definitions of relevant concepts and a broad review of the existing body of literature on project risk, risk management, risk awareness, risks in the construction sector and the overall risk management processes. This chapter will finally finish by demonstrating the overall conceptual framework followed by the study.

#### **2.1 Theoretical Review**

It is important to understand relevant concepts before they can be managed or knowledge about them can be developed. Therefore this part describes the theoretical rationale of project risk, risk management and reviews discussions on construction sector risks. Therefore this part will start the theoretical analysis with sections on defining risk, uncertainty, risk management and its corresponding facets.

##### **2.1.1 Risk and Uncertainty**

The International Organization for Standardization [ISO], (2009) defines risk as an effect of uncertainty on objectives and is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.

Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood (ISO, 2009).

Project risk is an uncertain event or condition that, if it occurs, will cause a positive or negative effect on one or more project objectives such as scope, schedule, cost and quality (Project Management Institute [PMI], 2013).

Different Standard English dictionaries also try to define risk with more or less same connotations. Longman English Dictionary (1995) defined risk as the possibility that something bad, unpleasant or dangerous may happen while Macmillan English Dictionary (2007) defines it as the possibility that something unpleasant or dangerous might happen.

Dale, Stephen, Geoffrey and Phil (2005) defined risk as an exposure to the consequences of uncertainty and in a project context; it is the chance of something happening that will have an

impact upon objectives. It includes the possibility of loss or gain, or variation from a desired or planned outcome, as a consequence of the uncertainty associated with following a particular course of action. Risk, according to Dale et al. (2005), thus has two elements: the likelihood or probability of something happening, and the consequences or impacts if it does.

Tomas (2016) described risk as a deviation from the desired or expected outcome of a set of circumstances due to a state of deficiency of information. Since risk is related to uncertainty, as described above, the chance of events happening is uncertain as well. Therefore, to be able to quantify risk, probability is introduced, which expresses the chance of events happening in a number between 0 and 1.

PMI (2013) further analyzed that positive and negative risks are commonly referred to as opportunities and threats. In addition a project may be accepted if the risks are within tolerances and are in balance with the rewards that may be gained by taking the risks; while positive risks that offer opportunities within the limits of risk tolerances may be pursued in order to generate enhanced value.

According to Hilson (2001) risk is an umbrella term, with two varieties: opportunity which is a risk with positive effects and threat which is a risk with negative effects. On the other hand uncertainty is the overarching term, with two varieties: risk referring exclusively to a threat, i.e. an uncertainty with negative effects and an opportunity which is an uncertainty with positive effects.

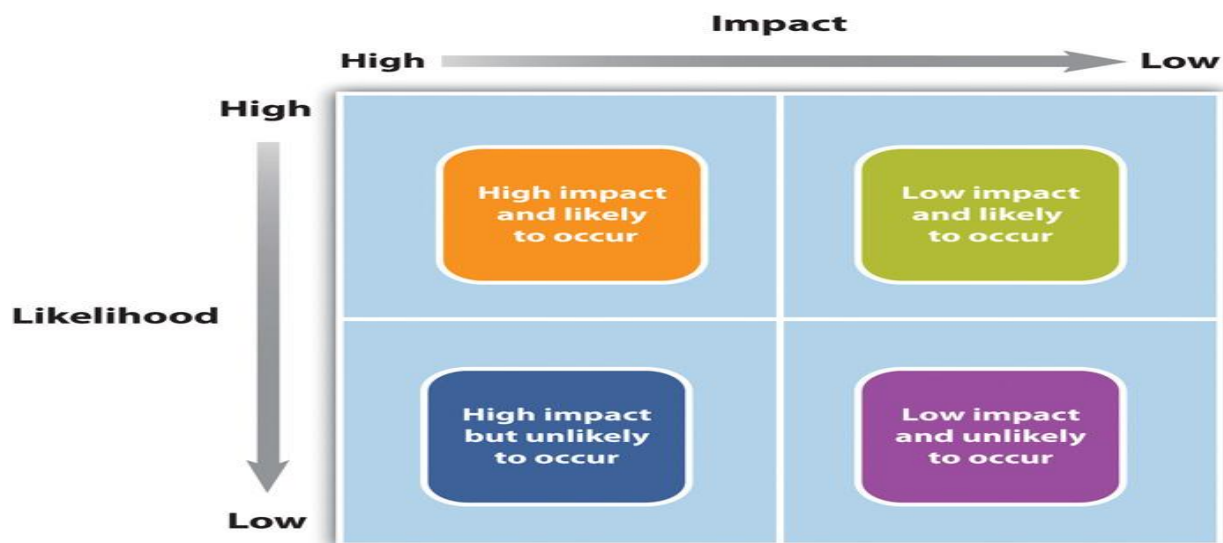
As defined above by Dale et al. (2005) project risk is a combination of likelihood or probability of occurrence and the impact if it does happen. The same probability-impact scheme is presented in a table by PMI (2013) to show the impacts of a negative risk event, while impact definitions can be developed for opportunities in a similar way, in the four major project objectives namely; Cost, Time, Scope and Quality. It identifies four levels of the impact of a negative risk event in project objectives based on their severity. A negative risk event can have a very low, low, moderate, high and very high impact on project objectives each having their own implications for the project organization based on the damage they bring to important project parameters. See table 2.1 below:

**Table 2.1: Definition of Impact Scales for Four Project Objectives**

Project Objective	Defined Conditions for Impact Scales of a Negative Risk on Major Project Objectives				
	Very low /0.05	Low /0.10	Moderate /0.20	High /0.40	Very high /0.80
<b>Cost</b>	Insignificant cost Increase	< 10% cost increase	10 – 20% cost Increase	20 – 40% cost Increase	> 40% cost increase
<b>Time</b>	Insignificant time Increase	< 5% time increase	5 – 10% time Increase	10 – 20% time Increase	> 20% time increase
<b>Scope</b>	Scope decrease barely noticeable	Minor areas of scope affected	Major areas of scope affected	Scope reduction unacceptable to sponsor	Project end item is effectively useless
<b>Quality</b>	Quality degradation barely noticeable	Only very demanding applications are affected	Quality reduction requires sponsor approval	Quality reduction unacceptable to sponsor	Project end item is effectively useless

Source: PMI (2013)

Another demonstration of impact and likelihood of occurrence of a risk event scenario is presented by David and Alison (2004) showing four quadrants to indicate the combination of the level of an impact and probability of occurrence of a risk event. See figure 2.1 below:

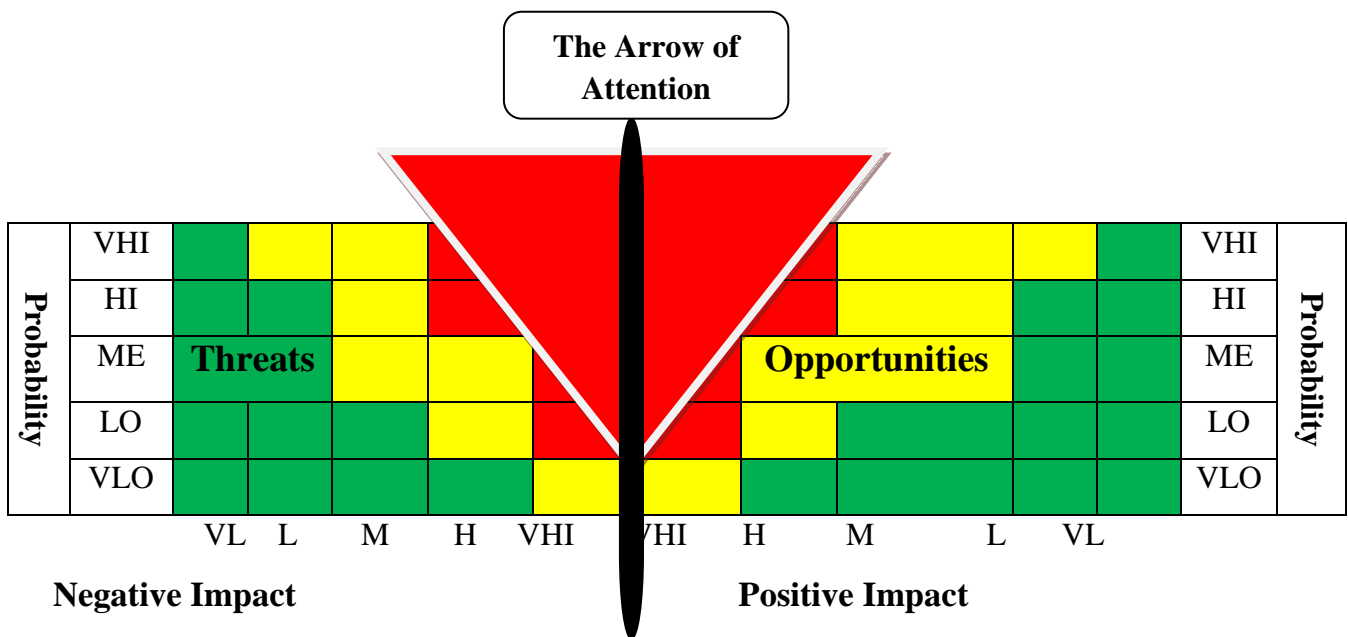


**Figure 2.1: Combination of the Level of an Impact and Probability of Occurrence of a Risk Event**

Source: David et al. (2004)

According to David et al. (2004) any given risk event may fall under one of the above drawn four quadrants of high impact but unlikely to occur, low impact and unlikely to occur, low impact and likely to occur or high impact and likely to occur. A project with new and emerging technology will have a high-complexity rating and a correspondingly high risk. The more complex the technology, the more resources the project manager typically needs to meet project goals and each of those resources could face unexpected problems.

On another point of view, Hilson (2001) argued that it is hard to visualize how a single Probability-Impact Matrix could clearly show both threats and opportunities, since the impact scale would need to reflect both positive and negative effects. Therefore rather than using a single grid, two grids could be used, with one for threats (negative impacts) and another for opportunities (positive impacts). Probability of occurrence is categorized as very high (VHI), high (H), medium (ME), low (LO) and very low (VLO). In each case, high-probability/high-impact risks are prioritized, since these are either show-stopper threats which must be avoided if possible or golden opportunities which must be exploited if possible. Therefore Hilson(2001) proposed a double Probability-Impact Matrix which involves rotating the opportunity half as shown in below. This allows key threats and opportunities to be visualized by focusing on the area called "Arrow of Attention". The size of the attention arrow can be increased if the organization is more risk-averse or if more effort is available for risk management.



**Figure 2.2: Double Probability-Impact Matrix for Opportunities and Threats**

Source- Hilson (2001)

PMI (2013) further discussed that organizations perceive risk as the effect of uncertainty on projects and organizational objectives. Organizations and stakeholders are willing to accept varying degrees of risk depending on their risk attitude. The risk attitudes of both the organization and the stakeholders may be influenced by a number of factors, which are broadly classified into three themes:

- Risk appetite, which is the degree of uncertainty an entity, is willing to take on in anticipation of a reward.
- Risk tolerance, which is the degree, amount, or volume of risk that an organization or individual will withstand.
- Risk threshold, which refers to measures along the level of uncertainty or the level of impact at which a stakeholder may have a specific interest. Below that risk threshold, the organization will accept the risk. Above that risk threshold, the organization will not tolerate the risk.

### **2.1.2 Project Risk Management**

According to the PMI (2013), project risk management is one of the nine most critical parts of project commissioning indicating a strong relationship between managing risks and a project success. PMI (2013) defined project risk management as a systematic process of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project having an objective of increasing the likelihood and impact of positive events, and decrease the likelihood and impact of negative events in the project. A good RM procedure will support better decision-making concerning risk, as there will be a better understanding of the risks, how these risks will affect the project and the responses to these risks if they should occur.

Risk management is set of coordinated activities to direct and control an organization with regard to risk (ISO, 2009).

Catriona, John and Peter (2000) reflected that the practice of risk management will involve identifying precautionary measures to avoid a risk or to reduce its consequence, establishing contingency plans to deal with risks if they should occur, initiating more investigations to reduce uncertainty through better information, considering risk transfer to insurers, considering risk allocation in contracts and setting contingencies in cost estimates, float in programs and tolerances or 'space' in performance specifications.

Catriona et al. (2000) investigated that the project organization and its senior management, internal & external clients and project managers are the major beneficiaries of the risk analysis and management practice. They further sketched out the following benefits of project risk analysis and management practices:

- ❖ An increased understanding of the project, which in turn leads to the formulation of more realistic plans, in terms of both cost estimates and timescales.
- ❖ An increased understanding of the risks in a project and their possible impact, which can lead to the minimization of risks for a party and/or the allocation of risks to the party best able to handle them.
- ❖ An understanding of how risks in a project can lead to the use of a more suitable type of contract.
- ❖ An independent view of the project risks which can help to justify decisions and enable more efficient and effective management of the risks.
- ❖ Knowledge of the risks in a project which allows assessment of contingencies that actually reflect the risks and which also tends to discourage the acceptance of financially unsound projects a contribution to the build-up of statistical information of historical risks that will assist in better modeling of future projects.
- ❖ Facilitation of greater, but more rational, risk taking, thus increasing the benefits that can be gained from risk taking.
- ❖ Assistance in the distinction between good luck and good management and bad luck and bad management.

Project risk analysis and management is a continuous process that can be started at almost any stage in the life-cycle of a project and can be continued until the costs of using it are greater than the potential benefits to be gained. As time progresses, the effectiveness of using project risk analysis and management tends to diminish, therefore it is most beneficial to use it in the earlier stages of project (Catriona et al. 2000).

### **2.1.3 Project Risk Management Process**

According to International Marine Contractors Association [IMCA], (2006) project risk management is a five step process by which the likelihood of risk occurring or its impact on a project is reduced. The five steps involved in the process are identifying the potential sources of

risk on the project, determining their individual impact and selecting those with a significant impact for full analysis, assessing the overall impact of significant risks, determining how the likelihood or impact of risk can be reduced and finally develop and implementing a plan for controlling the risks and achieving the reductions.

The PMI (2013) identifies the following six major steps of the project risk management process:

- **Plan Risk Management:** is the process of defining how to conduct risk management activities for a project.
- **Identify Risks:** having the benefit of documenting existing risks and the knowledge and ability it provides to the project team to anticipate events, this step is the process of determining which risks may affect the project and documenting their characteristics. The project manager, project team members, risk management team (if assigned), customers, subject matter experts from outside the project team, end users, other project managers, stakeholders, and risk management experts are the major participants in risk identification activities. Documentation reviews, information gathering techniques (like brainstorming, Delphi technique, interview and root cause analysis), checklist analysis, assumptions analysis, diagramming techniques (like cause and effect diagrams, influence diagrams and process flow charts), SWOT analysis and expert judgment methods can be applied to identify risks in a project undertaking.
- **Perform Qualitative Risk Analysis:** having the benefit of enabling project managers to reduce the level of uncertainty and to focus on high-priority risks, this step focuses on prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact. This step assesses the priority of identified risks using their relative probability or likelihood of occurrence, the corresponding impact on project objectives if the risks occur, as well as other factors such as the time frame for response and the organization's risk tolerance associated with the project constraints of cost, schedule, scope, and quality. Risk Probability and Impact Assessment, Probability and Impact Matrix, Risk Data Quality Assessment, Risk Urgency Assessment, Risk Categorization and Expert Judgment are the key types of methods used to assess risks qualitatively.
- **Perform Quantitative Risk Analysis:** is the process of numerically analyzing the effect of identified risks on overall project objectives. The advantage of this process is that it produces quantitative risk information to support decision making in order to reduce project

uncertainty. It is on risks that have been prioritized by the qualitative risk analysis process as potentially and substantially impacting the project's competing demands. The Perform Quantitative Risk Analysis process analyzes the effect of those risks on project objectives. It is used mostly to evaluate the aggregate effect of all risks affecting the project. The most common methods used to perform quantitative risk assessment include Data Gathering and Representation Techniques (like probability distributions and interview), Quantitative Risk Analysis and Modeling Techniques (like sensitivity analysis, expected monetary value analysis and modeling & simulation) and expert judgment techniques.

- **Plan Risk Responses:** is the process of developing options and actions to enhance opportunities and to reduce threats to project objectives.
- **Control Risks:** is the process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project. Risk Avoidance, Transference, Mitigation and Acceptance are the four major strategies which are used to deal with risks that may have negative impacts on project objectives if they occur. These strategies should be chosen to match the risk's probability and impact on the project's overall objectives. Avoidance and mitigation strategies are usually good strategies for critical risks with high impact, while transference and acceptance are usually good strategies for threats that are less critical and with low overall impact.

Chapman and Ward (2003) outlined a generic risk management process framework for projects, referred to as the SHAMPU (Shape, Harness, and Manage Project Uncertainty) process. The process involves nine phases. The starting point is shape the project strategy, which involves shaping project uncertainty at a strategic level to make the chosen approach to project uncertainty both effective and efficient in a risk efficient sense. This is followed by harness the plans, which involves harnessing the uncertainty shaped at a strategic level by developing risk efficient plans at a tactical level. These tactical level plans are necessary for implementation. Manage implementation, managing this harnessed uncertainty, is the third key ingredient. In very simple terms shape, harness and manage project uncertainty is what the SHAMPU process is about.

**Table 2.2: A nine phase portrayal of the SHAMPU process outlining purposes and tasks**

N <sup>o</sup> .	Phases in the SHAMPU process	Purposes and Tasks in Outline
1.	Define the project	Consolidate relevant existing information about the project at a strategic level in a holistic and integrated structure suitable for risk management. Fill in any gaps uncovered in the consolidation process, and resolve any inconsistencies.
2.	Focus the process	Scope and provide a strategic plan for the RMP. Plan the RMP at an operational level.
3.	Identify the issues	Identify sources of uncertainty at a strategic level in terms of opportunities and threats. Identify what might be done about it, in terms of proactive and reactive responses. Identify secondary sources of uncertainty associated with responses.
4.	Structure the issues	Complete the structuring of earlier phases. Test simplifying assumptions. Provide more complex or alternative structures when appropriate.
5.	Clarify ownership	Allocate both financial and managerial responsibility for issues (separately if appropriate).
6.	Estimate variability	Size the uncertainty that is usefully quantified on a first pass. On later passes, refine earlier estimates of uncertainty where this is effective and efficient.
7.	Evaluate implications	Assess statistical dependence (dependence not modeled in a causal structure). Synthesize the results of the estimate phase using dependence assumptions that are fit for the purpose. Interpret the results in the context of all earlier phases. Make decisions about proactive and reactive responses, and about refining and redefining earlier analysis, managing the iterative nature of the process as a key aspect of these tasks.
8.	Harness the plans	Obtain approval for strategic plans shaped by earlier phases. Prepare detailed action plans. These are base plans (incorporating preventative responses) and contingency plans (incorporating reactive responses with trigger points) ready for implementation within the action horizons defined by appropriate lead times. Commit to project plans that are fit for implementation.
9.	Manage implementation	Manage the planned work. Develop action plans for implementation on a rolling basis. Monitor and control (make decisions to refine or redefine project plans as required). Deal with crises (unanticipated issues of significance) and be prepared to cope appropriately with disasters (crises that are not controlled).

Source: Chapman and Ward (2003)

## 2.1.4 Risk Awareness

Jen (2000) defined risk awareness as the raising of understanding within the population of what risks exist, their potential impacts, and how they are managed. “Raising the understanding” incorporates communication, cultural change, and accountability. This is more than simply knowledge; these are the additional behaviors that a project manager seeks in his or her project stakeholders, over and above management of project risks.

Jen (2000) further analyzed and discussed that major benefits of risk awareness as follows:

### ❖ **Increased Accountability**

By having a greater understanding of their specific roles and responsibilities in risk management, project stakeholders will be able to understand their accountability; this is exhibited by increased participation in risk identification, increased assumption of risk ownership and more proactive thinking.

### ❖ **Increased Identification**

Having greater risk awareness will assist project stakeholders at looking beyond their own experiences and find additional risks. Another improved trait is that project stakeholders will be able to better recognize risks as they appear, instead of waiting until they become issues.

### ❖ **Increased Experience**

As risk awareness increases, it adds new risk experiences to each stakeholder's history bank, and subsequent involvement with other projects. Greater experience results in better risk assessment and judgment

### ❖ **Better Decisions**

Risk elements are comprised of probability and impact. Having greater risk awareness allows for a higher degree of accuracy in assessment. Making proper decisions is based on having the right data and information. Risk awareness assists in development of options for risk response and better decision making.

### ❖ **Appropriate Approach**

As a consequence of making proper and better decisions; knowing the context of risks within the project environment can shape the approach taken for scope and risk response.

### ❖ **Increased Performance**

Generally better risk awareness and management will lead to better efficiency and performance of project team members.

In addition Jen (2000) listed out experience, technical ability, risk tolerance, communication skill and knowledge of risk management as the major components of risk awareness.

Institute for Road Safety and Research (2010) defines risk awareness as the degree of concurrence between the perceived task demands and the real ones – how dangerous does someone think it is, and how dangerous is it really? The more they coincide, the better the risk awareness.

## **2.2 Empirical Review**

Many researchers have conducted a lot of assessments to identify the major types of risk to be faced by construction projects in general and a railway construction projects specifically. This part of the research will present findings of the researchers regarding risks in the construction projects including the railway sector.

### **2.2.1 Risks in Construction Projects**

The Construction Regulations (2007) defined construction works as the carrying out of any building, civil engineering or engineering construction works.

The construction industry can be described as the sum of all economic activities related to civil and building works: their conception, planning, execution, and maintenance. Such works normally comprise capital investment in the form of roads, railways, airports, ports and maritime structures, dams, power generating stations, irrigation schemes, health centers and hospitals, educational institutions, warehouses, factories, offices and residential premises (Tecele and Mahelet, 2009).

The construction industry is heterogeneous and enormously complex. There are several major classifications of construction that differ markedly from one another: housing, nonresidential building, heavy, highway, utility, and industrial. Construction projects include new construction, renovation, and demolition for both residential and nonresidential projects, as well as public works projects, such as streets, roads, highways, utility plants, bridges, tunnels, and overpasses (Keoki, Sears and Clough, 2008).

The construction industry has been characterized as dynamic in nature as a result the increasing uncertainties in technology, budgets, and development processes. In recent time, building projects are becoming much more complex and require a careful integrated process management tools and techniques (Abdelnaser, Mohammed and Abdelwahab, 2012).

Ewelina and Mikaela (as cited in Smith, Merna and Jobbling, 2006) outlined that at the completion of each phase in the project life cycle there is a decision point where risk assessment takes place and based on the risk assessment, an appropriate decision is made regarding further actions or proceeding to the next phase.

The theoretical study of global construction project risk is accompanied by the formation and development of the global construction project market. As early as during the Second World War, risk analysis techniques were being applied in the field of systems engineering and operations research. Risk analysis techniques for construction project management began in the 1950's. Along with the post-war reconstruction in Western societies, especially in the economic recovery of Western Europe, a large number of large-scale space, utilities, energy and transportation construction projects were built in Europe. The huge investment made the project managers pay more and more attention to cost management, and the complex project environment made the project face a lot of uncertainty. How to identify and assess the uncertainty on the impact of project cost became a major problem of managers (Kyle Costa 2009, Page 27).

Nerija and Audrius (as cited in Institution of Civil Engineers and the Actuarial Profession, 2005) discussed that 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 having the benefits of identifying and analyzing risks, and improvement of construction project management processes and effective use of resources.

According to Zou, Zhang and Wang (2007) construction projects can be unpredictable and managing risks in construction projects has been recognized as a very important process in order to achieve project objectives in terms of time, cost, quality, safety and environmental sustainability. Project risk management is an iterative process: the process is beneficial when is implemented in a systematic manner throughout the lifecycle of a construction project, from the planning stage to completion.

Different researchers have made various classifications regarding risks occurred during construction project undertakings. Ebrahimnejad, Mousavi and Mojtahedi (2008) developed an extensive risk breakdown structure for construction projects in developing countries in Asia, mainly Iran to indicate the major risks faced by construction projects. The risk structure shows the risk groups, risk categories, and risk events at the lowest work breakdown structure level. The researchers divided project risks into five initial groups namely; Management, Engineering, Procurement, Construction, and Commissioning. Table 2.3 below will briefly show the risk classification made by Ebrahimnejad et al. (2008):

**Table 2.3: Risk Breakdown Structure**

WBS – Level 0	WBS – Level 1	The initial Risks
Management	-	1- Project management disabilities 2- Lack of attention to law and regulations 3- Economical inflation 4- Fluctuating currencies exchange rate 5- Increase in international crude oil price 6- Lack of attention to contract requirements 7- Communication matters between consortium members 8- Weak clientele 9- Delay in paying and receiving project's invoices
Engineering	Basic Design	1- Inaccessibility to foreign design consultants 2- Design failures 3- Change in project specifications 4- Failure in transmitting data from basic design to detail design 5- Lack of expert human resources 6- Lack of design quality
	Detail Design	
Procurement	Equipment and Bulk Material	1- International relations 2- Ambiguity in project cash injection 3- Inappropriate vendor list 4- Incorrect long lead item time schedule 5- Imperfect data transmission to vendors 6- Lack of experience in inspection and forwarding
	Long Lead Items	
	Spare Parts	
Construction	Site Preparation	1- Soil and site bed problems 2- Unsuitable weather conditions 3- Heavy lifting matters 4- Health, Safety and Environment matters 5- Workers riots 6- Lack of communication between central office and site office 7- Change in construction scope of work 8- Lack of experienced workers 9- Contagious diseases 10- Subcontractor interferences 11- Delay in equipment delivery to site 12- Delay in paying subcontractors invoices 13- Deficiency in quality assurance & control inspections and audits
	Camp Construction	
	Site Establishment	
	Plant Construction	
Commissioning	Pre-commissioning	1- Non-consideration of pre-commissioning requirements
	Commissioning	2- Lack of pre-commissioning materials quality 3- Non-consideration to commissioning procedures

Source: Ebrahimnejad et al. (2008)

Another interesting risk classification is the one outlined by IMCA (2006) which classifies construction project risks into five major categories according to where control of the risk event lies. They are:

❖ **External: Unpredictable**

These are risks beyond the control of the individual or operator and are totally unpredictable. They arise from external influences such as third parties, acts of god, etc.

❖ **External: Predictable but Uncertain**

These risks are also beyond the control of individuals or companies. They are expected, but to what extent they are going to happen is uncertain. There is usually data to determine an average, but the actual impact can be more or less than this average. Bad weather is an example.

❖ **Internal: Technical**

These are risks arising directly from the technology of the project work, of the design, construction or operation of the facility.

❖ **Internal: Non-Technical**

These are within the control of individuals or the operator and usually arise from a failure of a project team to achieve its expected performance. They may result in schedule delays, cost over-runs or an interruption to cash flow.

❖ **Legal: Civil and Criminal**

These are risks arising from the civil or criminal law of a country. Risks under civil law can arise from contractual arrangements, patent rights etc. Risks under criminal law can arise under specific decrees or bill of laws.

According to IMCA (2006) there are seven major risk areas in construction projects namely; contractual, performance, financial, political, technical, geographical and operator. Each risk areas have their own risk triggering factors. Even if there will always be an overlap between these areas, the main areas of risk in construction contracts according to IMCA (2006) are discussed in the table below:

**Table 2.4: List of Main Risk Areas of Construction Projects**

Main risk Areas	Risk factors	
Contractual	<ul style="list-style-type: none"> <li>• Operator group and contractor group property and personnel</li> <li>• Project works (including both operator and contractor supplied items)</li> <li>• Pollution</li> <li>• Third parties</li> <li>• Consequential losses</li> <li>• Warranty obligations</li> <li>• Delay</li> <li>• Variation orders</li> </ul>	<ul style="list-style-type: none"> <li>• Free access to worksite</li> <li>• Intellectual property rights</li> <li>• Termination by operator for convenience</li> <li>• Operator’s obligation to pay contractor.</li> <li>• Insurance cover</li> <li>• Force majeure and suspension</li> <li>• Unlimited liability/damages at large</li> </ul>
Performance	<ul style="list-style-type: none"> <li>❖ Scope, nature and duration of work</li> <li>❖ Schedule interactions</li> <li>❖ Size</li> <li>❖ Safety and environmental performance</li> </ul>	<ul style="list-style-type: none"> <li>❖ Weather</li> <li>❖ Soil and foundations</li> <li>❖ External influences</li> <li>❖ Operator and influences at time of bid.</li> </ul>
Financial	<ul style="list-style-type: none"> <li>• Profitability</li> <li>• Value of contract (size)</li> <li>• Balance sheet debt</li> <li>• Off-balance sheet debt</li> <li>• Level of exposure</li> </ul>	<ul style="list-style-type: none"> <li>• Foreign currency exposure</li> <li>• Terms of payment</li> <li>• Operator creditworthiness</li> <li>• Insurance.</li> </ul>
Political	<ul style="list-style-type: none"> <li>❖ Interference</li> <li>❖ Disturbance</li> </ul>	<ul style="list-style-type: none"> <li>❖ Confidentiality</li> <li>❖ Permits and licenses</li> </ul>
Technical	<ul style="list-style-type: none"> <li>• Quality</li> <li>• New technology</li> </ul>	<ul style="list-style-type: none"> <li>• Weather</li> <li>• Soil and foundations</li> </ul>
Geographical	<ul style="list-style-type: none"> <li>❖ Location of the work</li> </ul>	
Operator	<ul style="list-style-type: none"> <li>• Operator areas of influence</li> <li>• Insurance</li> <li>• Problems which impact the operator and can impact the contractor.</li> </ul>	

Source: IMCA Risk Guideline (2006)

Further review of related literatures indicates that depending on the project scope, types of risks may differ among investments. According to Krantikumar, Konnur and Amarsinh (2016), risks associated with the construction industry can be broadly categorized into seven major categories and are discussed below:

1. **Technical Risks:** the risks associated with inadequate specification, inadequate site investigation, change in scope, construction procedures and insufficient resource availability etc. are termed as technical risks.
2. **Construction Risks:** these are the type of risks associated with labor productivity, labor disputes, site condition, equipment failures, too high quality standard and new technology.
3. **Physical Risks:** the risks arising from the damage to structure, damage to equipment, labor injuries, equipment & material fire and theft etc. are known as physical risks.
4. **Organizational Risks:** the organizational risks consist of contractual relations, contractor's experience, and attitude of project participants, inexperienced work force and communication.
5. **Financial Risks:** increased material cost, low market demand, exchange rate fluctuation, payment delays and improper estimation taxes etc. are related to financial risks.
6. **Socio-Political Risks:** are risks associated with changes in laws and regulations, pollution and safety rules, bribery/corruption, language/cultural barriers, law & order, war and civil disorder and requirement for permits and their approval.
7. **Environmental Risks:** includes natural disasters and weather implications.

### **2.2.2 Risks on Railway Construction Projects**

After briefly discussing the common types of risks to be faced by a typical construction project, it will be sensible to further review researches to find risks associated with transportation projects in general and railway construction projects in particular. Therefore this section of the research will present literatures related to risks in railway projects.

Wei (2004) discussed that the typical characteristics of transportation projects make project management and risk analysis more important than others. In general, transportation projects have a relatively large scale and have various parties involved even including many related communities and numerous ordinary people who might become the potential clients. Transportation projects are usually developed in several stages. It takes longer time to complete a transportation project than others.

Moreover, transportation projects are usually funded by government or public. In the conventional approach to project development, government is the project promoter and financier, and private firms who actually conduct the project are intended to do the best-case feasibility

studies, produce the designs, and earn additional profits by numerous change orders later on. It's going to be harder and harder to get public and political support for much-needed mega-projects unless we can come up with better-performing delivery models (Wei, 2004).

Risks on railway construction projects are broader than the usual financial and safety risks on construction projects. They will potentially prevent or affect the railway project from functioning as intended, leading to uncertainties of cost overruns, project delay, and safety issues in relation to both construction and operation and risks associated with system integrity and reliability (Nicola, 2014).

Nicola (2014) further categorized risk in rail projects as technical, design (e.g. completeness, integration, and intellectual property rights), construction/operational (e.g. safety, quality control and labour), technology and obsolescence (e.g. use of unproven/outdated technology), location (e.g. adverse climatic or geological conditions), commercial, procurement, interface, financial (e.g. funding and budget constraints, changes in exchange rate and inflation), legal and Political risks (e.g. government policy, uncertain regulatory environment, taxation and public perception).

Another classification of risks faced by the railway construction projects is briefly discussed in a research work made by Mrunal, Shinde and Hailkar (2017) which classified causes in to fifteen risk factors including risks related with financial, design, political, legal, management, material, site safety, site risk, environmental, cultural, construction, external, contractual and human resource factors.

Among all risk factors in railway construction projects site and material risks are the most important and hence risk transferring for a third party is identified as the major risk response mechanism applied (Mrunal et al. 2017).

When coming to the Ethiopian case, even if research undertakings related with risk management in railway projects are few, some researchers tried to identify major types of risks involved in the railway construction projects.

A research work made by Wubshet (2015) on risks of Addis Ababa LRT project found out that risks having an impact on quality, cost and time appeared during the implementation stage of the project include financial risks, technical and technological risks, risks related to design and supervision, contract administration risks such as delay in solving contract issues and ground

surveying risks such as encountering cultural and religious relics along proposed alignment, cost overrun due to variation of works and design adjustments, risks on safety of workers, risks related to environmental protection, risks due to lack of trained personnel, right of way risks and newness of the project.

Contractual & legal, safety & social, financial and economic, design and planning & procurement risks are identified by Wubshet (2015) as the top five risks based on their probability of occurrence. In addition while Wubshet (2015) ranked design risk, planning and procurement risk, financial and economic risk, construction risk and safety & social risks as the top five critical sources of risks that have high impact on the cost of Addis Ababa LRT project; contractual & legal risks, financial & economic risk, planning and procurement risks, design risk and safety and social risks are identified as the top five critical sources of risks that have high impact on time. In relation to the concept of project quality those risks ranked top as having a high impact on project quality by Wubshet (2015) are planning and procurement risks, design risk, safety and social risks, financial and economic risks and operational risk.

### **2.3 Conceptual Framework**

The research will mainly focus on the concepts of project risk and risk management practices of railway construction projects in Ethiopia. Thus the three focus areas that the research tries to assess are the risk level of awareness in ERC's employees, identification of major risks involved in the completed railway construction projects and project risk management practices applied by ERC in its project endeavors.

A profound explanation about project risk management process and its steps by Dale, Stephen, Geoffrey and Phil (2005) and explanation about major components of risk awareness by Jen (2000) will serve to conceptually frame this research. According to Dale et al. (2005) project risk management is a five step process and in each step a project organization should ask certain questions to help it guide and fulfill the process effectively. Communicating, consulting, monitoring and reviewing of project risks through each steps of the process are also main activities to be performed in a characteristic project risk management process.

Steps of a typical project risk management process and the major questions a project organization should ask at each stage of the project risk management steps are discussed as follows:

- ❖ Establish the context- What are we trying to achieve?

This step includes actions in relation to defining project objectives, criteria, key elements and key project stakeholders.

- ❖ Identify the risks- What might happen? What can happen? How can it happen?

This step is aimed at determining what might happen that could affect the objectives of the project, and how those things might happen.

- ❖ Analyze the risks- What might that mean for the project's key criteria?

Analyzing is a step done through the systematic use of available information to determine how often specified events may occur and the magnitude of their consequences. Likelihood, consequence and level of risk are major items to be analyzed.

- ❖ Evaluate the risks- What are the most important things?

It is the process of comparing the estimated risk against given risk criteria to determine the significance of the risk. Converting the consequence and likelihood ratings to an initial priority for the risk and developing agreed risk priorities and inherent risk levels are major activities here.

- ❖ Treat the risks- What are we going to do about them?

Identifying options, selecting the best response mechanism, developing risk treatment plans and finally implementing the plan are key procedures under this stage.

- ❖ Monitor and review- How do we keep them under control?

This step will ensure that new risks are detected and managed, and risk treatment action plans are implemented and progressed effectively.

- ❖ Communicate and consult- Who should be involved in the process?

This step is highly linked to the concept of risk awareness. To project owners, clients and end users this step will help to understand the risks and trade-offs that can be made in the project undertaking. This ensures all parties are fully informed, and thus avoids unpleasant surprises. Within the project management team, this will help to maintain the consistency and 'reasonableness' of risk assessments and their underlying assumptions.

A diagram showing all the combined three steps of project risk management process and major elements of risk awareness will conceptually connect the three research variables which the study tries to assess.

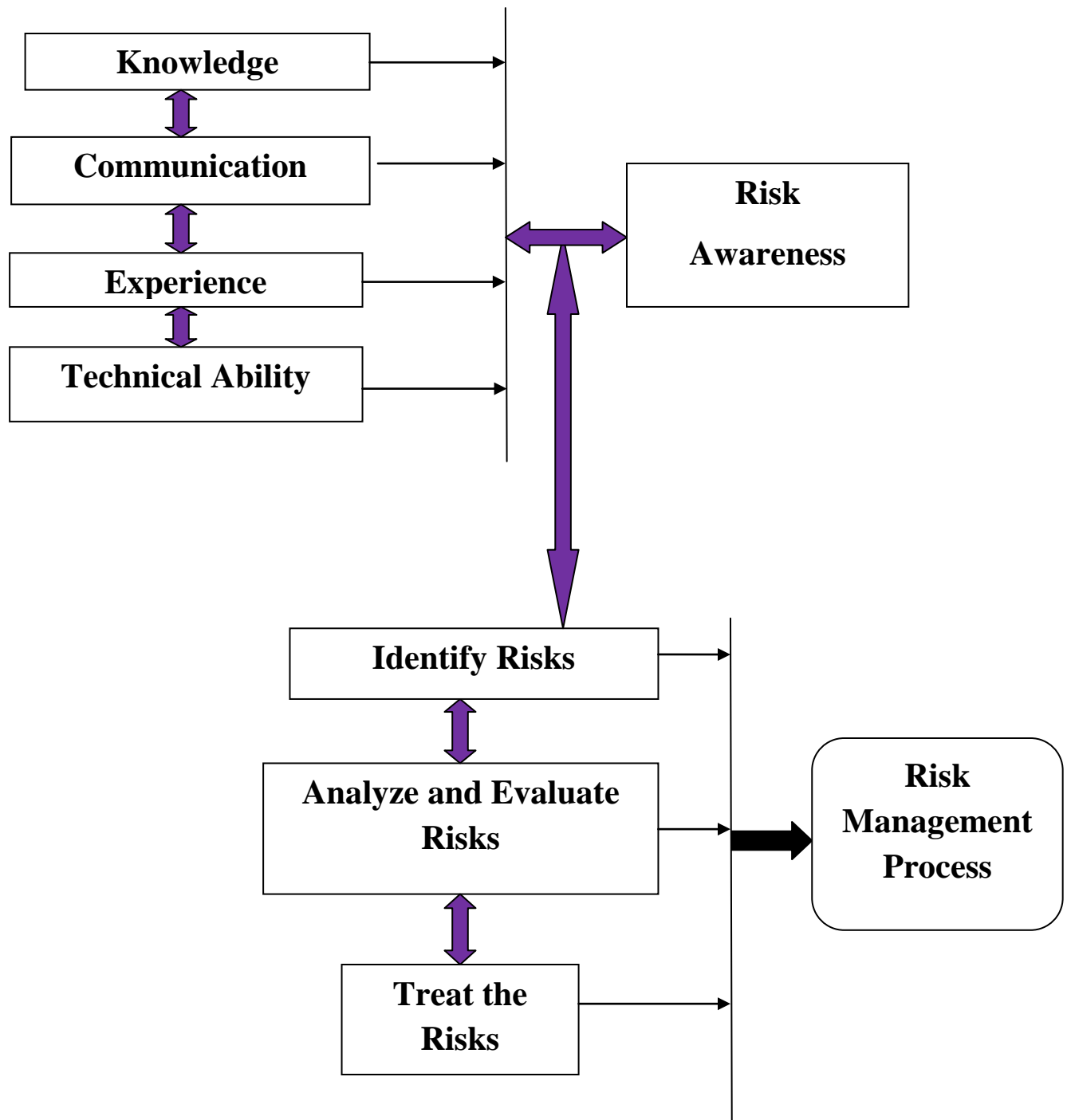


Figure 2.3: Conceptual Framework

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Research Design**

The proposed research is descriptive in its nature. Data will be collected from relevant sources to identify the major types of risks involved in undertaking railway construction projects, determine the major project risk management mechanisms applied by ERC and assess the current level of awareness regarding risk management practices in ERC. To obtain valid information, achieve the objectives of the study and ensure that the limitations of one type of data are balanced by the strengths of other both quantitative and qualitative approaches has been applied in the research. Hence the research design is mixed in its approach.

#### **3.2 Type and Source of Data**

In order to obtain relevant information and clearly address research objectives both primary and secondary sources of data are used. Primary data is collected using questionnaires with both open ended and closed ended questions to the respondents that were selected through simple random sampling and detail desk studies. Secondary data is collected by reviewing archival records, contract documents, published works, journals and related articles that contributed to better understanding of the research topic.

#### **3.3 Sampling Design**

The selection of respondents is limited to 330 workers of ERC, which is the total population of the study, including contract administration personnel, resident engineers, project personnel, finance experts, legal experts and other related department staff. Simple random sampling technique is used to select respondents to this study.

#### **3.4 Sample Size Determination**

This study applied the simplified formula provided by Yamane, (1967) to determine the required sample size at 85% confidence level, degree of variability = 0.5.

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n = Desired sample size

N = Total population size (330 in this case)

e = Accepted error limit (0.15) on the basis of 85 percent degrees of confidences put into decimal form

$$n = \frac{N}{1 + N*(e)^2}$$

$$n = \frac{330}{1 + 330*(0.15)^2}$$

$$n = 39.169$$

$$n \sim 40$$

### **3.5 Data Collection Methods and Tools**

The research is conducted using data collection tools to collect data from both primary and secondary sources. A questionnaire with both open & closed ended questions did provide the primary data for the study. Detail desk study is also conducted based on the questionnaire survey results for the deeper analysis of the practices of risk management in the selected projects.

Reviewing research papers, archival records, contract documents, published works, internet sources, journals and project risk management related articles are used as an instrument to collect secondary data.

### **3.6 Data Analysis and Presentation**

The collected data is analyzed using both qualitative and 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) software version 20. Statistical results like mean score, frequency of occurrence, ratio and percentages will be displayed in a tabular format followed by discussions. On the other hand, the data obtained

using open ended items of the questionnaire are analyzed by organizing the common ideas and concepts of the response into a meaningful format.

Besides the above mentioned data analysis methods the following questionnaire survey analysis methods for the major project risk identification and risk impact status measurement issues are practiced in the research:

**A. Relative Importance Index (RII):** is a method used to rank different factors in terms of their degree of importance. Therefore in the questionnaire respondents are asked to rank the different types of risks according to their probability of occurrence and their impact on project cost, time and quality. Even if Dale et al. (2005) used a scale of 1 to 5 to indicate the level of probability of occurrence of risks and to measure their impact, scale of 1-3 will be for this study purpose used to reduce the confusion on respondents which may arise from differentiating the list of possible options to choose from; where '1' is low, '2' is medium and '3' is high.

The equation goes as follows:

$$RII = \frac{\sum P_i U_i}{N(n)}$$

Where:

RII- Relative Importance Index

P<sub>i</sub>- Respondent's rating of risk

U<sub>i</sub>- Number of respondents placing identical weighting on the risk

N- The total number of samples (Sample Size- which is 40 in this study)

n- The highest attainable score for each risk (which is 3 in this study)

**B. Risk Ranking:** based on the results obtained by RII, risks are ranked.

### 3.7 Ethical Standards and Procedures

Since ethical considerations are expected to be involved in any kind of research endeavor, the study did take the following ethical matters into consideration:

- ❖ Right to choose: participants have the right to determine whether or not to participate in the proposed research.

- ❖ Right to be informed: research participants have the right to be informed of all aspects of the research undertaking. Knowing what is involved, how long it will take, and what will be done with the data, etc.
- ❖ Right to Privacy: all research participants have right to Privacy.

Participants are also assured that the source of data collected would remain confidential and that secrecy has been maintained. Through briefing the questionnaire to the respondents, oral consensus is reached with respondents.

### **3.8 Data Validity & Reliability**

To ensure the quality of the research and make the findings credible; due care is given to both validity and reliability issues of the data, the research process in general as well as the research output. To check the questionnaire's validity selected experts in project risk management are approached and invited to comment on the questionnaire as a pre-assessment means. To check the questionnaire item's internal consistency, its reliability was checked by the Cronbach's alpha test coefficient using SPSS software and the gained result was .734 which is beyond .70a result considered as "acceptable" in social science researches.

## **CHAPTER FOUR**

### **DATA ANALYSIS AND PRESENTATION**

#### **4.1 Introduction**

This chapter describes the results and discussion of questionnaires and the in-depth desk study undertaken. It is aimed to assess the current level of employee awareness regarding risk and risk management in ERC, identify and rank the major types of risks faced by railway construction projects and find out the overall risk management practices of the Corporation.

The data collected from close-ended questions of the questionnaire are analyzed using descriptive data analysis supported by the use of Statistic Package for Social Science (SPSS) Version 20. Appropriate statistical results are presented in a tabular format followed by discussions. On the other hand, the data obtained using open ended items of the questionnaire, especially designed to address the overall risk management practices of the Corporation, are analyzed by organizing the common ideas and concepts of the response into a meaningful format. In addition the collected data from the questionnaire's second part aimed at identifying and ranking the major types of risks faced by railway construction projects were tabulated and analyzed using the Relative Importance Index (RII) to rank risks based on their probability of occurrence and their impact on major project objectives.

#### **4.2 Questionnaire Response Rate**

Questionnaires with both open and close ended questions were designed and distributed for the research purpose. Out of the totally distributed 40 questionnaires, 35 were filled and returned. Table 4.1 below will show the respondents' response rate through displaying the number of questionnaires distributed to the respondents and returned.

**Table 4.1: Summary of Number and Percentage of Questionnaires Distributed and Returned**

<b>Questionnaires Distributed</b>	<b>Questionnaires Returned</b>	<b>Questionnaires Unreturned</b>	<b>Response Rate (%)</b>
40	35	5	87.5

Source: Own Survey (2018)

As depicted in the above table among the totally distributed 40 questionnaires, those respondents who fill and returned were 35 which makes the overall questionnaire response rate 87.5 percent.

### 4.3 Respondents' Profile

Professionals with different levels of work experience and educational background were approached to fill the questionnaire survey. Looking at the respondents' work experience in the railway construction sector, out of the total 35 questionnaire filled and returned, Five (14.3%) of respondents have more than 9 years of experience, Seventeen (48.6%) with an experience between 5 to 9 years and the rest Thirteen (37.1%) respondents have a work experience of less than five years in the railway sector.

**Table 4.2: Years of Experience of Respondents in the Railway Sector**

Work Experience	Frequency	Percent	Valid Percent	Cumulative Percent
0-5 Years	13	37.1	37.1	37.1
5-9 years	17	48.6	48.6	85.7
More than 9 years	5	14.3	14.3	100.0
Total	35	100.0	100.0	

Source: Own Survey (2018)

With regard to the educational status of respondents, among those participated in the survey 42.9% of the respondents are first Degree holders and 57.1% of the respondents are Masters Degree holders.

**Table 4.3: Educational Status of Respondents**

Educational Status	Frequency	Percent	Valid Percent	Cumulative Percent
BA/B.Sc.	15	42.9	42.9	42.9
MA/M.Sc.	20	57.1	57.1	100.0
Total	35	100.0	100.0	

Source: Own Survey (2018)

Looking into the respondents' educational field of specialization; among the total respondents 43% are Engineers, 43% Business related, 11.4% Law and the rest 2.9% are categorized under other subject areas.

**Table 4.4: Respondents Field of Specialization**

Field of Specialization	Frequency	Percent	Valid Percent	Cumulative Percent
Engineering	15	42.9	42.9	42.9
Business	15	42.9	42.9	85.7
Law	4	11.4	11.4	97.1
Others	1	2.9	2.9	100.0
Total	35	100.0	100.0	

Source: Own Survey (2018)

#### **4.4 Risk Awareness among Employees of ERC**

This section of the research is intended to present and analyze data collected from the survey regarding the current level of awareness regarding risk and risk management in Ethiopian Railways Corporation. Different open and close ended questions were presented for the respondents on the questionnaire to come up with an understanding of the level of awareness about risk within the employees of ERC.

The first question offered for the respondents regarding the issue of risk awareness is about whether they think there is a common understanding of the term “Risk” within the employees of ERC or not. Respondents were asked to scale their responses in five Lickert items namely; strongly agree, agree, neutral, disagree and strongly disagree to show their level of agreement or disagreement about their perception of existence of a common understanding about risk within employees of ERC.

Among the entire 35 respondents participated in the survey, only 5 of them do agree that there is a common understanding of the term risk within ERC staff. The rest 30 respondents disagree, strongly disagree or remained neutral about the issue. The frequency and percentage of answers

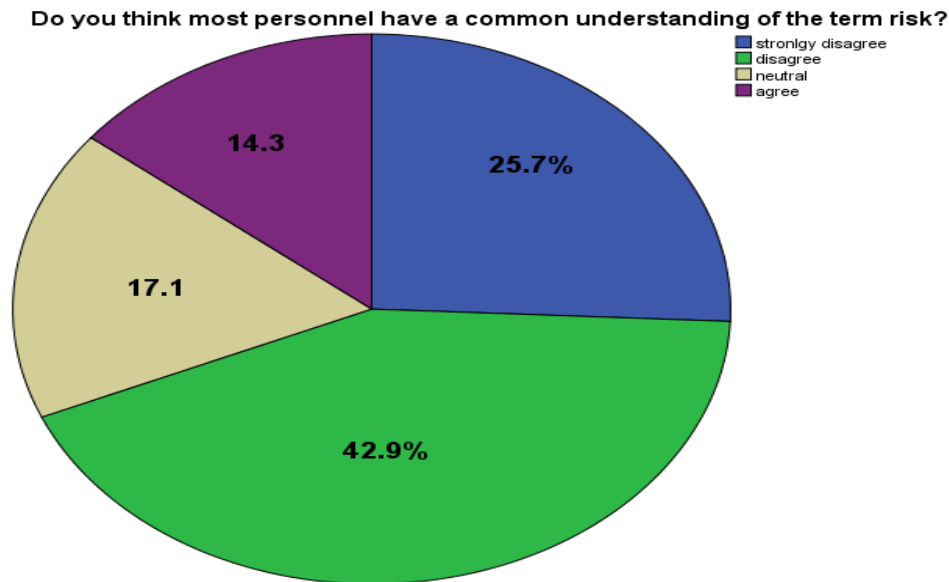
by the respondents for the above question is displayed in a tabular format in table 4.5 and graphically in figure 4.1 below:

**Table 4.5: Frequency of Respondents Answers about the Common Understanding of the term Risk within Employees of ERC**

Lickert Items	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	9	25.7	25.7	25.7
Disagree	15	42.9	42.9	68.6
Neutral	6	17.1	17.1	85.7
Agree	5	14.3	14.3	100.0
Strongly Agree	0	0	0	100.0
Total	35	100.0	100.0	

Source: Own Survey (2018)

Figure 4.1 below also displays the respondents' answers regarding understanding of the term risk within ERC employees graphically:



**Figure 4.1: Percentage of Responses on the Level of Common Understanding Of the term Risk within Employees of ERC**

Source: Own Survey (2018)

As it can easily be portrayed from the above table and graph around 25% and 43% of the respondents either strongly disagree or disagree that there is a common understanding of the term “Risk” within employees of ERC respectively. In addition while 17% of the respondents replied neutral; only 14% of them agreed that there is a common understanding about risk in ERC and no respondent scaled strongly agree.

Those respondents who replied strongly disagree or disagree were asked to list the possible causes of low level of common understanding of the term risk in ERC. Among the list of possible reasons the following are the main ones:

- ❖ Lack of technical knowledge about risk and risk management,
- ❖ Poor information flow and communication,
- ❖ Less institutional maturity regarding risk management,
- ❖ No training and development programs regarding risk and risk management,,
- ❖ Attaching the issue of risk with financial conditions only,
- ❖ Attaching the term risk with the issue of responsibility and accountability,
- ❖ No approved and functional risk management policy/manual and
- ❖ Limited risk planning and risk management exercise in the corporation.

Jen (2000) listed out experience, technical ability, risk tolerance, communication skill and knowledge of risk management as the major components of risk awareness. Since communication is one of the major components of risk awareness, another question posed for respondents is regarding communication of risks across the corporation and project stakeholders.

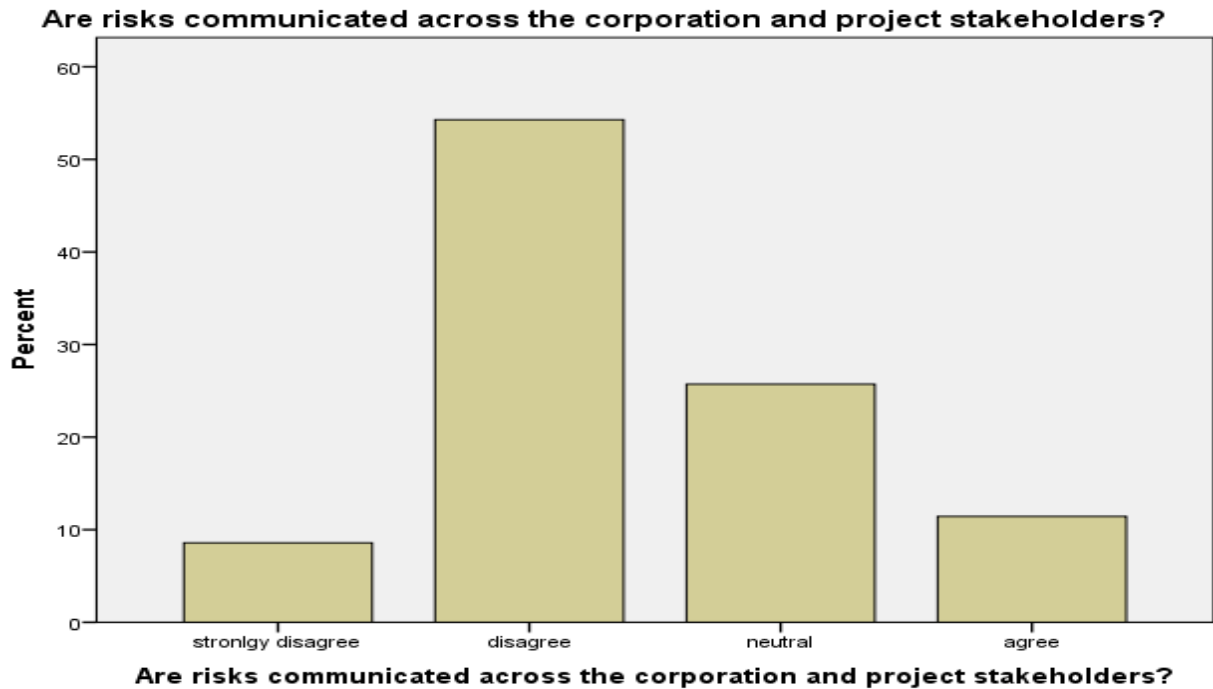
Respondents were asked to scale their responses in five Lickert items namely; strongly agree, agree, neutral, disagree and strongly disagree to show their level of agreement or disagreement regarding whether they think that risks are communicated across the corporation and project stakeholders.

The frequency of respondents’ answers is displayed below:

**Table 4.6: Frequency of Respondents' Answers regarding the Communication of risks across the Corporation and Project Stakeholders**

Likert Items	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	3	8.6	8.6	8.6
Disagree	19	54.3	54.3	62.9
Neutral	9	25.7	25.7	88.6
Agree	4	11.4	11.4	100.0
Strongly Agree	0	0	0	100.0
Total	35	100.0	100.0	

Source: Own Survey (2018)



**Figure 4.2: Percentage of Responses on the Level of Communication of Risks Across the Corporation and Project Stakeholders**

Source: Own Survey (2018)

Among the respondents around 54% and 8.6% of the respondents either disagree or strongly disagree that risks are communicated across the corporation and project stakeholders. In addition while around 25% of the respondents replied neutral to the question; only 14% of them agreed that risks are communicated and no respondent scaled strongly agree.

As Jen (2000) listed knowledge of risk management as one of the major components of risk awareness and since training and development are among the tools of increasing knowledge, respondents are also asked whether they attended a training or development program related to project risk or risk management or not.

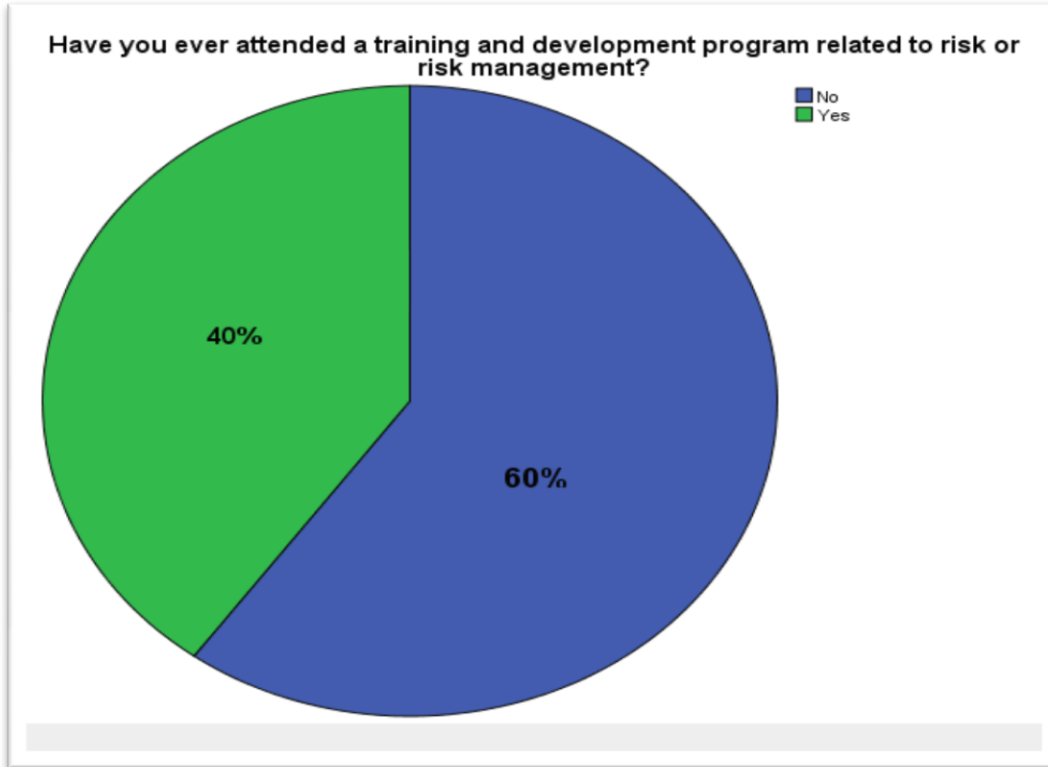
Among the 35 respondents 21 of them never attended a training program related to risk or risk management while the rest did. Table 4.7 and figure 4.3 below will display the frequency and percentage of answers provided by the respondents:

**Table 4.7: Frequency of Respondents’ Answers about Attending a Training and Development Program Related to Risk or Risk Management**

<b>Attended Training?</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
No	21	60.0	60.0	60.0
Yes	14	40.0	40.0	100.0
Total	35	100.0	100.0	

Source: Own Survey (2018)

See the figure below:



**Figure 4.3: Percentage of Responses on Attending a Training and Development Program related to Risk or Risk Management**

Source: Own Survey (2018)

As indicated above 40 percent of the respondents have attended a training or development program related to risk or risk management. However using a follow-up question for those who answered “Yes” about attending training, it is found out that among 14 respondents who attended training only 5 of them were involved in a training or development program organized by ERC and the rest did train somewhere else.

Experience in risk management practices is one of the major components of risk awareness (Jen, 2000). Since involvement in the risk management process is believed to increase risk management experience, respondents are asked if they ever get involved in risk identification, analysis and/or risk response mechanism decision making process or not.

Among the entire 35 respondents which did participate in the survey, 23 of them never get involved in risk identification, analysis and/or risk response mechanism decision making process in ERC while the rest did.

**Table 4.8: Frequency of Respondents' Answers about Getting Involved in Project Risk Management Processes in ERC**

<b>Involved in PRM Process?</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
No	23	65.7	65.7	65.7
Yes	12	34.3	34.3	100.0
Total	35	100.0	100.0	

Source: Own Survey (2018)

As observed in the above table 34% of the participants did get involved in one or more processes of risk management. However it is observed from the survey that most of those who did participate in risk management processes in ERC encompass a job position of chief officer and above, showing sole involvement of the top management in the process.

#### **4.5 Major Risks in Railways Construction Projects of ERC**

This section of the study is intended to analyze and present information collected from the questionnaire which is aimed to identify the major types of risks involved in three completed railway construction projects undertaken by ERC namely; Addis Ababa light rail, Addis Ababa/Sebeta-Meiso and Mieso-Dewanle railway construction projects and their probability of occurrence.

In addition information collected regarding the impact of different types of risks on project cost, time and quality will be analyzed and presented. Relative Importance Index (RII) for each type of risk is calculated to rank risks based on their probability of occurrence.

##### **4.5.1 Identifying Major Risks and Their Probability of Occurrence**

Different researchers tried to classify risks in to diverse categories in the construction sector in general and in railway projects in particular. While Kantikumar et al. (2016) categorized construction risks in to seven major types, Mrunal et al. (2017) listed fifteen types of risks associated with railway projects in their research.

For this research purpose a list of eleven commonly known types of risks involved in a typical construction project were presented for the respondents and asked to rank their probability of

occurrence on a scale of 1-3 where; 1 indicates low probability of occurrence, 2 with medium and 3 a risk with a high probability of occurrence.

The frequency of weights given to indicate the probability of occurrence of different types of construction project risks by the 35 respondents is depicted in table 4.9 below:

**Table 4.9: Frequency of Respondent’s Weights on the Probability of Occurrence of a Risk Event in Railway Projects**

N <sup>o</sup> .	Risk Type	Frequency of Probability of Occurrence			Total Frequency
		Low	Medium	High	
1.	Technical risks	3	24	8	35
2.	Construction risks	12	17	6	35
3.	Physical risks	15	15	5	35
4.	Organizational risks	11	14	10	35
5.	Financial risks	4	11	20	35
6.	Socio-political risks	12	16	7	35
7.	Environmental risks	20	8	7	35
8.	Design risks	11	12	12	35
9.	Legal risks	16	14	5	35
10.	Material risks	18	10	7	35
11.	Access to construction site risks	6	20	9	35

Source: Own Survey (2018)

Among all the listed types of risks it is financial risk which is frequently allotted as having a high probability of occurrence (20 times). Design and organizational risks are marked second and third in frequency with a high probability of occurrence 12 and 10 times by the respondents respectively. Legal, physical and construction risks are marked less frequently by the respondents with high probability of occurrence i.e.; 5, 5 and 6 times respectively.

When looking into the Mean values for the scores of probability of occurrence of each risk; financial risks are marked by the respondents as a risk with a high probability of occurrence with a Mean Score of 2.46. Technical, access to construction site, design and organizational risks are also marked by the respondent with a high probability of occurrence with Mean Scores of 2.14, 2.09, 2.03 and 1.97 respectively.

**Table 4.10: Mean Score (MS) Results for the Probability of Occurrence of Risks in Railway Projects**

Items to be Measured	Total Number of Respondents	Mean Score (MS)
Probability of Occurrence of technical risks	35	2.14
Probability of Occurrence of construction risks	35	1.83
Probability of Occurrence of physical risks	35	1.71
Probability of Occurrence of organizational risks	35	1.97
Probability of Occurrence of financial risks	35	2.46
Probability of Occurrence of socio-political risks	35	1.86
Probability of Occurrence of environmental risks	35	1.63
Probability of Occurrence of design risks	35	2.03
Probability of Occurrence of legal risks	35	1.69
Probability of Occurrence of material risks	35	1.69
Probability of Occurrence of access to construction site risks	35	2.09

Source: Own Survey (2018)

It is illustrated in the above table that environmental risks are marked relatively with less probability of occurrence with a Mean Score value of 1.63. Physical, legal and material risks are also manifested by the respondents as less probable to occur with Mean Scores of 1.71, 1.69 and 1.69 respectively.

After analyzing frequencies and Mean Scores of values obtained from the questionnaires for the probability of occurrence of a risk event in a railway construction project, analysis is done to rank the risks based on their probability of occurrence using RII formula.

**Table 4.11: RII and Rank of Railway Construction Project Risks Based on their Probability of Occurrence**

N <sup>o</sup> .	Risk Type	RII Value Based on Probability of Occurrence	Rank based on RII
1.	Technical risks	0.625	2 <sup>nd</sup>
2.	Construction risks	0.533	7 <sup>th</sup>
3.	Physical risks	0.5	8 <sup>th</sup>
4.	Organizational risks	0.575	5 <sup>th</sup>
5.	Financial risks	0.716	1 <sup>st</sup>
6.	Socio-political risks	0.541	6 <sup>th</sup>
7.	Environmental risks	0.475	10 <sup>th</sup>
8.	Design risks	0.591	4 <sup>th</sup>
9.	Legal risks	0.491	9 <sup>th</sup>
10.	Material risks	0.491	9 <sup>th</sup>
11.	Access to construction site risks	0.608	3 <sup>rd</sup>

Source: Own Survey (2018)

Using the RII formula it is found out that respondents ranked financial risks first based on their probability of occurrence with an RII value of 0.716. Technical risks, right of way risks (access to construction site risks) and design risks are ranked from second to fourth place based on their probability of occurrence with RII values of 0.625, 0.608 and 0.591 respectively. Unlike the findings of this study a research work by Mrunal et al. (2017) aimed at ranking risks in railway construction projects in India identified access to site and material risks as the two major

important risks in the sector. On another research work by Wubshet (2015) financial and design risks are ranked as third and fourth based on their relative probability of occurrence.

On the other hand legal, material and environmental risks are relatively specified with a low level of rank in this study based on their probability of occurrence from the respondents with an RII values 0.491, 0.491 and 0.475 respectively.

Looking into the mean score values and results obtained from the RII calculation, it can be easily judged that there is similarity on the results obtained from the above two data analysis methods on ranking of risks based on their probability of occurrence.

#### 4.5.2 Impact of Risks on Project Cost

As it was done in measuring the probability of occurrence of a risk event previously, a list of eleven commonly known types of risks involved in a typical construction project were presented for the respondents and asked to assign weight on the risks based on their impact on project cost on a scale of 1-3 where; 1 indicates low impact, 2 with medium and 3 a risk with a high impact on project cost.

Through the questionnaire respondents assign different weights for the listed risks based on their impact on project cost. Table 4.12 illustrates the frequency of weights given by the respondents and Mean Score values of the impact of different types of risks on project cost:

**Table 4.12: Frequency of Respondent’s Weights and their Mean Scores for the Impact of a Risk Event on Project Cost**

N <sup>o</sup> .	Risk Type	Frequency of Weight Assigned on the Risk’s Impact on Project Cost			Mean Score (MS)	Total Frequency
		Low	Medium	High		
1.	Technical risks	4	14	17	2.37	35
2.	Construction risks	7	17	11	2.11	35
3.	Physical risks	12	18	5	1.80	35
4.	Organizational risks	6	19	10	2.11	35
5.	Financial risks	2	9	24	2.63	35
6.	Socio-political risks	11	14	10	1.97	35
7.	Environmental risks	13	5	17	2.11	35
8.	Design risks	7	5	23	2.46	35
9.	Legal risks	16	14	5	1.69	35
10.	Material risks	12	16	7	1.86	35
11.	Access to construction site risks	9	14	12	2.09	35

Source: Own Survey (2018)

Like that of a result obtained while analyzing respondent’s data in the probability of occurrence of risks it is financial risks which is frequently assigned, 24 times, as having a high impact on

project cost parameter. Design and technical risks are marked second and third in frequency with a high impact on project cost which is weighted as high 23 and 17 times by the respondents respectively. Among all the listed types of risks legal and physical risks are marked less frequently, 5 times each, by the respondents with high impact on project cost.

Regarding the Mean Scores for frequency of weights assigned on each risk based on their impact on project cost; again it is financial risks which are marked first as having a high impact on project cost by the respondents with a Mean Score of 2.46. Design and technical risks are also marked by the respondent as having a high impact on project cost with Mean Scores of 2.46 and 2.37 respectively. Legal and physical risks with mean scores of 1.69 and 1.80 respectively are weighted as having relatively low impact on project cost. Ranking of risks based on their impact on project cost using the RII formula is presented below:

**Table 4.13: RII and Rank of Risks Based on their Impact on Project Cost**

N <sup>o</sup> .	Risk Type	RII Value Based on Impact on Project Cost	Rank Based on RII
1.	Technical risks	0.725	2 <sup>nd</sup>
2.	Construction risks	0.616	4 <sup>th</sup>
3.	Physical risks	0.525	8 <sup>th</sup>
4.	Organizational risks	0.616	4 <sup>th</sup>
5.	Financial risks	0.766	1 <sup>st</sup>
6.	Socio-political risks	0.575	6 <sup>th</sup>
7.	Environmental risks	0.616	4 <sup>th</sup>
8.	Design risks	0.716	3 <sup>rd</sup>
9.	Legal risks	0.491	9 <sup>th</sup>
10.	Material risks	0.541	7 <sup>th</sup>
11.	Access to construction site risks	0.608	5 <sup>th</sup>

Source: Own Survey (2018)

As depicted in table 4.13 it is financial risks with an RII value of 0.766 ranked first by the respondents based on the risk's impact on project cost. Technical and design risks are ranked

second and third with an RII values of 0.725 and 0.716 respectively. Wubshet (2015) ranked design and financial risks first and third respectively based on having relatively high impact on project cost. On the other hand Mrunal (2017) ranked design risks third and financial risks fifth most important risk events in railway construction projects.

Reversely in this study legal and physical risks are relatively specified by the respondents as having a low impact on project cost with an RII values 0.491 and 0.525 respectively.

#### 4.5.2 Impact of Risks on Project Time

Like that of the risks' impact on project cost, respondents were presented with a list of risks involved in a typical construction project and asked to assign weight on the risks based on its impact on project time on a scale of 1-3 where; 1 indicates low impact, 2 with medium and 3 a risk with a high impact on project time/schedule.

**Table 4.14: Frequency of Respondent's Weights and their Mean Scores for the Impact of a Risk Event on Project Time**

N <sup>o</sup> .	Risk Type	Frequency of Weight Assigned on the Risk's Impact on Project Time			Mean Score (MS)	Total Frequency
		Low	Medium	High		
1.	Technical risks	5	14	16	2.31	35
2.	Construction risks	6	13	16	2.29	35
3.	Physical risks	12	22	1	1.69	35
4.	Organizational risks	5	15	15	2.29	35
5.	Financial risks	5	14	16	2.31	35
6.	Socio-political risks	10	12	13	2.09	35
7.	Environmental risks	13	8	14	2.03	35
8.	Design risks	7	8	20	2.37	35
9.	Legal risks	15	12	8	1.80	35
10.	Material risks	13	9	13	2.00	35
11.	Access to construction site risks	2	10	23	2.60	35

Source: Own Survey (2018)

Looking into the frequency of weights given to indicate the impact of different risks on project time by the 35 respondents; access to construction (right of way) and design risks are the two major risk types frequently assigned with a high impact on project time i.e. 23 and 20 times respectively. On the other hand physical and legal risks are less frequently considered by the respondents as having a high impact on project time parameter.

Based on the mean score values of the impact of the listed risks on project time; access to construction site and design risks are specified by the respondents as having a high impact with mean scores of 2.60 and 2.37 respectively. On the contrary physical and legal risks are considered as having relatively low impact with mean scores of 1.69 and 1.80 respectively.

After analyzing frequencies and Mean Scores of values obtained from the questionnaires for the impact of a risk event on project time, analysis is done to rank the risks based on their impact using RII formula.

**Table 4.15: RII and Rank of Risks Based on their Impact on Project Time**

N <sup>o</sup> .	Risk Type	RII Value Based on Impact on Project Time	Rank Based on RII
1.	Technical risks	0.675	3 <sup>rd</sup>
2.	Construction risks	0.666	4 <sup>th</sup>
3.	Physical risks	0.491	9 <sup>th</sup>
4.	Organizational risks	0.666	4 <sup>th</sup>
5.	Financial risks	0.675	3 <sup>rd</sup>
6.	Socio-political risks	0.608	5 <sup>th</sup>
7.	Environmental risks	0.591	6 <sup>th</sup>
8.	Design risks	0.691	2 <sup>nd</sup>
9.	Legal risks	0.525	8 <sup>th</sup>
10.	Material risks	0.583	7 <sup>th</sup>
11.	Access to construction site risks	0.758	1 <sup>st</sup>

Source: Own Survey (2018)

Based on their RII value access to construction (right of way) risks are ranked first based on their impact on project time followed by design and technical risks with an RII value of 0.758 and 0.691 correspondingly. The same scenario is indicated by Mrunal et al. (2017) ranking site risks as the first most important category of risks in railway construction projects.

On the other hand legal and physical risks are relatively specified as having a low level of impact on project time with RII values of 0.525 and 0.491 respectively in this research. However legal and contractual risks are identified by Wubshet (2015) as having high impact in project time objective unlike this research.

#### 4.5.2 Impact of Risks on Project Quality

Respondents were presented with a list of risks and asked to assign weight on the risks based on their impact on project quality on a scale of 1-3 where; 1 indicates low impact, 2 with medium and 3 a risk with a high impact on project quality.

In the collected questionnaire respondents assign different weights for the listed risks based on their impact on project quality. The frequency of weights given by the respondents and Mean Score values of the impact of different types of risks on project quality is displayed below:

**Table 4.16: Frequency of Respondent’s Weights and their Mean Scores for the Impact of a Risk Event on Project Quality**

N <sup>o</sup> .	Risk Type	Frequency of Weight Assigned on the Risk’s Impact on Project Quality			Mean Score (MS)	Total Frequency
		Low	Medium	High		
1.	Technical risks	5	9	21	2.46	35
2.	Construction risks	6	19	10	2.11	35
3.	Physical risks	13	20	2	1.69	35
4.	Organizational risks	4	19	12	2.23	35
5.	Financial risks	14	8	13	1.97	35
6.	Socio-political risks	16	9	10	1.83	35
7.	Environmental risks	15	6	14	1.97	35
8.	Design risks	6	10	19	2.37	35
9.	Legal risks	22	7	6	1.54	35
10.	Material risks	2	15	18	2.46	35
11.	Access to construction site risks	15	16	4	1.69	35

Source: Own Survey (2018)

Observing the frequency of weights given to indicate the impact of different risks on project quality by the respondents; technical, design and material risks are the major risk types frequently assigned by the respondents with a high impact on project quality i.e. 21, 19 and 18 times respectively. On the other hand legal and physical risks are less frequently considered by the respondents as having a high impact on project quality.

Based on the mean score values of the impact of the listed risks on project quality it is material and technical risks jointly holding the first place as being specified by the respondents as having a high impact with mean score of 2.46 each. On the contrary physical, access to construction site and legal risks are considered as having relatively low impact on project quality with mean scores of 1.69, 1.69 and 1.54 respectively.

As practiced above in ranking risks based on their probability of occurrence, impact on project cost and time, an RII is used to rank the risks based on their impact on project quality.

**Table 4.17: RII and Rank of Risks Based on their Impact on Project Quality**

N <sup>o</sup> .	Risk Type	RII Value Based on Impact on Project Quality	Rank Based on RII
1.	Technical risks	0.716	1 <sup>st</sup>
2.	Construction risks	0.616	4 <sup>th</sup>
3.	Physical risks	0.491	7 <sup>th</sup>
4.	Organizational risks	0.65	3 <sup>rd</sup>
5.	Financial risks	0.575	5 <sup>th</sup>
6.	Socio-political risks	0.533	6 <sup>th</sup>
7.	Environmental risks	0.575	5 <sup>th</sup>
8.	Design risks	0.691	2 <sup>nd</sup>
9.	Legal risks	0.45	9 <sup>th</sup>
10.	Material risks	0.716	1 <sup>st</sup>
11.	Access to construction site risks	0.458	8 <sup>th</sup>

Source: Own Survey (2018)

Based on their RII value material and technical risks are jointly ranked first based on their impact on project quality with an RII value of 0.716 each, which is supported by a research work by

Mrunal et al. (2017), followed by design and organizational risks with an RII values of 0.691 and 0.65 correspondingly. In the reverse legal and access to construction site risks are relatively specified in this research as having a low level impact on project quality with RII values of 0.45 and 0.458 respectively.

## **4.6 Risk Management Process in ERC**

This part of the research is aimed to describe the overall project risk management practices applied by ERC in undertaking Addis Ababa light rail, Addis Ababa/Sebeta-Meiso and Mieso-Dewanle railway construction projects. It also tries to determine the methods practiced in the processes of risk identification, analysis and treatment practices.

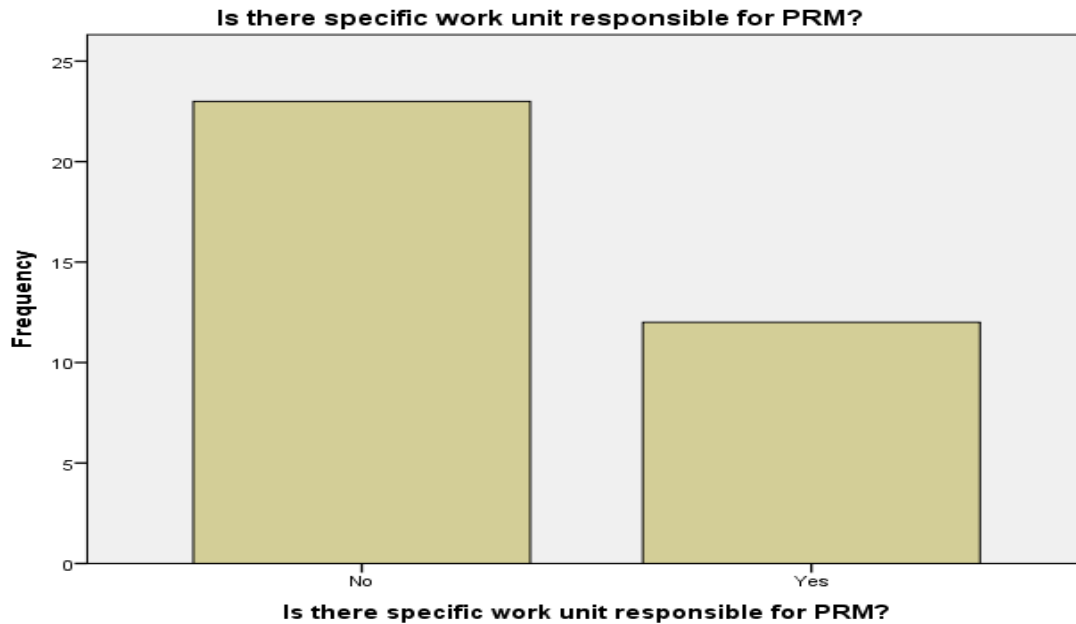
Both close and open ended questions were presented for the respondents. However this section of the research is mainly based on organizing the common ideas and concepts of responses from the respondents which is obtained using open ended questions. In depth desk study is also undertaken to come up with a steady and meaningful facts.

The amount of system-building activity for risk management that takes place in a project organization is likely to correlate strongly with its level of risk management maturity. While not measurable in any precisely quantitative sense, an organization's risk management maturity level should be noticeable through careful observation of the ways in which it has established mechanisms to deal with project risk situations. (AAU, 2015)

Hilson (2002) classified organizational risk maturity level in four ascending stages namely; ignoring, trying, growing and maturing. The major components which will help to distinguish organizations of different risk maturity levels include the existence and utilization of structured and determined work unit responsible for PRM practices, risk knowledge capturing, risk register and standard risk management procedure.

### **4.6.1 Responsible Department for Risk Management Practices**

Since, according to Hilson (2002), the existence of specific department which is responsible for PRM is one of the factors used to distinguish the level of organizational risk maturity, the first question presented for the respondents to find out the overall PRM practices of ERC is whether there exists a specific department responsible for PRM practices or not. The frequency of answers provided by the respondents is presented graphically in figure 4.4 below:



**Figure 4.4: Frequency of Responses on the Existence of Specific Department Responsible for PRM practices in ERC**

Source: Own Survey (2018)

When asked about the existence of specific work unit/department responsible for PRM practices in the corporation 23 of them answered “No” while the rest 12 respondents responded “Yes”. The answers provided by the respondents indicates that there is no clarity and smooth flow of information regarding the practices of risk management and who is responsible for it.

However while undertaking a desk study it is learnt that there is specific working team in ERC named “Project Feasibility and Risk Assessment” which is responsible for executing the processes of project feasibility study and risk assessment in financial aspects only and the working team is also not well equipped and necessary experts are not fulfilled yet. In addition there are also other departments like QSE Unit (Quality, Safety and Environment), Contract Administration Team, Audit, Ethics and Legal units which are in charge of performing activities related to PRM practices.

#### **4.6.2 Integration of Risk Management with ERC’s Strategic Direction**

As previously discussed in the first chapter of the research ERC has a strategic direction of establishing a national railway network by identifying eight railway corridors with an estimated

length of 5000Kms for further study, design and subsequent construction project implementation throughout Ethiopia.

According to Bruce (2004) risk is the core planning challenge at the heart of business development and later, project management. The separation of risk management process from the rest of the broader business and project management paradigm is the wrong approach to the subject because it implies that somehow risk is largely internal to a project and therefore controlled by the project team. Since project risk is business risk, the whole business strategic planning, marketing, and risk analysis process is directly relevant to project risk.

Therefore respondents were asked if they think whether RM practices are integrated with the corporation’s strategic direction and plan or not. The frequency of their answers is as follows:

**Table 4.18: Frequency of Respondent’s Answers about Integration of RM Practices with ERC’s Strategic plan**

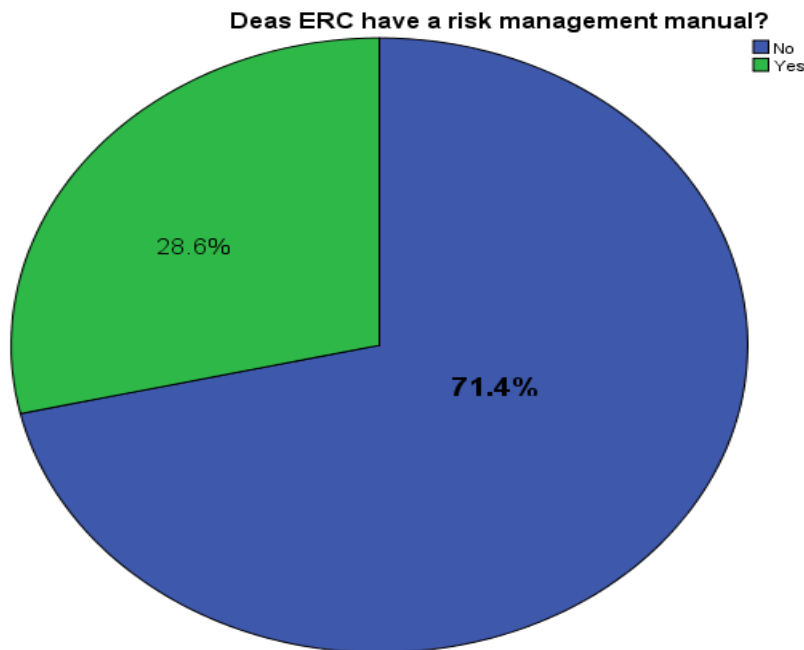
<b>RM Integrated with Strategic Plan?</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
No	28	80.0	80.0	80.0
Yes	7	20.0	20.0	100.0
Total	35	100.0	100.0	

Source: Own Survey (2018)

As displayed in table 4.18 above while 80 percent of the respondents don’t think that risk management practices are properly integrated with the overall strategic direction of the corporation while the rest 20 percent answered “Yes” to the question. In the desk study it is leant that the planning department make some effort to consider the issue of risk in its planning endeavors with little contemplation. This is an indication of the fact that ERC didn’t systematically integrate risk management with its strategic direction and hence is an indication of poor risk management practice by the corporation.

### 4.6.3 Risk Management Procedures Manual

One of the factors Hilson (2002) mentioned to help to distinguish the level of organizational risk management maturity is the existence of standard risk management procedure. Therefore respondents are asked if the corporation has a guideline/manual to govern the risk management practices or not.



**Figure 4.5: Percentage of Responses on the Existence of Risk Management Manual in ERC**

Source: Own Survey (2018)

Among the total 35 respondents participated in the survey 25 of them (71.4%) responded that the corporation has no guideline/manual to govern the risk management practices. The rest 10 respondents said the corporation has a risk management procedural manual.

The answers provided by the respondents by itself is an indication of lack of clarity and smooth flow of information regarding the practices of risk management and how the practices are performed actually.

However while undertaking a desk study it is learnt that there exists a draft risk management procedures manual prepared by the corporation but not yet approved by the top management and put into practice.

#### 4.6.4 Risk Register

According to Hilson (2002) proper knowledge capturing and risk register, a document in which the results of risk analysis and risk response planning are recorded are another components which are used to distinguish an organization's risk management maturity. Therefore respondents are asked whether the projects under study have their own risk register or not.

**Table 4.19: Frequency of Respondent's Answers about Projects having their own Risk Register Document**

<b>Risk Register for Projects?</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
No	33	94.3	94.3	94.3
Yes	2	5.7	5.7	100.0
Total	35	100.0	100.0	

Source: Own Survey (2018)

Only 2 respondents claim that the projects under study have their own risk register. The rest 33 respondents designate in their answers that the projects didn't have a risk register document. A desk study made to verify this issue came up with a result supporting the idea displayed by the majority of the respondents that the projects under research have no risk register. However it is also noticed in the desk study that railway construction projects like Awash-Weldiya which is currently under construction have its own risk register document which is open to be updated regularly.

#### 4.6.5 Risk Management Processes

This section of the study is aimed at describing methods and techniques applied in ERC through the processes of risk identification, analysis and response practices. Data collected from the desk study and the open ended questions presented for the respondents in the questionnaire is organized into a meaningful format and presented.

Respondents have been presented with a list of risk identification techniques and asked to indicate the methods applied to identify project risks in ERC. The following techniques are frequently marked by the respondents:

- ❖ Document Reviews- specially reviewing environmental and social feasibility studies undertaken before construction project commencement.
- ❖ Expert Judgment- those top management personnel working in areas related to project execution and monitoring department are more involved relative to other staff.
- ❖ Information gathering techniques in the form of field visits are also made.
- ❖ SWOT analysis is also done at the corporate level.
- ❖ Assumptions analysis is also made by the corporation to spot the major risks to be faced while undertaking the projects.
- ❖ PEST analysis is prepared at the corporate level.

The same is done to find out the major types of risk analysis techniques applied in ERC. The respondents frequently answered that like the process of risk identification those top management personnel working in areas related to project execution and monitoring department are more involved in risk analysis relative to other staff; i.e. expert judgment is the only technique applied to analyze risks. Hence risk analysis is the most neglected step in the process of project risk management in ERC. This finding is further supported by a research work by Wubshet (2015). However Tomas (2016) discussed that it is risk identification which is the most neglected step in the overall risk management process while risk response gets high attention.

Regarding the appliance of risk treatment methods it is found in the desk study and the survey that the transference of risks, a risk response strategy whereby the project organization shifts the impact of a threat to a third party together with ownership of the response, method is widely used by ERC. ERC put several clauses in the contracts signed with the project contractors which will enforce them to share certain risks which may arise in the project lifetime. The following are among the major issues regarding risk transference techniques applied by ERC addressed in the contract documents so that the contractors will also take responsibility of risk events:

- ✚ Indemnities of injuries and death of project personnel and also damage and loss of properties.
- ✚ The contractor's care of the works and goods from the commencement date until the issuance of taking-over certificate.
- ✚ Employer's risks like war, hostilities, invasion, rebellion, terrorism, explosions ...

- ✚ Consequences of Employers risks; addresses that the contractor is entitled for extension of time and additional payment for rectifying the damages caused by Employer's risks; and
- ✚ Limitation of liability of both parties is also discussed.

Other contractual clauses are also included in the contract which forces to be assumed that the contractors has all necessary information as to risks, contingencies and other circumstances which may affect the work; therefore the contract price shall not be adjusted to take account of any unforeseen difficulties or costs. Other contractual essences which deal with project risk response mechanisms include:

- ❖ Advance payment guarantee,
- ❖ Performance guarantee,
- ❖ Extension of time for project completion,
- ❖ Defects liability,
- ❖ Variations and price adjustments,
- ❖ Delay damages,
- ❖ Contract termination by ERC and contractors,
- ❖ Claims, disputes and arbitration

Another risk transference mechanism used by ERC is to oblige contractors to buy insurance coverage, in the joint names of the client and the contractor, for the construction works, plants, materials, documents and its project personnel. Then the contractors shall provide written evidence to ERC that the insurance required under the contract have been effective and shall provide the insurance policies to ERC.

Risk acceptance techniques are also applied by ERC. If an event or circumstance occurred which is beyond the control of the contractual parties and which could not reasonably be avoided before signing the contract; it is addressed in the contract agreement documents as Force Majeure. Employer's risks like war, hostilities, invasion, rebellion, terrorism, explosions... are considered as force majeure and the risks associated with them will be retained by ERC.

Risk avoidance, whereby the project organization acts to eliminate the threat or protect the project from its impact, and risk mitigation , where a project organization acts to reduce the probability of occurrence or impact of a risk, techniques are less applied by ERC.

#### 4.6.6 Formal Project Risk Management Practice

The process of risk management by a project organization can be applied in a very formal way, with defined work processes, or informally, with no defined processes or methods (M-Libraries, n.d).

The research tries to find out the assignment of proper resources for project risk management practices in the corporation by asking respondents if they think whether the corporation is assigning enough resources for the process or not. Table 4.20 below will show how the respondents reacted:

**Table 4.20: Frequency of Respondent’s Answers Regarding the Assignment of Enough Resources for RM Practices by ERC**

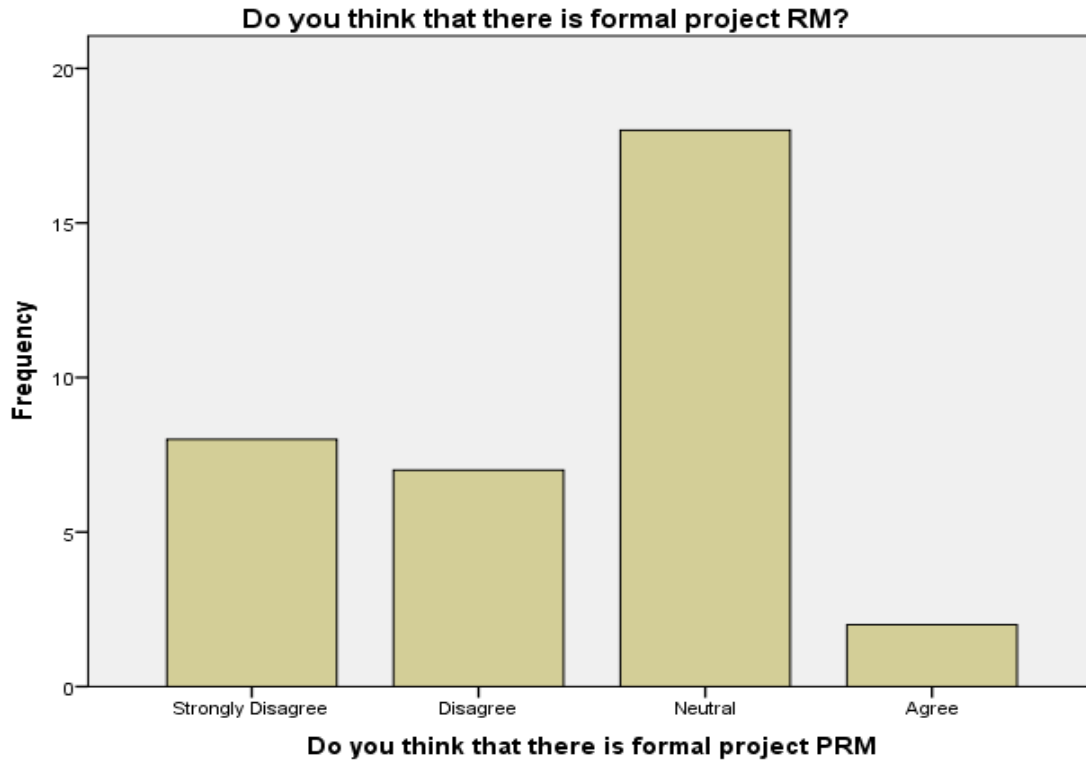
<b>Enough Resources Assigned for PRM?</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
No	32	91.4	91.4	91.4
Yes	3	8.6	8.6	100.0
Total	35	100.0	100.0	

Source: Own Survey (2018)

As depicted in the above table only 3 respondents believe that the corporation is assigning enough resources for risk management activities while the rest 32 respondents didn't.

Respondents are further asked about their thinking with regard to the existence of formal project risk management having its own defined work processes in ERC using five Lickert items namely; strongly agree, agree, neutral, disagree and strongly disagree to show their level of agreement or disagreement regarding the issue.

Among the total 35 respondents participated in the survey only 2 respondents agreed that there is a formal PRM in ERC while the rest 33 respondents strongly disagree, disagree or remained neutral about the issue. Look figure 4.6 below:



**Figure 4.6: Frequency of Responses on the Existence of Formal PRM in ERC**

Source: Own Survey (2018)

#### **4.6.7 Effectiveness of ERC in Project Risk Management**

Respondents are asked to rate the effectiveness of the overall project risk management practices of the corporation using five Likert items namely; Very effective, effective, acceptable, poor and very poor to show their level of agreement or disagreement regarding the issue. The frequency of respondents' answers is displayed below:

**Table 4.21: Frequency of Respondent's Answers Regarding the Effectiveness of ERC in PRM**

<b>Effectiveness of ERC in PRM</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Very Poor	6	17.1	17.1	17.1
Poor	22	62.9	62.9	80.0
Acceptable	5	14.3	14.3	94.3
Effective	2	5.7	5.7	100.0
Total	35	100.0	100.0	

Source: Own Survey (2018)

Regarding the effectiveness of ERC in PRM practices in the eyes of respondent's; around 63% of the respondents believe that the corporation is poorly effective in managing project risks. While only 5.7% of the respondents claim that the corporation is effective, the rest 14.3 and 17.1% think the corporation's effectiveness regarding project risk management is acceptable or very poor respectively.

The following list shows summary of the possible reasons for the poor effectiveness of ERC in project risk management practices outlined by the respondents and examined in the desk study:

- ❖ Lack of concern for risk management activities,
- ❖ Lack of technical knowledge regarding risk and risk management,
- ❖ Lack of communication and information flow,
- ❖ Poor resource assignment for risk management practices,
- ❖ No training and development in the area,
- ❖ No practical risk guideline/policy and
- ❖ Risk management often viewed as financial concern only.

# **CHAPTER FIVE**

## **CONCLUSIONS AND RECCOMENDATIONS**

### **5.1 Introduction**

Having a general objective of assessing the overall project risk management practices of railway construction projects undertaken by ERC; the research also tries to review the current level of employee awareness regarding risk and risk management practices, identify the major types of risks involved in undertaking railway construction projects and rank the risks based on their probability of occurrence and impact on project objectives and finally to determine the techniques used to carry out project risk management processes in ERC.

To appropriately accomplish the research objectives relevant literatures were reviewed and feasible research methodology developed. The data collected through questionnaire survey, desk study and document reviews was analyzed using statistical and qualitative techniques and the findings have been discussed in the previous sections of the paper. The upcoming final sub sections of the study will present conclusions and recommendations based on the research findings.

### **5.2 Conclusions**

The following concluding remarks are drawn from the finding of the study:

- a) The current level of awareness of ERC employees regarding risk and risk management practices can be considered as low since there is no common understanding of the term “Risk” within the employees of ERC, there is lack of communication of risks across the corporation and project stakeholders, there is shortage of training and/or development program related to project risk or risk management and there is also little involvement of respondents in risk identification, analysis and/or risk response mechanism decision making processes.
- b) Financial risks (increased material cost, low market demand, exchange rate fluctuation, payment delays and improper tax estimations etc...), technical risks (inadequate specification, inadequate site investigation, change in scope, construction procedures and insufficient resource availability), right of way (access to construction site risks including

Right of way problems, compensation, demolition...), design risks(defective design, design changes, awarding design to inexperienced designer...)and organizational risks (contractual relations, contractor's experience, attitude of project participants, inexperienced work force and communication) are the top five risks ranked based on their probability of occurrence.

- c) The top five risks ranked based on their impact on project cost are financial, technical, design environmental (natural disasters and weather implications) and access to site risks. While access to construction site, design, financial, organizational and construction (labor productivity, labor disputes, site condition, equipment failures, too high quality standard and new technology) risks are ranked on top by the respondents based on their impact on project time; material risks (Material not conforming to specification, lack of material availability...), technical, design, organizational and construction risks are the top five risks which will highly impact project quality according to the analyzed data.
- d) Even if there is specific working team in ERC named "Project Feasibility and Risk Assessment" which is responsible for executing the processes of project feasibility study and risk assessment; it is not equipped with the necessary skilled staff and not operational yet. In addition even if there is a draft risk management guideline prepared by the corporation it is not functional yet.
- e) The process of project risk management is not properly integrated with the overall strategic direction of the corporation and there is no risk register for the projects under study; hence it can be concluded that ERC is managing crises not risks.
- f) Usual methods of risk identification like document reviews, expert judgment, information gathering, SWOT analysis, assumptions analysis and PEST analysis are used by ERC. However based on the research findings it can straightforwardly be concluded that risk analysis is the most neglected step in the process of project risk management in ERC. While risk transference and acceptance are the two mostly used methods of risk response by ERC, risk avoidance and mitigation techniques are less applied.
- g) Due to reasons like lack of concern, inadequate resource assignment for risk management practices, poor communication, lack of training and development programs and no practical risk management policy ERC is poorly effective in managing its risks and it can be wrapped up that there is no formal risk management practice in ERC.

### **5.3 Recommendations**

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

- I. Proper emphasis should be given to create a good understanding and enhanced technical knowledge regarding risk and risk management practices within the employees' of ERC. In addition ERC should prepare appropriate training and development programs related to risk and risk management for its employees.
- II. Since communication is one of the major factors of raising risk awareness in project organizations, proper communication tools shall be prepared and put into practice to easily communicate risks and risk management activities across the corporation and project stakeholders.
- III. Even if it is advised to assemble a separate department which is responsible for risk management with full power and authority, it is also recommended to exercise risk management activities in every departments of ERC and all personnel shall be allowed to get involved in the processes so that the corporation get affluent in its experience in managing risks.
- IV. Special emphasis should be given to address financial, access to construction site, material and all those risks ranked as having a high impact on the major project objective parameters of cost, time quality and revealed as having a high probability of occurrence.
- V. As envisioning to modernize the railway transport sector and contribute its share to the nations ambitious and green economic development endeavor through the construction and management of both cargo and public railway services by constructing more than 5000 km long railway interconnecting major cities and border towns of the country; ERC should properly integrate risk management practices with its strategic direction for successful implementation of its project undertakings.
- VI. Besides using risk transference and acceptance techniques to respond to a risk event ERC should also apply risk mitigation methods and take actions to reduce the probability of occurrence or an impact of a risk event.
- VII. To make informed and objective decisions the management of ERC should give concern for the formal application of risk management processes, allocate adequate resources for the process and give special emphasis for risk analysis activities.

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# APPENDIXES

## Appendix I:

### Research Budget Plan

Nº	Cost Item	Unit of Measurement	Quantity	Unit Price (Birr)	Total Cost (Birr)
1.	Printing	Pages	500	2	1,000.00
2.	Stationeries and consumables	Piece	20	50	1,000.00
3.	Transportation	Trip/km	20	10	200.00
4.	Data collection	-	-	-	800.00
5.	Refreshment for questionnaire respondents	Per head	-	-	1,000.00
6.	Telephone and Internet	-	-	-	500.00
7.	Miscellaneous Expense	-	-	-	1,000.00
	<b>Total Cost</b>				<b><u>5,500.00</u></b>

## **Appendix II:**

### **Questionnaire**

**Addis Ababa University**  
**School of Commerce**  
**Department of Business Administration and Information System**  
**Questionnaire**

### **Introduction**

Dear Participant:

I am a graduate student in Project Management at Addis Ababa University School of Commerce. I am conducting a research on “**Assessing Project Risk Management Practices in Railway Construction Projects: the case of Ethiopian Railways Corporation**” for my MA Thesis.

The purpose of the study is to assess the overall risk management practices of Ethiopian Railways Corporation by identifying the major types of risks involved in project undertakings, determining the major project risk response mechanisms applied and identifying the current level of awareness regarding risk management practices in the company.

The questionnaire is cataloged into FOUR major sections with a total of 45 questions. The first section comprises general profile of the respondents. Section two will assess the current level of awareness regarding risk management practices in Ethiopian Railways Corporation. The third section will help to identify the major types of risks involved in project undertakings and the final section will review project risk management practices applied in project activities.

The survey will only take about 20-30 minutes of your time. Your response is highly precious and contributing to the outcome of the research. I assure you that your answers will be kept confidential and be used for this academic study only.

If you need any clarifications on the questionnaire please contact me at +251912058696 and/or aminujuharkemal@yahoo.com

Thank you for your time and consideration.

Aminu Juhar Kemal  
Post Graduate Student, Project Management  
Addis Ababa University, School of Commerce  
Addis Ababa, Ethiopia

## Section 1- Respondent's General Profile

1- Name (**Optional**): \_\_\_\_\_

2- Current Position

Expert  Team Leader  Chief Officer and Above

3- Educational Background?

BA/B.Sc  MA/M.Sc  PhD  Others (Please Specify) \_\_\_\_\_

4- Field of Specialization?

Engineering  Business  Law  Others (Please Specify) \_\_\_\_\_

5- Experience in Ethiopian Railways Corporation

0-5 Years  5-9 Years  More than 9 Years

## Section 2- Risk Awareness

A. The following questions are intended to assess the current level of employee awareness regarding risk and risk management in Ethiopian Railways Corporation. (Use **X** sign to indicate your answer)

1. Do you think most of the personnel in ERC have a common understanding of the term 'risk'?  
Strongly Agree  Agree  Neutral  Disagree  Strongly Disagree
2. If your answer to the above question is "Disagree or Strongly Disagree" please specify the possible reasons? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. Are risks communicated across the Corporation and project stakeholders?  
Strongly Agree  Agree  Neutral  Disagree  Strongly Disagree
4. If your answer to the above question is "Strongly Agree or Agree"; what type of risk communication methods are used? (Written reports, verbal, E-mail, Others please specify)  
\_\_\_\_\_  
\_\_\_\_\_
5. Have you ever attended a training and development program related to project risk or risk management?  
Yes  No
6. If your answer to the above question is "Yes"; was the training and development program organized by ERC?  
Yes  No
7. Have you ever get involved in project risk identification, analysis and response mechanism decision process in ERC?  
Yes  No
8. Does ERC have a risk management guideline/manual?  
Yes  No

### Section 3- Major Risks in Project Undertakings

B. From your experience and observation what are the major sources of risks in Addis Ababa light rail, Addis Ababa/Sebeta-Meiso and Mieso-Dewanle railway construction projects? Please identify from the list and rank their probability of occurrence (Use **X** sign to indicate your answer)

**Where:** (Low means a risk with less than 10% probability of occurrence, Medium means a risk with a probability of occurrence between 10 to 50% and High a risk with greater than 50% probability of occurrence)

N <sup>o</sup>	Risk Categories	Probability of Occurrence		
		Low	Medium	High
1.	<b>Technical Risks:</b> (inadequate specification, inadequate site investigation, change in scope, construction procedures and insufficient resource availability etc.)			
2.	<b>Construction Risks:</b> (labor productivity, labor disputes, site condition, equipment failures, too high quality standard and new technology)			
3.	<b>Physical Risks:</b> (damage to structure, damage to equipment, labor injuries, equipment& material fire and theft etc.)			
4.	<b>Organizational Risks:</b> (contractual relations, contractor's experience, attitude of project participants, inexperienced work force and communication)			
5.	<b>Financial Risks:</b> (increased material cost, low market demand, exchange rate fluctuation, payment delays and improper estimation taxes etc.)			

<b>6.</b>	<b>Socio-Political Risks:</b> (changes in laws and regulations, pollution and safety rules, bribery/corruption, language/cultural barriers, law & order, war and civil disorder and requirement for permits and their approval)			
<b>7.</b>	<b>Environmental Risks:</b> (natural disasters and weather implications.)			
<b>8.</b>	<b>Design Risks:</b> (defective design, design changes, awarding design to inexperienced design...)			
<b>9.</b>	<b>Legal Risks:</b> (Ambiguity of work legislations, difficulty to get work permits, disputes among contracting parties...)			
<b>10.</b>	<b>Material Risks:</b> (Material not conforming to specification, lack of material availability...)			
<b>11.</b>	<b>Access to Construction Site Risks:</b> (Right of way problems, compensation, demolition...)			
<b>12.</b>	<b>Others</b> (Please Specify)			

C. From your experience and observation please indicate the impact of listed risk categories on cost, time and quality of the above mentioned three projects. (Use **X** sign to indicate your answer)

**Where:** (Low means a risk with a minor impact on project cost, time and quality to be dealt with routine management procedures, Medium means a risk with moderate impact on project cost, time and quality but can be managed with effort using standard procedures and High means a risk with a major impact on project cost, time and quality which needs senior management attention.

N <sup>o</sup>	Risk Categories	Impact of the risk on project:										
		Cost			Time			Quality				
		Low	Medium	High	Low	Medium	High	Low	Medium	High		
1.	<b>Technical Risks:</b> (inadequate specification, inadequate site investigation, change in scope, construction procedures and insufficient resource availability etc.)											
2.	<b>Construction Risks:</b> (labor productivity, labor disputes, site condition, equipment failures, too high quality standard and new technology)											
3.	<b>Physical Risks:</b> (damage to & equipment, labor injuries, equipment& material fire and theft etc.)											
4.	<b>Organizational Risks:</b> (contractual relations, contractor's experience, attitude of project participants, inexperienced work force and communication)											

5.	<b>Financial Risks:</b> (increased material cost, exchange rate fluctuation, payment delays etc.)													
6.	<b>Socio-Political Risks:</b> (changes in laws and regulations, pollution and safety rules, bribery/corruption, language/cultural barriers, law & order, war and civil disorder)													
7.	<b>Environmental Risks:</b> (natural disasters and weather implications.)													
8.	<b>Design Risks:</b> (defective design, design changes, awarding design to inexperienced design...)													
9.	<b>Legal Risks:</b> (Ambiguity of work legislations, difficulty to get work permits ...)													
10.	<b>Material Risks:</b> (Material not conforming to specification, lack of material availability...)													
11.	<b>Access to Construction Site Risks:</b> (Right of way problems, compensation, demolition...)													
12.	<b>Others</b> (Please Specify)													

## Section 4- Risk Management Practices

D. Dear participant this is the final section of the questionnaire. (Please Use **X** sign to indicate your answer)

1. Is there specific department/Work unit responsible for project risk management practices?

Yes  No

2. Is the practice of risk management integrated with the corporation's strategic direction and plan?

Yes  No

3. Does ERC have a risk management guideline/manual?

Yes No

4. Does Addis Ababa light rail, Addis Ababa/Sebeta-Meiso and Mieso-Dewanle railway construction projects have their own risk management plan before construction?

Yes  No

5. Does Addis Ababa light rail, Addis Ababa/Sebeta-Meiso and Mieso-Dewanle railway construction projects have their risk management officer/team?

Yes  No

6. Do ERC and its projects have a risk register? (a document in which the results of risk analysis and risk response planning are recorded)

Yes  No

7. If your answer to the above question is "Yes"; what information is available in the risk register and who is responsible for preparing the document?

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8. What risk identification methods are used for the projects in ERC?

Document Reviews	<input type="checkbox"/>	Information Gathering	<input type="checkbox"/>	Checklist Analysis	<input type="checkbox"/>
Assumptions analysis	<input type="checkbox"/>	Diagramming Techniques	<input type="checkbox"/>	SWOT Analysis	<input type="checkbox"/>
Expert judgment	<input type="checkbox"/>				

Others please specify \_\_\_\_\_

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9. What risk analysis methods are used for the projects in ERC?

Quantitative risk analysis  Probability and impact matrices  Modeling

Expert Judgment  Risk categorization  Risk urgency assessment

Sensitivity analysis

Others please specify \_\_\_\_\_

10. What risk treatment methods are used for the projects in ERC? (avoidance, mitigation, transference or accepting the risk)

Risk Avoidance  Risk Mitigation  Risk Transference  Risk Acceptance

Others Please Specify \_\_\_\_\_

11. How effective is the Corporation in its process for identifying, analyzing and responding to project risks?

Very Effective  Effective  Acceptable  Poor  Very Poor

12. Is there a mechanism in which the Corporation monitors and evaluates changes in the external environment and their impact on the organization's strategy and project risk management practices?

Yes  No

13. If your answer to the above question is "Yes"; who is responsible for monitoring and evaluation work?

\_\_\_\_\_  
\_\_\_\_\_

14. How is risk management coordinated across the Corporation?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

15. Is there an appropriate documentation system in projects?

Yes  No

16. Does the Corporation assign enough resources for the risk management practices?

Yes  No

17. Do you think there is formal project risk management practice in ERC?

Strongly Agree  Agree  Neutral  Disagree  Strongly Disagree

18. If your answer to the above question is “Disagree or Strongly Disagree”; what could be the possible reason? (Lack of Technical knowledge, Lack of information/communication, Lack of time, Lack of concern, Others please specify)

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19. If you have anything to add please;

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