ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES

AN ASSESSMENT OF RISK MANAGEMENT PRACTICES: IN THE CASE OF ETHIOTELECOM TOWER CONSTRUCTION PROJECT

BY

FASILE MEKONNEN

SGS/0398/2010A

JUNE 2019

ADDIS ABABA, ETHIOPIA

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APPROVED BY BOARD OF EXAMINERS

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Statement of Declaration

I, fasile mekonnen, have carried out independently a research work on the topic entitled “An assessment of risk management practices: in the case of Ethiotelecom tower construction project” in partial fulfillment of the requirement for the degree of masters of art in project management with the guidance and support of the research advisor Dejene Mamo (Assoc. Prof.). This study is my own work that has not been submitted for any degree or master program in this or any other institutions.

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ENDORSEMENT

This thesis has been submitted to St. Mary's university, school of graduate studies for examination with my approval as a university advisor.

_____ _____

Advisor **Signature**

St. Mary's university, Addis Ababa **May 2019**

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LIST OF ABBREVIATION AND ACRONYMS

PLC: Project Life Cycle

SICETE: Second International Conference on Emerging Trends in engineering

ISSN: International standard Serial Number

IJCRB: Interdisciplinary Journal of Contemporary Research in Business

ZTE: Zhongxing Telecommunication Equipment

PHA: Preliminary Hazard Analysis

MCS: Monte Carlo Simulation

SRM: Strategic Risk Management

FRM: Financial Risk Management

ERM: Enterprise Risk Management

COSO: Committee of Sponsoring Organization of the Treadway Commission

SCRM: Supply Chain Risk Management

AHP: Analytical Hierarchy Process

FST: Fuzzy Set Theory

SWIFT: Structured "What-if" Technique

PERT: Project Evaluation and Review Technique

P&I: Probability and Impact

ANN: Analytical Neural Network

BBN: Bayesian Belief Network

LR: Likelihood occurrence of Risk

RCA: Root Cause Analysis

BIA: Business Impact Analysis

TA: Toxicity Assessment

ABSTRACT

This study focused on an assessment of risk management practice in the case of Ethiotelecom tower construction project. The descriptive survey design was used for data collection. Data were generated through personal interview and survey questionnaires. The interview and questionnaires were prepared and conducted to Ethiotelecom tower construction project department, ZTE and HUAWEI staffs were involved collecting the most common and frequently used of the identified risk factors, to assess risk analysis techniques and risk management techniques on the project. The finding of this study specified that to identify the major risk factors that affect the tower construction project in Ethiotelecom tower construction project. So categories of different risk groups and risk factors related to tower construction project was done. 37 types of risk factors, 13 types of risk analysis techniques, 10 types of preventive techniques and 9 types of mitigated techniques were selected under this study. Socio-political risk category was the first higher risk categories from the others of tower construction project and from those categories bribery/corruption risk factor was also affect the project highly from all 37 risk factors. Financial risk category was the second type of higher risk category and from this category increase material cost and availability and fluctuation in foreign exchange were affect the project highly next to bribery/corruption. Risk management department staff highly used expert system, using computer simulation and Delphi techniques type of risk analysis techniques. Purchase technology/software to capture and display critical information, seek out the experts and use them, Hire or assign internal staff and Use hedging budget and labor were practices highly on mitigation techniques of risk management techniques. Recognizing the Identify hazards, Standards on Protective Equipment (Equipment care), Good training program also practices on preventive techniques. The study concludes most of the Ethiotelecom tower construction project staff did not have sufficient knowledge about risk management and also, they were new for risk factors and risk management techniques. Based on the findings, a recommendation for Ethiotelecom tower construction project, Ethiotelecom should give careful attention for risk management practices and techniques. Ethiotelecom top management must deal with the contractors frequently about risk before that happened and use standard risk management simulation software. Ethiotelecom staffs those involves on the project must be participate and take any type of risk management training program.

Key Words: Risk Management, project management, tower construction project

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Risk management is a proactive approach to control the level of risk and to mitigate its effects. It also prepares project managers to take risks when a time, cost, and/or technical advantage is possible. Successful management of project risks gives the project manager better control over the future events and can significantly improve chances of reaching project objectives on time, within budget, and meeting required technical/functional performance (Gray and Larson, 2008). Risk management is probably the most difficult aspect of project management.

Risk management has become an important part of the management process for any project. In fact, Risk management came into the foreground of business literature during the last two decades of the 20th century (Loosemore et al., 2006), Akintoye et al. (2003) believes that the circumstances within the construction industry had led to adopting risk management and analysis into practice. An effective use of project management techniques such as risk and value management are considered as key supporting processes and to add to them quality, cost, time and change control (Fewings, 2005); all together generate an integrated approach to the project success. Risk management requires top-level management support, acknowledgment that risks are realities, and a commitment to identify and manage them. One discriminator of a successful organization or project is the use of risk management to anticipate potential negative conditions, problems, and realities. Ineffective projects are forced to react to problems; effective projects anticipate those (Loosemore et al., 2006). Risk management is a broad factor affecting quite a number of business sectors however it's also a factor which must be addressed by every human being on earth regarding their way of living otherwise if ignored human life is left in harm's way and susceptible to death, diseases and poverty.

Risk management is a series of steps whose objectives are to identify, address, and eliminate risk items before they become either threats to successful operation or a major source of expensive rework. (Boehm, 1989). The risk management process can be broken down into two interrelated phases, risk assessment and risk control. These phases are further broken down. Risk assessment involves risk identification, risk analysis, and risk prioritization. Risk control involves risk planning, risk mitigation, and risk monitoring (Boehm, 1989). It is essential that risk management be done iteratively, throughout the project, as a part of the team's project management routine.

According to Herroelen (2011), risk management is generally a part of other management systems such as quality, environmental or work environmental management systems. Some of the core values are environmental management systems, the pledge of all employees, customer concentration, management commitment, focus, continuous improvement, and fact-based decisions. These basic values are closely connected and could easily be found in the theoretical

framework of risk management. Risk management is a complicated process that interrelates with many other processes in the construction industry. Investigating project risks includes studying potential events that may affect the scope, cost, time, or performance of the project's objectives (Alexander, 2015). Risk management in a project encompasses the identification of influencing factors which could negatively impact the cost schedule or quality objectives of the project, quantification of the associated impact of the potential risk and implementation of measures to mitigate the potential impact of the risk.

According to (Loose more *et al*., 2006); project risk management is all about people making decisions for improving project performance and achieving project objectives. It the most difficult part in the risk management process is not finding techniques for identifying and managing risks but accepting that life is uncertain, and it cannot be ignored so it is better to grasp it. Chapman and Ward (2003) believe that; Risk management should be a part of project life cycle (PLC) and an on-going activity because prerequisites of a project and its environment will vary throughout its duration. In addition, it should be considered as an „adding" process to the project management process as a whole, not an „add-on". They argue that the risk management process should be addressed in all phases of the project life cycle and they have considered the planning phase as the initiation point of this process.

1.2 Statement of the problem

Risks and uncertainties, involved in construction projects, because cost overrun, schedule delay and lack of quality during the progression of the projects and at their end (PMBOK®, 28-42, 2002). "The situation is made complex by many external factors. The record of accomplishment of construction industry is very poor in terms of coping with risks, resulting in the failure of many projects to meet time schedules, targets of budget and sometimes even the scope of work. As a result, a lot of suffering is inflicted to the clients and contractors of such projects and to the public.

The poor risk management as one of the principal delay factors that actions and inactions of construction project participants contribute to overall project delays (Audrius and Nerija, 2012).
As construction projects become more technically and contractually complex, the risks associated with them are magnified and the negative impacts to their execution are enhanced. Thus, timely and adequate risk identification and analysis is paramount in order to enable risk to be adequately managed and administered (Cohen, 2002). Late completion of projects, surpassing their estimated budgets and in some worse instances without even achieving the desired quality and operational requirements, has given a bad name to the industry. Thus, effective management of construction-associated risks remains a big challenge to the industry stakeholders (Salman and Rizman, 2014). Construction is one of the most dynamic, risky, and challenging businesses, and is associated with a high degree of risk due to the nature of its business activities, processes, and external environment. However, the construction industry has a poor reputation for managing risks, with many major projects failing to meet deadlines and cost targets (Edwards, 1995). Different stakeholders on construction projects rarely use these techniques due to lack of

knowledge and expertise (Salman, 2014). Risk management will not remove all risks from the projects. Its main objective is to ensure that risks are managed most effectively. The formal risk analysis and management techniques are rarely used by construction industry due to lack of knowledge and expertise.

Construction risks can be related to technical, management, logistical, or sociopolitical aspects or can be related to natural disasters. Formal risk analysis and management techniques are rarely employed by construction industry owing to the lack of experience and knowledge in the area. There isn't any absolute risk free project and therefore if the risks are not carefully identified, properly analyzed and workable risk management strategies put in place, then the likelihood of the project failure will be high (Mahendra et al., 2013).

The industry also holds disbelief that these techniques are suitable to be employed in construction projects, much in the same manner as employed in other industries (Mubin M. Shaikh, 2015).

Lack of risk management in Construction projects is one of the major setbacks for construction projects performance in Ethiopia. It includes identification, assessment, monitoring, and sharing (Mitikie, 2017). As observation and impacts of risk that show from literature show the current status of risk identification, assessment, monitoring and risk sharing in is not practiced and modeled. According to the parties involved in Ethiopian building construction projects, most projects are not completed in conformity to the original plan i.e. they face various problems and changes that lead to delay, cost overrun or lower quality. The risks involved throughout the life of a building project might be causes for variations in project objectives if they are not managed well.

Ethiotelecom tower construction projects suffer on quality, time and delay. Therefore, from the above fact, we can mention some knowledge areas on risks and its management and also it can be point out different faces with a challenge of an effective risk assessment and management system. Previous researches similar to this show that the main causes of delay and cost overrun in building construction is improper project management and claim administration. Due to unforeseen incidences and contract management problems, building projects sometimes face many kinds of claims.

From the above study, we conclude that there are different difficulties and issues identifying with risks in Ethiotelecom tower construction projects and assess the risk management techniques and practices. In addition, there is no research on risk management practices in Ethiotelecom tower construction project.

1.3 Objective of the Research

The general objective of this study is to assess the risk management practices of Ethiotelecom tower construction projects.

1.4 Specific Objectives

The specific objectives of this study are as follows:

- To identify the most common and frequently happened risk factors that affect Ethiotelecom tower construction projects.
- To investigate the risk management techniques those are being practices on the Ethiotelecom tower construction projects.

1.5 Research Questions

Based on the gaps identified in the above, this study will be addressing the following research questions.

1. What are the most common and frequently used the identified risk factors that affect Ethiotelecom tower construction projects?
2. What are the risk management techniques and practices being used on the Ethiotelecom construction projects?

1.6 Significance of the study

More importantly, this study was adding to existing knowledge on the subject matter. It is hope that a careful explanation of previous works as well as exploration of new works on Ethiotelecom cellular site project risks management, would unfold new levels of thinking, dimensions and the outlook on the subject matter. It helped for managers and other professionals find the best way of planning and executing projects through the appropriate risk management tools.

This research also provides for Ethiotelecom cellular site projects with guidelines of best risk management practices.

The findings of this study was provided a wide stock of information for use not only in academia but also by corporate practitioners and other Ethiotelecom cellular site players in their bid to developing sustainable business climate and risk management techniques.

1.7 Scope and limitations of the study

This study is limited to only Ethiotelecom tower construction projects. This is a general limitation with the dependence on questionnaires as the main source of primary data for research. During the questionnaire administration, information could be sourcing from respondents who largely expresses their judgements, beliefs and values in providing answers to the questions

presented to them. A likelihood of respondents would be providing unreliable information that could distort the outcomes of the research.

1.8 Organization of the Study

This thesis is orgnized into five chapters: introduction; literature review; research methodology; findings and discussion; and summary, conclusion and implications. The coverage of each of these chapters is as follows:

Chapter one covers the background of the study and details the main concepts of the study namely assessment of risk management practices. The chapter also contains a discussion tower construction projects in Ethiotelecom, the research problem, the research objectives and value of the study. Chapter two is a literature review in which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions. Chapter three describes the research methodology and details the research philosophy, the research design, the study population and sample, data collection methods, reliability and validity of the measurement instruments. Chapter four covers the study findings including the response rate, respondent‘s profile, data analysis, interpretation and presentation of this research. Chapter five presents a summary of findings for each of the research objectives, conclusion from study findings and study contributions.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews the various theories, concepts and studies that exist on the risk management of tower construction projects based on the research question.

2.1 Overview of Ethiotelecom tower construction project

Ethiopia is one of the last countries in Africa to allow its national telco a monopoly on all telecom services including fixed, mobile, internet and data communications. For many years Ethio Telecom's monopolistic control stifled innovation, restricted network expansion and limited the scope of services on offer. However, a management contract with Orange Group dramatically improved the company's performance, though there remain weaknesses in quality of service. The contract was considered a first step towards sector privatisation and the introduction of competition, and though the government for many years rejected calls to progress along these lines, citing the need for higher profits from the company to subsidise unrelated projects, a shift emerged in mid-2018 with plans to sell a stake in the telco as part of a wider economic reform.

There has been considerable investment in telecoms services, infrastructure and service expansion projects in recent years. Ethio Telecom has secured a network monitoring platform to help it improve services and has also revised plans to launch a telecom satellite, while the government has proposed building a $3 billion technology city. However, the sector remains heavily regulated and the government has complete control over networks, with virtually unlimited access to the call records of all phone users and to logs of internet traffic. Most of the technologies deployed have been provided by ZTE and Huawei, which have often been preferred for offering vendor financing.

Despite major vendor contracts aimed at improving the reach and capabilities of mobile networks, the country's mobile penetration remains among the lowest in Africa. Nevertheless, growth is strong and considerable growth potential remains. Policies have been guided by the government's Growth and Transformation Plan.

The country's broadband market is also set to develop further following substantial increases in international bandwidth, improvements in national fiber backbone infrastructure and the growing availability of mobile broadband services via 3G and LTE networks. After years of low uptake due to prohibitive pricing, retail prices are now comparable to other more developed markets in the region.

2.2 Theoretical Literature Review

2.2.1 Theory of risks

Risk can be defined as the event that negatively affects the project objectives such as time and schedule, cost, quality of work. Risk Management is the process of identifying the potential risk associated with risk and responding to those risks. Risk in any project is a choice rather than fate.

(Gary R. Heerkens, 2002) defined uncertainty as an absence of information, knowledge or understanding regarding the outcome of an action, decision or event and risk as the measure of the uncertainty that exists.

Risks and uncertainties inherent in the construction industry are more than other industries. The process of planning, executing and maintaining all project activities is complex and time-consuming. The whole process requires number of people with diverse skill sets and the coordination of a vast amount of complex and interrelated activities. The situation is made complex by many external factors. The track record of construction industry is very poor in terms of coping with risks, resulting in the failure of many projects to meet time schedules, targets of budget and sometimes even the scope of work. As a result, a lot of suffering is inflicted to the clients and contractors of such projects and also to the general public. Risk in the construction industry is perceived to be a combination of activities, which adversely affect the project objectives of time, cost, scope and quality. Some risks in construction processes can be easily predicted or readily identified; still some can be totally unforeseen. Construction risks can be related to technical, management, logistical, or sociopolitical aspects or can be related to natural disasters. In the domain of project management, some of the critical effects of risks are failure to achieve operational requirements and the required quality, non-completion of the project within stipulated time and estimated cost.

According to Salman A., Rizwan U.Farooqui, (2014), uncertainty is related to the probability of occurrence of an event. The research further explains that an event is assumed to be certain if the probability of its occurrence is 100% or totally uncertain if the probability of its occurrence is 0%. The existence of uncertainty makes it difficult to predict future events. Risk is defined as an event that has a probability of occurring, and could have either a positive or negative impact to a project should that risk occur.

Risk in itself is not bad; risk is essential to progress, and failure is often a key part of Learning. But we must learn to balance the possible negative consequences of risk against the potential benefits of its associated opportunity. (Van Scoy, 1992).

A risk is a potential future harm that may arise from some present action; such as, a schedule slip or a cost overrun. The loss is often considered in terms of direct financial loss, but also can be a loss in terms of credibility, future business, and loss of property or life. (Wikipedia, 2004).

Risk is defined as exposure to loss/gain or the probability of occurrence of loss/gain multiplied by its respective magnitude. Events are said to be certain if the probability of their occurrence is 100% or totally uncertain if the probability of occurrence is 0%. In between these extremes, the uncertainty varies rather widely. Nowadays, risk can be assessed using various

types of information (Bon-Gang *et al*. 2014; Zavadskas *et al.* 2010b; Ustinovičius *et al.* 2010). Just as any other economic activity, construction business is risky. Successes and implementation in construction industry depends on the level of risk (Paslawski 2013). However, construction projects are perceived to have more inherent risks due to involvement of many contracting parties, such as owners, designers, contractors, subcontractors, suppliers, etc. (PMI 2004).

"Risk is the combination of probability and the extent of consequences" (Alexander 2015). Risk is the "effect of uncertainty on objectives", "Risk should be proportional to the probability of occurrence as well as to the extent of damage." Blaise Pascal (1623–1662).

According to Deviprasadh A., (2007), uncertainty is the unpredictability of environmental and organizational variables that might impact the performance of the organization or the party. Risk is the consequences of uncertainty and it is the chance of something happening that will have an impact upon project objectives which includes the possibility of loss or gain, a variation from a planned or desired outcome as a consequence of the uncertainty associated with following a particular course of action.

Risk is inherent in all human endeavors, including construction activities, and the risk elements involved are diverse and varied [Odeyinka, (2000)]. Risk has been defined in many different ways by economists, insurance scholars and construction management researchers among others. In the business and insurance domain, defines risk as measurable uncertainty or uncertainty of loss. Risk has also been defined as the uncertainty that exists as to the occurrence of some events [Greene, (2001)].

According to [Akintoye and MacLeod (1997)], risk in construction has been the object of attention because of time and cost overrun associated with construction projects. Many time and cost overruns according to [Perry and Hayes (1985)] are attributable to either unforeseen or foreseen events for which uncertainty was not appropriately accommodated. Risk in construction and engineering has been defined in various ways: the chance of injury, damage, or loss (Mehr & Cammack 1966); any exposure to the possibility of loss or damage (Papageorge 1988), the uncertainty and the result of uncertainty (Hertz & Thomas 1983), or the variation in the possible outcomes, a property of an entire probability distribution, whereas there is a separate probability for each outcome (Williams & Heins 1971).

2.2.2 Risk management theory

Risk management is a proactive approach to control the level of risk and to mitigate its effects. It also prepares project managers to take risks when a time, cost, and/or technical advantage is possible. Successful management of project risks gives the project manager better control over the future events and can significantly improve chances of reaching project objectives on time, within budget, and meeting required technical/functional performance (Gray and Larson, 2008). Risk management is probably the most difficult aspect of project management.

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According to Wenzhe T. (Dec 2007**)** "Risk Management in the Chinese Construction Industry" studied the empirical Chinese industry survey on the importance of project risks, application of risk management techniques, status of the risk management system, and the barriers to risk management, which were perceived by the main project participants. According to Riaan van Wyk, Akin tola Akintoye (Mar 2007) "Project risk management practice: the case of a South African utility company "documented the risk management practice of a utility company for its Recovery Plan project to address the risks of power interruptions Risk management is an attempt to identify potential threats to the project and the probability of risk occurrence must take appropriate actions to address these threats and verify the probability of their occurrence (Namara,2008**)**.

According to Samuel G. (1996), risk management is generally a part of other management systems such as quality, environmental or work environmental management systems. Some of the core values are environmental management systems, the pledge of all employees, customer concentration, management commitment, focus, continuous improvement, and fact-based decisions. These basic values are closely connected and could easily be found in the theoretical framework of risk management. Risk management is a complicated process that interrelates with many other processes in the construction industry. Investigating project risks includes studying potential events that may affect the scope, cost, time, or performance of the project's objectives (Alexander, 2015). Risk management in a project encompasses the identification of influencing factors which could negatively impact the cost schedule or quality objectives of the project, quantification of the associated impact of the potential risk and implementation of measures to mitigate the potential impact of the risk.

According to ISO 31000 (ISO, 2009) Risk management define creates value, it is an integral part of the organizational processes and part of the decision-making, it is systematic, structured and timely, it is is capable of continuous improvement and enhancement. The Project Management Institute (2013) considered it as one of the nine Project Management Knowledge areas in the last and previous versions of the PMBOK. Its philosophy in RM evolves towards the incorporation of new tools that reflect how times have changed regarding the incorporation of a greater number of risks in projects. Risk management is part of our daily live, even if is it noticed

or not. Most of the time, it is assessing on an unconscious level, using habits to solve them. But theses habits are different from person to person. Not everyone manage risk in the same way, but most of the times common sense commands the way of managing the risks (Cretu, et al., 2011).

Ehsan, et al. (2010) said that risk management has four phases; the first one is risk identification that is the process of identify which risks are more prone to affect the project and characterize them. The second one is risk quantification that is evaluation of the outcomes of the project based on the interaction of these risks. The third one is risk response development that definition of all the activities related to the elimination of risks during the PLC. And the final one is risk response control that response to the changes to eliminate risks during the project.

According to (Henschel, 2009; ISO 31000, 2009; Urciuoli and Crenca, 1989), definition; Risk management a preparatory step requires defining the risk management plan to be consistent with strategic business objectives, and conducting a context analysis. The first stage aims to identify all the risks to which the enterprise is exposed. The second stage is the assessment and risk analysis, which aims to determine the probability and the expected magnitude associated with the occurrence of the damage. In the literature, the first two phases (identification, evaluation and analysis) are often called risk assessment. The implementation of an RM system is a long-term, dynamic and interactive process that must be continuously improved and integrated into the organization's strategic planning (Di Serio, et al., 2011).

Strategic risk management (SRM): an integrated and continuous process of identification and assessment of strategic risks (human, technological, brand, competition, project and stagnation risks), which are considered obstacles that prevent reaching an organization's financial and operational goals (Chatterjee, et al., 2003). Financial risk management (FRM): a process of creating economic value in a firm by using financial techniques and methodologies to manage exposure to risk (credit, exchange rate, inflation, interest rate, price and liquidity risk) (Crockford, 1986). Enterprise risk management (ERM): a process applied across the enterprise, designed to identify potential events that may affect the organization, and manage risk (strategic, market, financial, human, technological and operational risks) to be within its risk tolerance, to provide reasonable assurance for achieving enterprise objectives (COSO, 2004).

According to (Regan and Patè-Cornell, 1997); risk management is engineering side it is a complex and continuous process that involves managing the planning, design, operation and evolution of an engineering system. This is aimed to identify and choose appropriate responses to problems related to different risk factors (technical/operational risks) through the use of a systemic and proactive approach. (Norman and Lindroth, 2002) according to supply chain risk management (ScRM) is a shared RM process, developed in collaboration with the partners in the entire supply chain, to deal with the risks (logistics, financial, information, relationships and innovation risks) and uncertainties resulting from logistic activities and resources. A holistic and flexible approach in governing any community, involving a series of actions (programs, projects and measures) and tools aimed at reducing disaster risks (deriving from natural phenomena, terrorism, epidemics and industrial accidents) and mitigating the spread of disasters, following the processes, structures and rigor typical of risk management (Garatwa and Bollin, 2002).

According to (Loose more *et al*., 2006); project risk management is all about people making decisions for improving project performance and achieving project objectives. It the most difficult part in the risk management process is not finding techniques for identifying and managing risks but accepting that life is uncertain, and it cannot be ignored so it is better to grasp it. Chapman and Ward (1997) believe that; Risk management should be a part of project life cycle (PLC) and an on-going activity because prerequisites of a project and its environment will vary throughout its duration. And it also should be considered as an „adding" process to the project management process as a whole, not an „add-on". They argue that the risk management process should be addressed in all phases of the project life cycle and they have considered the planning phase as the initiation point of this process.

According to (Mills, 2001); Risk management is not a one-off activity and there should be continuous management of risks throughout the life of the project. Division of risk management process into further processes and details of each process are argued in the following section.

In construction field, quality, time and cost which are referred as project objectives may hamper by the risks. It is very important for the contractor to be alert and prepare for risks that arises by identifying it (Zayed and Halpin (2005) Construction project should be adjusted to the cooperative environment by the process of risk management. But this is very unfortunate as far the condition for Pakistan is concerned. Risk management largely depends on contracts in the Pakistan construction industry. The ultimate cost of the project increased when contracts are awarded to other parties (Hameed, 2007).

From the literature point of view, practical experience, best guess and human judgment are being applied for the identification and handling of construction risks. Expert judgment is considered to be very useful for managing risks as risks are highly dependent upon specific conditions. When practical experiments, lesson learned and expert judgement are not properly secured then the problem will take place while other risks relate to possible biased decision making (Kaplinski A., 2008). Risk management consumes resources which are considered as a perception as the biggest barrier for implementation of effective risk management is lack of resources. In term of money, it is difficult to measure the benefits of good management of risks (ISO, A Risk Management – Principles and guidelines, 2009).

2.3 Empirical Literature Review

This section presented a review of the literature related to the problem under study. The section was categorized according to the specific objectives in order to ensure relevance to the overall research study.

2.3.1 Risk management in construction project

Flyvbjerg, Holm and Buhl (2003) argue that the importance of instituting risk management in construction projects is to increase value-added along the construction value chain, ensuring compliance with best practice construction approaches, thus minimizing waste and inefficiencies. Risk management of construction projects thus optimizes shareholder value on all activities along the value chain and maximizes overall profitability. This is mainly through minimizing or eliminating the potential adverse impact of uncertain events that may affect achievement of the

project objectives. Flyvbjerg et al. (2003), further observe that effective risk management increases value through adherence to budget, adherence to schedule, and conformance to quality expectations, among other measures.

According to Altoryman (2014) classified the risk factors under three heads: External, Legal and internal. External risk was sub divided into two subsets: unpredictable/ uncontrollable, predictable/ uncontrollable and Internal risk was sub divided into two subsets: Non- technical / controllable, Technical / controllable. Further he suggested a hierarchy based risk break down structure and identified the key risk factors. Assaf and Al-Hejji (2006) identified 19 risk factors in the life cycle of the project under four heads such as Planning stage, Design stage, Procurement stage, construction stage, Handling over stage. They discussed the use of work shop with an integrated approach which includes brain storming, checklist, probability impact matrices, subjective judgment, and risk register. Finally, they suggested that the risk management workshop will be useful for risk identification and analysis, as a means of managing risks. Many researchers have tried various approaches for representing the interdependencies between project risks and its complexity of the surrounding environment (Dawood, 1998). (Hwang et al., 2014) reported that risk management implementation is relatively low in small construction projects and this is due to lack of time and budget, low profit margin and not economical. The results indicated a positive correlation between RM implementation and improvement in project quality, cost and schedule performance of small projects.

According to Tah *et al*. (1993); Risks in construction have been classified in different ways. Categorized project risks into external and internal risks and developed a fuzzy model for contractor's risk assessment at the tender stage. External risks are those that are prevalent in the external environment of projects, such as those due to inflation, currency exchange rate fluctuations, technology change, major client induced changes, politics, Climate, Weather Condition and major accidents or natural disasters. They are relatively non-controllable and so there is the need to continually scan and forecast these risks and in the context of a company's strategy. Similarly, internal risks are relatively more controllable and vary between projects. These internal risks cover uncertainties due to labor, plant, material and subcontractor, resources and the site conditions. Consequently, many researchers identified several risk factors and they are classified into different types depends on the nature of risk such as Physical, Environmental, design, Financial, Contractual / legal, Construction, Political, Management, Natural hazards, Safety and Delay risk (Mustafa, 1991).

The construction projects can be defined as the industry that creates infrastructure for cities, towns and industries, and considered to be one of the largest industries in the world. This industry is made out of many types of buildings in addition to civil Engineering jobs.

According to Grace F. M. (2010) there are different types of construction projects: these are residential, building, Institutional and commercial and specialized industrial construction.

According to (Gray and Larson, 2008); risk management in construction project can be analyses in different methods: namely the qualitative and quantitative approach. The quantitative

analysis relies on statistics to calculate the probability of occurrence of risk and the impact of the risk on the project. The most common way of employing quantitative analysis is to use decision tree analysis, which involves the application of probabilities to two or more outcomes. Another method is Monte Carlo simulation, which generates value from a probability distribution and other factors. The qualitative approach relies on judgments and it uses criteria to determine outcome. A common qualitative approach is the precedence diagramming method, which uses ordinal numbers to determine priorities and outcomes. Another way of employing qualitative approach is to make a list of the processes of a project in descending order, calculate the risks associated with each process and list the controls that may exist for each risk.

According to (Zavadskas *et al.* 2010a); Construction industry in general as well as construction project activity are risky. Risk can be explained as an event that has an impact on objectives, may have a positive or negative outcome and takes place in micro, meso and macro environments. Risk management is a system which aims to identify and quantify all risks, to which a business or project is exposed, so that a conscious decision can be taken on how to manage the risks (Markmann *et al.* 2013). PMBOK lists risk management as one of nine focuses in project management and explains it as a systematic process of identifying, analyzing and responding to project risks. It includes maximization of the probability and consequences of positive events and minimization of the probability and consequences of events averse to project objectives. Rajaie (2013) said that High importance of project selection in the project life cycle while solving bid/no-bid problems, especially in the construction industry, have been analyzed.

A construction project is plagued with various risks in all the stages of the life cycle of the project (Zhao et al., 2015). Therefore, Risk Management should be emphasized in construction project, regardless of the project size to assure the achievement of project objectives (Hwang et al.,1981). Risks have been represented as uncertain future event by construction managers and researchers and so they tried to control systematically through risk management and analysis method since early stage of 1990's. The purpose of this paper is to review and bring together these previous discussions about risk factors and to provide a comprehensive list of major sources of risk factors in the life cycle of construction projects based on extensive literature study.

2.3.2 Risk management process

Chen et al. (2004) proposed different risk management strategies for the different risk clusters as a means of enhancing firm performance. Risk management strategies aimed at mitigating the risk of cost overruns included agreeing on contract prices for materials at various stages of the project to hedge against the risk of price volatilities. Chen et al. (2004) also agreed that management factors could be controlled through use of qualified and experienced personnel at all stages of the project life cycle.

The risk analysis and management techniques have been described in detail by many authors. According to Berkeley *et al.* (1991); Flanagan and Norman (1993); project risk management processes have categorized risk management process to risk identification, risk classification, risk analysis and risk response. In addition, according to Chapman (1997); risk management process consists of define, focus, identify, structure, ownership, estimate, evaluate, plan and

manage. However, in this study, the researcher follows only According to (Gray and Larson, 2008); risk management process has the following steps.

A. Risk Identification

Risk identification is the first and perhaps the most important step in the risk management process, as it attempts to identify the source and type of risks. It includes the recognition of potential risk event conditions in the construction project and the clarification of risk responsibilities. Risk identification develops the basis for the next steps: analysis and control of risk management. Corrects risk identification ensures risk management effectiveness.

Risk identification is the determination of most likely risks affecting the project and documentation of characteristics of each risk. The risk management process begins by trying to generate a list of all the possible risks that could affect the project. Risks in construction can be classified into six categories as follows: (i) *Acts of God*, e.g. floods, hurricanes; (ii) *Physical risks*, e.g. labor injuries, fire, damage to equipment; (iii) *Financial and economic risks*, e.g. inflation, unavailability of funds; (iv) *Political and environmental risks*, e.g. changes in rules and regulations, political uncertainty; (v) *Design-related risks*, e.g. defective design, incomplete design; and (vi) *Construction-related risks*, e.g. change orders, labor productivity, etc (Al-Bahar,1991). Various techniques are available to assist in risk identification. Hillson (2002) lists "brainstorming and workshops, checklists, questionnaires and interviews, Delphi groups, and various diagramming approaches (e.g. cause-effect diagrams, systems dynamics, influence diagrams, etc.)" as suitable for risk identification. He mentioned that there is no single "best method" for risk identification, and an appropriate combination of techniques should be used.

Risks exist from the very outset of a project. Therefore, we need to identify what they are, ascertain when they might arise, what effect they may and what measures need to be taken to prevent their occurrence or mitigate their potential impact. The identification of risks may be considered as the most important stage in Risk Management, if only in terms of bringing considerable benefit to all parties in the greater understanding of the project, irrespective of whether further action is taken or not. When identifying risks, it is important to appreciate not merely the risk itself but the source, the event that may lead to the risk materializing and the effect of the risk if it does materialize. Risk identification process can be divided into techniques, assessment and categorization.

B. Risk Identification Techniques

1. Brainstorming

This is one of the most popular techniques. Generally, it is used for idea generation; it is also very useful for risk identification. All relevant persons associated with project gather at one place. There is one facilitator who is briefing about various aspects with the participants and then after note down the factors. Before closing it the facilitator review the factors eliminate the unnecessary ones.

2. Questionnaires or Checklists

These are simple but very useful predetermined lists of factors that are possible for the project. The check list which contains a list of the risks identified in projects undertaken in the past and the responses to those risks provides a head start in risk identification. Questionnaires are usually drawn up from a combination of previous experience and specific project criteria. There are two forms of questionnaire, one is a very general form with non-specific prompts or questions and the other can be detailed as is required by the particular project. Questionnaires also facilitate consistently presented answers from different team members which allow less time consuming and more meaningful comparisons. Therefore, the risk manager can ascertain more readily any apparent consensus.

3. Interviews

Experts or personnel with sufficient experience in a project can be a great help in avoiding/solving similar problems over and over again. All the participants or the relevant persons in the project can be interviewed for the identification of factors affecting risk. This is a technique that has been used historically by personnel departments and other consultants to extract information. It has also been used by risk managers to identify possible risk in a development. The interviews may take place on a one to one basis or on a many to one basis. The many to one basis should consist of projects members from different disciplines so that the subjects raised can be viewed from different perspectives. The problem with this method is that it is time consuming not only to carry out the interviewing but also record the risks arrived at there from.

4. Expert system

A lot of research is being done on artificial intelligence and expert systems. Specifically, one of the most sophisticated models that can be developed for risk management is by making use of knowledge-based systems or human-computer cooperative systems. This system is designed to assist the project managers in achieving more effective control over risks by providing them with appropriate knowledge, gathered from many project managers and compiled into a knowledge-base. It is designed to warn project managers of risks that may follow etc. While doing this, the logical thinking and the intuitive thinking of the managers is accounted for in the system.

5. The Delphi technique

This technique is similar to brainstorming but the participants in this do not know each other and they are not at the same place. They will identify the factors without consulting other participants. The facilitator like in brainstorming sums up the identified factors. The Delphi technique attempts to produce objective results from subjective discussions. It is a systematic, interactive forecasting method which relies on a panel of independent experts. This method may be applicable to the identification of risks but it is more suited to attaching likelihood of occurrence and potential impacts of previously identified risk events.

6. Past Experience

Past experience from the same kind of project, the analogy can be formed for identification of the factors. When comparing the characteristics of projects will provide insight about the common factors.

2.4 Risk assessment

According to DAVIDSON, R. and Lambert, S. (2004**)** argues that Risk assessment is the overall process of risk identification, risk analysis, and risk evaluation. Risks can be assessed at an organizational level or a departmental level for projects, individual activities, or specific risks. Different tools and techniques may be appropriate in different contexts. Risk assessment provides an understanding of risks, their causes, consequences, and their probabilities.

Risk assessment is the Assessment of risks and the possible interactions of risks with project activities to evaluate the possible outcomes of the project. It helps in estimating potential impacts of risk and in making decisions regarding which risks to retain and which risks to transfer to other parties. Both quantitative and qualitative techniques are available for risk assessment. The quantitative methods rely on probability distribution of risks and may give more accurate results than the qualitative methods, if the available data is strong and reliable. On the other hand, qualitative methods depend on personal judgment and past experiences of the analyst and the results may vary from person to person. Hence, the quantitative methods should be given precedence if both choices are available (Ward and Chapman, 2004).

Risk analysis involves consideration of the causes and sources of risk, their consequences, and the probability that those consequences can occur. Factors that affect consequences and probability should be identified. An event can have multiple consequences and can affect multiple objectives. Existing risk controls and their effectiveness should be taken into account. More than one technique may be required for complex applications. Risk analysis normally includes an estimation of the range of potential consequences that might arise from an event, situation or circumstance, and their associated probabilities, in order to measure the level of risk. However, in some instances, such as where the consequences are likely to be insignificant, or the probability is expected to be extremely low, a single parameter estimate may be sufficient for a decision to be made. In some circumstances, a consequence can occur as a result of a range of different events or conditions, or where the specific event is not identified. In this case, the focus of risk assessment is on analyzing the importance and vulnerability of components of the system with a view to defining treatments that relate to levels of protection or recovery strategies. Methods used in analyzing risks can be qualitative, semi-quantitative, or quantitative. The degree of detail required will depend upon the particular application, the availability of reliable data, and the decision-making needs of the organization. Some methods and the degree of detail of the analysis may be prescribed by legislation (Williams C.A., Heins R.M. (1971)**.**

Qualitative assessment defines consequence, probability and level of risk by significance levels, such as “high,” “medium” and “low,” may combine consequence and probability and

evaluates the resultant level of risk against qualitative criteria. Semi-quantitative methods use numerical rating scales for consequence and probability and combine them to produce a level of risk using a formula. Scales may be linear or logarithmic or may have some other relationship, and the formulae used can also vary.

Quantitative analysis estimates practical values for consequences and their probabilities, and produces values of the level of risk in specific units defined when developing the context. Full quantitative analysis may not always be possible or desirable due to insufficient information about the system or activity being analyzed, the lack of data, the influence of human factors, etc. or because the effort of quantitative analysis is not warranted or required. In such circumstances, a comparative semi-quantitative or qualitative ranking of risks by specialists, knowledgeable in their respective field, may still be effective.

2.4.1 Risk Assessment Techniques

According to Laryea and hughes (2010) concluded that the assumptions underpinning analytical models of risk management may not be suitable in practice and why what actually happens in practice is important for those who seek to model the pricing of construction bids. The risk assessment techniques followed by various researches in various literatures. The various risk assessment techniques are Project Evaluation and review technique (PERT), Probability and Impact (P&I), Montecarlo simulation (MCS), Analytical Hierarchy process (AHP), Likelihood occurrence of risk (LR), and Fuzzy Logic. Few researches have made an attempt using Analytical neural network (ANN), Bayesian belief Network (BBN). This figure shows that most of the researches have done the risk assessment model in AHP, MCS and LR compared to other techniques. The proposed models carried out using these three techniques have showed good results in assessing the project risk in construction projects. Among different approach models, AHP model is more effective, because of its systematic approach to structuring risk assessment problems by providing hierarchical approach. While assessing the project risk at the initial stage of the project, practitioners may not have sufficient data at that time. So it is essential to develop a simple regression model for each project specific task. Moreover, simplicity is a key factor for encouraging professionals to use risk assessment tools in practice.

According to different authors there are different types of risk assessment techniques; some of them are the Preliminary hazard analysis (PHA), Toxicity assessment (TA), Structured “What-if” Technique (SWIFT), Scenario analysis (SA), Business impact analysis (BIA), Root cause analysis (RCA),

2.5 Risk factors identification in construction projects

Many contractors developed a series of thumb rules to analyze and assess risks. As a result, many construction projects failed to achieve their time, cost and quality goals. (Al- Bahar, 1988) The project risks and uncertainties in cost and time can be managed by a systematic approach during estimation stage in order to minimize their effects. This approach involves identifying risk sources, assessing their effects on a project and selecting ways to control them. (Birnie and

Yates,1991). Accordingly, the sources of risk were categorized based on controllable and uncontrollable factors which will lead to cost and time overrun in a project (Akincl, 1998). Based on this result, different risk assessment models have been formulated to analyze and assess project risks during the bidding stage of a construction project (Mustafa and Bahar, 1991). Similarly, few attempts were made by the researches like (Tah et al., 1993), (Wirba et al., 1996), (Dawood, 1998) in risk assessment by Probability- Impact assessment (P-I), Fuzzy Set Theory (FST) and Monte Carlo Simulation (MCS). The critical risk factors identified by many researches done in different type projects like residential, industrial, commercial, infrastructure etc. There are different factors like, Country risk (Inflation, country economic condition), Environmental and geological risk (Weather and climatic conditions), Statutory Compliance Risk (Statutory clearance before planning a project), design risk (scope and design changes), Project Execution risk (new technology implementation, Poor Safety procedures, Construction Delays, Inadequate managerial skills, improper coordination between teams), Resource Risk(Lack of availability of resources) are the critical risk factors in various international projects.

Risks in construction have been classified in different ways. Tah *et al*. (1993) categorized project risks into external and internal risks and developed a fuzzy model for contractor's risk assessment at the tender stage. External risks are those that are prevalent in the external environment of projects, such as those due to inflation, currency exchange rate fluctuations, technology change, major client induced changes, politics, Climate, Weather Condition and major accidents or natural disasters. They are relatively non-controllable and so there is the need to continually scan and forecast these risks and in the context of a company's strategy. Similarly, internal risks are relatively more controllable and vary between projects. These internal risks cover uncertainties due to labour, plant, material and subcontractor, resources and the site conditions.

Consequently, many researchers identified several risk factors and they are classified into different types depends on the nature of risk such as Physical, Environmental, design, Financial, Contractual / legal, Construction, Political, Management, Natural hazards, Safety and Delay risk (Mustafa, 1991; Akincl et al., 1998; Prasanta kumar dey, Goh et al., 2013).

Different authors identify types of risk factors. Some of them are:
Scope and design changes, Technology Implementation, Site conditions and Unknown Geological Condition, Inflation, Country Economic Condition and rules and regulation, unavailability of funds, Financial failure, Lack of availability of resources. (Shenhar & Dvir, 2007). Site conditions and Unknown Geological Condition, Inflation, Country Economic Condition and rules and regulation, unavailability of funds, financial failure, inadequate managerial skills, improper coordination between teams, Lack of availability of resources.

2.6 Different Risk Factors in Constructions Industry

Risks in construction have been classified in different ways (see for example, Edwards and Bowen 's (1998) comprehensive review of risk literature (1960-1997) in construction). However,

they have the same meaning, in that authors generally agree that some risks can be controlled whereas others cannot. Murdoch and Hughes (2008) classified risks affecting construction projects under physical works, delay and disputes, direction and supervision, damage and injury to persons and property, external factors, payment, and law and arbitration.

Eriksson (1979) classified risks in construction as contractual risk (caused by lack of clarity, absence of communication between parties, problems of timeliness in contract administration) and construction risk (inherent in the work itself). In developing a fuzzy model for contractor's risk assessment at the tender stage, Tah et al. (1993) categorized project risks into external and internal risks (see below). Generally, we conclude that from the above articles risks can be classified in to two: external factors and internal factors.

2.6.1 External risk factors

External risks are those that are prevalent in the external environment of projects, such as those due to inflation, currency exchange rate fluctuations, technology change, major client induced changes, politics, and major accidents or disasters. They are relatively non-controllable and so there is the need to continually scan and forecast these risks and in the context of a company's strategy (Tah et al., 1993). In our context, the following are some of external factors:

1. Government

According to Agyakwa-Baah (2009), the ultimate goal of government to lead and fast-track infrastructure project the society and the performance of the government is assessed in the developing countries by developmental projects. This creates unnecessary pressure on government to start something, which will be terminated because it is not accommodated in the government's budget. It was argued by De la Cruz et al. (2006) that, winning political scores leads to unplanned infrastructure development, which lacks the necessary funding, and required coordination of such projects.

2. Environmental Risk Factors

According to De la Cruz *et al*. (2006) opined that, any time risk factors are to be considered, events such as the conditions of the ground and likely contaminants and site conditions should be notes as well as time restrictions imposed on the project by the client. These are risks relating to occurrence of environmental incidents during the course of implementation of the project. These risks are generally within the control of the construction and the operation and maintenance consortium. This risk has increased due to the presence of strict legal liability in relation to such environmental incidents, which can result not only in adverse effects on the financials of a project but may also cause a closure of any work or operations of and in relation to the facility. The main environmental risks associated with hydro power projects are

- Loss of flora and fauna
- Loss of fertile lands
- Rehabilitation and resettlement problems

3. Technical Risk Factors

According to Ofori (1994), there was the mention of technological development in Ghana requiring investment, sound economic environment, a physical infrastructure, top management support and assistance. However, it is difficult to credit these factors to the construction sector in developing countries including Ghana. Moreover, technical incompetence of designers has resulted to inaccurate design details or the inexperience of working on complex projects and risk prone projects. In addition, Oladapo (2007) identified that, variations is very profound in construction projects and its effect is inevitable on project objectives such as time and cost. To provide a simple understanding of variations, Baxendale and Schofield (1986) said the addition or subtractions made to the scope of the project amount to variation.

4. **Financial risks**

This risk is the totality of all risks that relate to financial developments external to the project that are not in the control of the project developer. This results from consequences that may have adverse economic effects. Financial risks fall into these categories: Exchange rate risk relates to the possibility that changes in foreign exchange rates alter the exchange value of cash flows from the project. This risk may be considerable, since exchange rates are particularly unstable in many developing countries or countries whose economies are in transition. In addition to exchange rate fluctuations, the project company may face the risk that foreign exchange control or lowering reserves of foreign exchange may limit the availability in the local market of foreign currency needed by the project company to service its debt or repay the original investment. Interest rate risk forces the project to bear additional financing costs. This risk may be significant in infrastructure projects given the usually large sums borrowed and the long duration of projects, with some loans extending over a period of several years.

5. Political risk

The project company and the lenders face the risk that the project execution may be negatively affected by acts of the contracting authority (Government), another agency of the government or the host country's legislature. Such risks are often referred to as political risks. Political risk faced by firms can be defined as "the risk of a strategic, financial, or personnel loss for a firm because of such nonmarket factors as macroeconomic and social policies. Political risk includes risk such as change in law, payment failure by government, increase in taxes and change in government.

6. Legal risks

It is the risk of non-compliance with legal or regulatory requirements. Much of the law is general and will apply to all organizations e.g. employment law, health and safety, environmental legislation, etc. Others may be industry specific e.g. covering specific transport services such as railways or airlines. Some of the legal risks that a construction projects can face are related to lease of property, ownership of asset and breach of financial documents.

2.6.2 Internal risk factors

According to Tah et al. (1993), internal risks are relatively more controllable and vary between projects. They include the level of resources available, experience in the type of work, the location, and the conditions of contract. Some of these risks are local to individual work packages or categories within a project, whilst others are global to an individual project and cannot be associated with any particular work package. The local risks cover uncertainties due to labor (availability, quality, and productivity), plant (availability, suitability, and productivity), material (availability, suitability, supply, wastage) and subcontractor (availability, quality, productivity, and failure) resources and the site (ground conditions, accessibility, type of work, complexity of work). They are considered for each work package in the case of bill of quantities.

According to Laryea and Hughes (2009), the world operates on a global platform, global risks are often generally allocated to projects. They further explained that these global risks cover areas relating to the performance (management experience, availability of partners, relationship with client, workload commitment), contract (contract type, contractual liabilities, amendments to standard form), location (head office, project) and financial (cash flow, funding, economic conditions) aspects of the project.

Teamwork, communication and positive human dynamics are intertwined because of their efforts in risk management on a project and their impact on the project goals. Additionally, the inadequate flow of information amongst project stakeholders is an indictment on the health of the project. Earlier Lester (2007), observed that within the project environment, different kinds of relationships are established such as cordial or aggressive from the stakeholders which should be managed in a professional manner to offsite its ugly effect on the project. Communication and teamwork are very critical and should be endorsed by the coordinator of the project because the document that even govern the project is a form of communication and such has a bearing on the project. Santoso *et al*. (2003) evaluated 130 risk factors and found that, communication is the highly ranked factor and has an average impact and probability of occurring.

According to Berko (2007), Inadequate and faulty Plants and equipment have been suggested to be an influential problem in construction firms, although local contractors mostly use labors for their works. Moreover, materials shortage, defective materials unavailability of the required skills and the abysmal performance of labour as well as the lack of technical expertise to operate plant and equipment have also been identified as risk most local contractors are experiencing internally (Berko, 2007; Agyakwa-Baah, 2007).

2.7 Conceptual Framework

A conceptual framework is an analytical tool with several variations and contexts. It can be applied in different categories of work where an overall picture is needed. It is used to make conceptual distinctions and organize ideas. Strong conceptual frameworks capture something real and do this in a way that is easy to remember and apply.

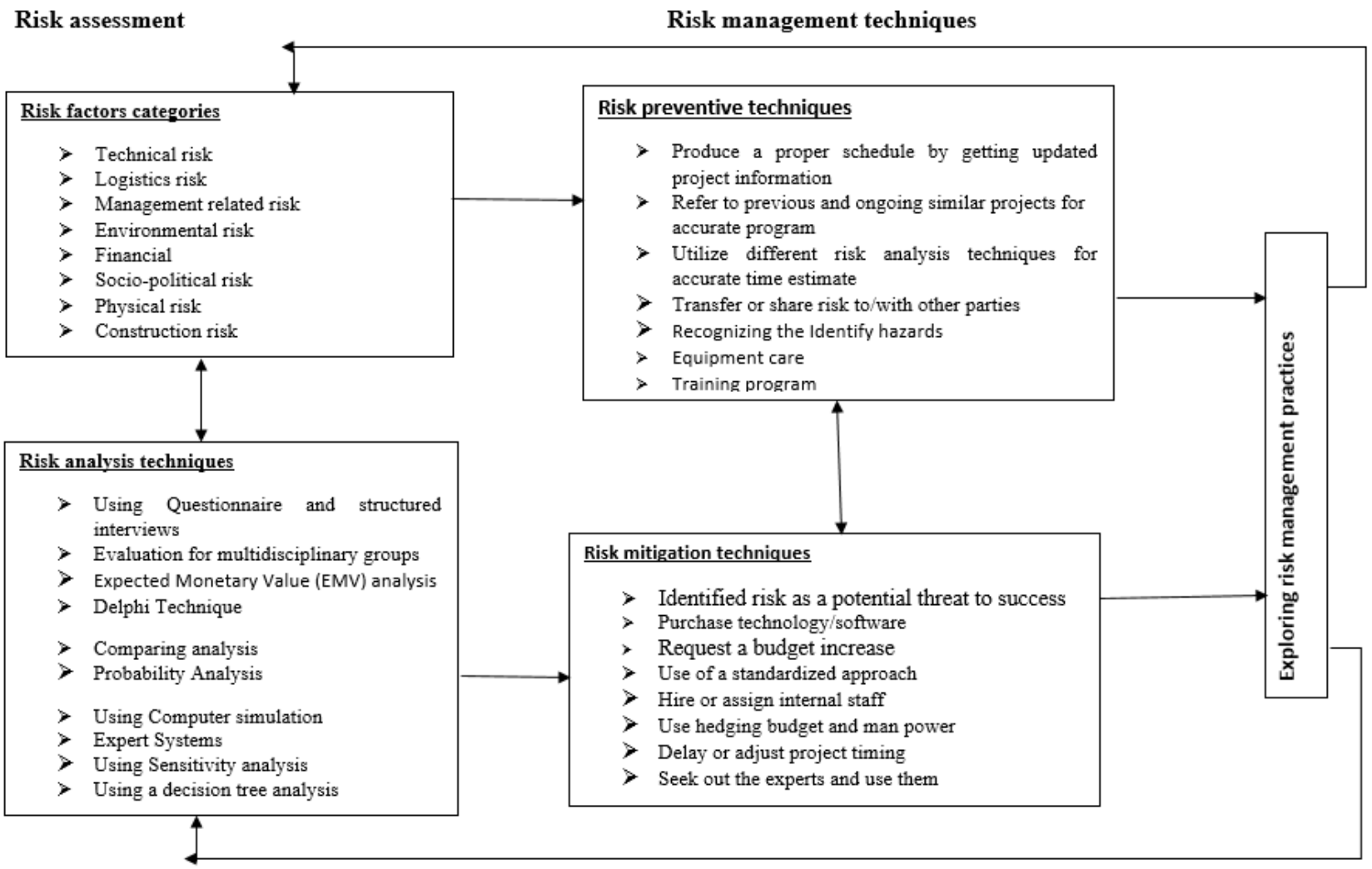

Figure 2.1 Conceptual frameworks for risk assessment techniques prepared by the research.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0. Introduction

This chapter presents the method used to collect information and data for making business decisions. The methodology may include publication research, interviews, surveys and other research techniques, and could include both present and historical information. In addition, it used for the intuitive analysis conducted in the successive chapter (four) of this study. The methodology is devoted to developing the research analytical framework in line with the theoretical framework that has been systematically built in the literature review.

3.1. Design of Research

This research is a descriptive research, and it adopted a descriptive research design. Data was systematically collected at a point in time, analyzed and presented to give a clear image of risk management practices on Ethiotelecom tower project. A descriptive research was used in that is designed to find out the existing situation of a particular phenomenon of concern. This type of research is a systematic attempt to collect information from members of an identifiable population particularly, tower project department of Ethiotelecom. The descriptive survey is helps in telling what the situation is in a systematic manner; it involves collection of accurate data for the purpose of determining the current nature of the subject of study.

3.2. The Target Population

In the case of this study, the tower project department staffs' of Ethiotelecom were involved. This study mainly conducted on census method of data collection. Because targeted population of all respondents were involved. **Census** refers to the quantitative research method, in which all the members of the population are enumerated. Ethiotelecom has two major external contractors' companies (i.e. ZTE and HUAWEI) with each having a handful of staff base being directly or indirectly involved in cellular site related projects execution and administration. The 34 targeted populations of the company were involved in this study those who were working in Ethiotelecom tower construction project, seven (7) HUAWEI tower construction project department staff, twenty-one (21) Ethiotelecom tower construction project department staff, and six (6) ZTE tower construction project department. So senses sampling was conducted in this study.

3.3. Data sources and data collection method

The researcher collected data's' from two sources namely primary and secondary data sources.

3.3.1. Primary Data Sources

The primary data were gathered from the response of subject of the study through questionnaire and interview. The questionnaires were distributed to twenty-one (21) Ethiotelecom staff and seven (7) Huawei staff and six (6) ZTE staff of Ethiotelecom tower project. The interview was prepared for one Director and six manager of tower project. The secondary data also obtain from the internet and the previous related documents. The type of data used for this study was ordinal by use of five point Likert scale items in the questionnaire.

3.3.2. Secondary Data Sources

Secondary data can be categorized into internal as well as external sources. Internal sources incorporate data that exists and were stored in the organization. External data refers to the data that were gathered by other individuals or associations from outer environment.

3.4 Data Collection Instrument

The questionnaire was design to consist of five main sections gears at covering the research objectives. The first section contains the respondent's demographic background. The second section contains Risk groups and Factors. The third section contains risk analysis techniques. The fourth section contains Preventive Method and finally the five sections contain mitigation method of project risk management.

Closed-ended questions were asked. The closed questions had a selection of choices, which offered the respondents the opportunity of selecting answers that they felt were (most) appropriate. Closed ended questions are advantageous, especially when a substantial amount of information on a subject exists and the response options are relatively well known (Walliman, 2006). The use of closed ended questions considers the fact that respondents are usually busy, and this method enables the researcher to obtain responses promptly.

3.5 Procedure for Data Collection

The questionnaires would have delivered to the respondents mainly by hand delivery. The three-day interval provided some ample time for respondents to complete and submit the completed questionnaire. The respondents therefore had enough time to put their level of agreement under a stress-free condition and demanding timeframe. This procedure is hoping to source quality responses for analysis.

3.6 Method of Data Analysis

The form of data analysis for this study is descriptive statistics because it includes survey and fact-finding and it describe the state of affairs, as it exists at present. The researcher which made use of frequency and percentages because frequency tables can be useful for describing the number of occurrences of a particular type of datum within a dataset. Frequency tables, also called frequency distributions, are one of the most basic tools for displaying descriptive statistics. In addition, it presented in the form of tables to show the level of agreement clearly. A percentage frequency distribution is a display of data that specifies the percentage of observations that exist for each data point or grouping of data points. It is a particularly useful method of expressing the relative frequency of survey responses and other data. Frequency tables are useful for analyzing categorical data and for screening data for data entry errors. This study uses mainly SPSS to analyze data because it is the main software to analyze and interpret the encoding data.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents the data collected from the field, analysis and interpretation. The study has attempted to examine some general aspects of risk management practices of Ethiotelecom tower construction projects by gathering information from administrators of the organization through questionnaire and interview. The interview was conducted with Ethiotelecom tower project managers, Huawei managers and ZTE managers only those have some knowledge of risk management on tower project. The questionnaire was distributed to 34 Ethiotelecom tower construction project employees. In this research from the total of 34 target population the response rate is 100%.

4.2 Respondents' Profile Category

Out of the targeted population of 34 respondents, completed data (primary and secondary) was received. Questionnaires were administered to tower project employees, supervisors, managers, coordinators and directors. Profiles of the respondents detailed in the following sections.

As shown in Table 4.1 below, majority of the respondents 56% were tower project normal staffs that works day today activities on tower project followed tower project managers in which managing those tower construction project process at 17.6%, the supervisors supervise the day today activities on tower project at 14.7%. In addition, the project coordinators coordinate different teams on which project staff at 8.8% while director of the project control all over activities on this project and report the CEO at 2.9%. On the distribution of the respondents by their organization, 67.6% of the respondents were Ethiotelecom and 17.6% of respondents were Huawei while 14.7% were ZTE as presented in Table 4.1 below.

In most jobs, experience is considered as one of the key determinants of performance in any company. Thus, respondents 'profile was analyzed in terms of their experience. The results of the analysis are shown in Table 4.1 below. In terms of experience, 58.8% of the respondents were 2-7 years of experience. 29.4% were 8-15 years of experience and 11.8% were above 15 years. Results in Table 4.1 below show that, majority of the tower construction projects in Ethiotelecom were being done by well potential adults; this shows that the respondent gave valid information about the assessment of risk management practices on tower construction project but above 8 years' experience respondents have a full of information and well experienced about risks on tower construction project for a long period of time on Ethiotelecom projects.

Table 4.1 Respondents profile by Category

Categories		**Frequency**	**Percent**
Ethiotelecom		21	67.6
Huawei		7	17.6
ZTE		6	14.7
Total		34	100.0
Experience	2-7 years	20	58.8
	8-15 years	10	29.4
	Above 15 years	4	11.8
	Total	34	100.0
Position	Project Staffs	19	56
	Project Supervisors	5	14.7
	Project Managers	6	17.6
	Project Coordinators	3	8.8
	Project Directors	1	2.9
	Total	34	100.0

(Sources: own survey 2019)

4.3 Identified Risk Factors

The main objective of this study was to identify the most common and frequently used risk factors that affect Ethiotelecom tower construction projects. The respondents were required to indicate their level of agreements on the different risk factors that affect the project by ticking "strongly disagree", "disagree", "undecided", "agree" and "strongly agree".

According to the result of the following table below, the identified risk factors that categorized in different risk groups. The researcher also saw the results according to their categories. According to 4.2, table on the technical risk group point of view, all the listed risk factors affect the tower construction projects. This study made it to clear that the sum of the respondents' who were agreed and strongly agreed 50% that they believe inadequate site investigation is the one of risk factors that affect the projects technically, 17.7% of the respondents believes that inadequate site investigation isn't a risk factors and 32.4% of the respondents were undecided about inadequate site investigation. Peacock (1990) concluded that in order to reduce risk during substructure work "preplanning site investigative work in a logical sequence and improving the communication system between the principal parties was vital to achieve the projects".

According to incomplete design point of the sum of the respondents' who were agreed and strongly agreed 41.1% that they believe incomplete design is risk factors, 35.3% of the respondents' incomplete design is not a risk factors and 23.5% of the respondents were undecided.

According to table 4.2, it shows 58.8% of the respondents said that they were agreed and strongly agreed Inadequate of specifications for the main risk factors on technical risk group point of view. 20.6% of the respondents they were disagree and strongly disagree; the remaining 20.6% of the respondents said that they did not decide. The signing of a contract with incomplete design and specification is a source of significant risk for owner and contractors Revay report (2010). 64.7% of the respondents said that they agreed and strongly agreed for the question that Uncertainty over the source and availability of materials; 5.9% the respondents said they could not decide about this question; the remaining 29.4% of the respondents said disagreed for this question. According to jamie,S and christophe,M (2015), The contention is that a better understanding of the uncertainties surrounding resource estimates for both conventional and renewable energy resources can contribute to more effective policy decision making in the long term.

According to table 4.2, it shows 64.7% of the respondents said that were agreed and strongly agreed Construction procedures that include on technical risks; 14.7% were undecided the remaining 20.5% of the respondents also disagree about this question. The Construction Procedures ("CP") sets out how the development is to be constructed and managed to ensure compliance with Environmental Commitments (from the Environmental Statement) and Planning. From the five list of risk factors that are categorized in the technical risk category Uncertainty over the source and availability of materials and Construction procedures were the main factors in tower construction; and also the ZTE, HUAWEI and Ethiotelecom manager's told to the researcher during the interview those risk factors are mainly affect the project. However, the remaining of risk factors also had its own impact the tower project rarely. According to (Andery et al. 1998), Technical risk assessment in building construction emphasizes are the role of project quality planning in client satisfaction and should be one of the main tools for evaluating the reliability of quality systems.

Table 4.2 Identified risk factors for technical risk group

	Variables	Responses	Frequency	Percent
Technical risk categories	**Inadequate site investigation**	Strongly disagree	2	5.9
		Disagree	4	11.8
		Undecided	11	32.4
		Agree	11	32.4
		Strongly agree	6	17.6
		Total	34	100.0
	Incomplete design	Strongly disagree	3	8.8
		Disagree	9	26.5
		Undecided	8	23.5
		Agree	8	23.5
		Strongly agree	6	17.6
		Total	34	100.0
	Inadequate of specifications	Strongly disagree	3	8.8
		Disagree	4	11.8
		Undecided	7	20.6
		Agree	12	35.3
		Strongly agree	8	23.5
		Total	34	100.0
	Uncertainty over the source and availability of materials	Strongly disagree	6	17.6
		Disagree	4	11.8
		Undecided	2	5.9
		Agree	13	38.2
		Strongly agree	9	26.5
		Total	34	100.0
	Construction procedures	Strongly disagree	1	2.9
		Disagree	6	17.6
		Undecided	5	14.7
		Agree	15	44.1
		Strongly agree	7	20.6
		Total	34	100.0

Source own survey (2019)

. According to 4.3, table on the logistics and management related risk group point of view, all the listed risk factors affect the tower construction projects. Logistical Risks include availability of resources such as construction equipment's, spare parts, fuel and labor and availability of enough transportation facilities. According to 4.3, table, it shows that 67.6% of the respondents were agreed and strongly agreed on Availability of sufficient transportation facilities question; 8.8%

of the respondents were undecided on a question the remaining 23.5% of the respondents were disagreed on this type of logistics risk factors. 61.8% of the respondents were agreed and strongly agreed on Availability of resources-particularly construction equipment spare parts question; 11.8% were undecided on this risk factors the remaining 26.5% were disagreed on this logistics risk factor. According to

Lhoussaine, O. and Mostapha, A**. (**2013) to create a smart logistics risk management plan that puts your company in a position to balance cost vs. risk factors without compromising your operation and customer relationships.

According to table 4.3 shows that 52.9% of the respondents were, agreed and strongly agreed on Difficulty to give permits risk factors**;** 32.4% of the respondents were undecided on this risk factors the remaining 14.7% of the respondents were strongly disagreed and disagreed. ZTE and HUAWEI managers told to the researcher during the interview those logistics risk factors are the main problem of tower construction project delay, but Ethiotelecom managers and supervisors said that logistics factors are not the main problems in tower project.

The assigned project manager may have missed them or ignored them, but the risks were present. It can either be a long, painful process for very large and complex projects or just a 15-minute brainstorming session for short-term small projects, but the process of risk analysis and management needs to happen - must happen, no matter how badly we want to skip over it.

According to table 4.3, it shows that Management related risks are a type of risk factors and it includes risks. 44.1% of the respondents were agreed on uncertain productivity of resources monopolizing of materials due to closure and other unexpected risk factors; 50% were undecided on this risk factors and 5.9% were disagreed. It shows that these risk factors were not valuable on management risk groups.

According to table 4.3 shows that 67.6% of the respondents were strongly agreed and agreed; 26.5% were undecided and the remaining 5.9 were disagreed on Contractual relation risk factors. Open scholar (2018), said that contracts can be verbal or written and are used to create or expand the relationship between two or more parties and define the conditions of how each will interact within a given set of circumstances.

55.9% of the respondents were agreed on Contractors experience; 17.6% of the respondents were undecided on these risk factors and the remaining 26.4% the respondents were disagreed. Experience is the main factors for the success or failure of any project. According to the interviewed respond, ZTE and HUAWEI contractors were transfer some parts of the project to local sub-contractors, because of sub-contractors experience the tower project affected by them.

Attitude of participant's questionnaire survey were agreed by 73.6% of the respondents; 20.6% were undecided and the remaining 5.9% were disagreed on this type of risk factors. It shows that almost all respondents were agreed these risk factors are the first rank from all management related risk groups. According to table 4.3 Communication is one of the risk factors on this group and the 64.7% respondents were agreed and strongly agreed; 14.7% were undecided and 20.5%

were disagreed on this risk factors. (Petty, & Cacioppo, 1981, 1986) said that participants are all volunteers and are thus highly motivated to engage in the project,making them more likely to read the educational material in a thoughtful manner,and thus activating the central route to persuasion.

Most of the whole organization top management replied on their interview period, management related risk factors were one of frequently encountered on tower construction project.

Table 4.3 Identified risk factors for logistics and management related risk group

Logistics	**Availability of sufficient transportation facilities**	Strongly disagree	2	5.9
		Disagree	6	17.6
		Undecided	3	8.8
		Agree	10	29.4
		Strongly agree	13	38.2
		Total	34	100.0
	Availability of resources-particularly construction equipment spare parts	Strongly disagree	5	14.7
		Disagree	4	11.8
		Undecided	4	11.8
		Agree	14	41.2
		Strongly agree	7	20.6
		Total	34	100.0
	Difficulty to give permits	Strongly disagree	3	8.8
		Disagree	2	5.9
		Undecided	11	32.4
		Agree	15	44.1
		Strongly agree	3	8.8
		Total	34	100.0
Management related risks	**Uncertain productivity of resources Monopolizing of materials due to closure and other unexpected**	Strongly disagree		
		Disagree	2	5.9
		Undecided	17	50.0
		Agree	7	20.6
		Strongly agree	8	23.5
		Total	34	100.0
	Industrial relations problems	Strongly disagree		
		Disagree	4	11.8
		Undecided	8	23.5
		Agree	13	38.2
		Strongly agree	9	26.5

		Total	34	100.0
	Contractual relation	Strongly disagree		
		Disagree	2	5.9
		Undecided	9	26.5
		Agree	17	50.0
		Strongly agree	6	17.6
		Total	34	100.0
	Contractors experience	Strongly disagree	3	8.8
		Disagree	6	17.6
		Undecided	6	17.6
		Agree	11	32.4
		Strongly agree	8	23.5
		Total	34	100.0
	Attitude of participants	Strongly disagree		
		Disagree	2	5.9
		Undecided	7	20.6
		Agree	14	41.2
		Strongly agree	11	32.4
		Total	34	100.0
	Communication	Strongly disagree	1	2.9
		Disagree	6	17.6
		Undecided	5	14.7
		Agree	12	35.3
		Strongly agree	10	29.4
		Total	33	100

Source own survey (2019)

. According to 4.4, table on the environmental and financial risk group point of view, all the listed risk factors affect the tower construction projects.

According to (Malalgoda, CI, Amaratunga, RDG and Pathirage, CP,2010) the built environment disciplines together with the construction industry have a vital role in all phases of the disaster management cycles in relation to disaster risk reduction. They can involve in disaster risk reduction in numerous ways, including planning, designing, engineering, construction and maintenance of the built environment. 73.6% of the respondents were strongly agreed and disagreed; 8.8% were undecided and the remaining 17.6% were disagreed on Weather and seasonal implications risk factors. According to table 4.4 Natural disasters risk factors questionnaire survey were strongly agreed by 73.6% respondents; undecided by 5.9% of the respondents and 20.6% were disagreed. (Sapir and Lechat 1986), Earthquakes, volcanic

eruptions and landslides, for all their dramatic impact, do not remotely match the scale of casualties that result from droughts, floods, and coastal storms.

According to Hassanein and Afify, (2007) said that various financial risks such as lack of clarity in the allocation of responsibilities for payment of some taxes; lack of provisions for partial payment thus reducing the risk of default; the improper withholding of guarantees on the advance payment. 76.5% of the respondents were strongly agreed on Availability and fluctuation in foreign exchange questionnaire survey; 14.7% of the respondents were undecided and the remaining 23.5% of the respondents were disagreed on these financial risk factors categories. The Samuel, K. (2011). Practice of efficient and timely payment in construction projects is a major factor that can contribute to the success of a project. It causes severe cash-flow problems to contractors and this canhave a devastating effect down the contractual payment chain. Delays in Payment questionnaire survey were agreed by 70.6% of the respondents; 20.6% were undecided by the respondents and 8.8% were disagreed this type of risk factors. Increase material costs were strongly agreed and agreed by 79.4% of the respondents; 20.6% were undecided by the respondents.

Table 4.4 Identified risk factors for environmental and financial risk group

Environmental risks	**Weather and seasonal implications**	Strongly disagree	3	8.8
		Disagree	3	8.8
		Undecided	3	8.8
		Agree	11	32.4
		Strongly agree	14	41.2
		Total	34	100.0
	Natural disasters	Strongly disagree	2	5.9
		Disagree	5	14.7
		Undecided	2	5.9
		Agree	9	26.5
		Strongly agree	16	47.1
		Total	34	100.0
Financial	**Availability and fluctuation in foreign exchange**	Strongly disagree		
		Disagree	3	8.8
		Undecided	5	14.7
		Agree	15	44.1
		Strongly agree	11	32.4
		Total	34	100.0
	Delays in Payment	Strongly disagree	1	2.9
		Disagree	2	5.9
		Undecided	7	20.6
		Agree	17	50.0

		Strongly agree	7	20.6
		Total	34	100.0
	Inflation	Strongly disagree	1	2.9
		Disagree	2	5.9
		Undecided	17	50.0
		Agree	7	20.6
		Strongly agree	7	20.6
		Total	34	100.0
	Local taxes	Strongly disagree		
		Disagree	4	11.8
		Undecided	16	47.1
		Agree	10	29.4
		Strongly agree	4	11.8
		Total	34	100.0
	Improper estimation	Strongly disagree	4	11.8
		Disagree	4	11.8
		Undecided	6	17.6
		Agree	12	35.3
		Strongly agree	8	23.5
		Total	34	100.0
	Increase material costs	Strongly disagree		
		Disagree		
		Undecided	7	20.6
		Agree	12	35.3
		Strongly agree	15	44.1
		Total	34	100.0

Source own survey (2019)

According to table 4.5, it shows that socio-political risks on Change in laws and regulations risk factors questionnaire survey 35.3% of the respondents were agreed; 26.5% were undecided and 38.2% were disagreed. This result shows that most of the respondents were not agreed this type of risk factors and it is not important for this study.52.9% of the respondents were agreed on Pollution and safety rules questionnaire survey; 23.5 were undecided and 23.5 were disagreed for this risk factors. Bribery and corruption are by their nature deceptive and each act or instance of bribery or corruption can taint not only the individuals involved but also an entire organization or process, sometimes long into the future. Bribery/ corruptions is one of the main risk factors on socio-political risk categories of which 85.3% of the respondents were strongly agreed; 11.8% were undecided and the remaining 2.9 were disagree. This result shows that "Bribery/ corruptions" is higher rank from the whole risk factors on socio-political risk categories.

Almost all respondents' supervisors, managers and director told to the researcher during the interview "Bribery/ corruptions" is one of the risk factors frequently encountered on Ethiotelecom tower construction project. Language and cultural barrier questionnaires survey of the 55.9% of respondents were agreed; 32.4% were undecided and 11.8% were disagree for this type of risk factors. According to **(**Tamara Bekefi andMarc J. Epstein, 2006) Social and political risks that can devastate a company's operations can be adequately accounted for, rather than being relegated to a footnote to financial calculations in the hopes that the risks will not emerge. Measurement of social and political risks also enables decision-makers to devise mitigation strategies, sometimes pre-emptively, that can produce significant cost savings.55.9% of the respondents were agreed on Requirement for permit then approval risk factors; 35.3% were undecided and the remaining 8.8% were disagree for this type of risk factors.

Physical risk in constructions is risks that normally deal with physical nature of the project. This type of risk cannot be controlled by any means, thus it is a team as (the act of God), for instants: bad weather, flood, fire, landslip etc. there can also be some unexpected or unforeseen event that can occur on the construction site. Physical risk can cause direct harm or damages. According to table 4.5 physical risks is one of the risk categories types and 41.2% of the respondents were agreed on Damage to structure that is one of the risk lists under physical risk; 26.5% were undecided and 32.3% were disagreed on this risk factors. According to Nitin Yeshwantrao (6 April 2013. Structural integrity and failure is an aspect of engineering which deals with the ability of a structure to support a designed structural load (weight, force, etc...) without breaking, and includes the study of past structural failures in order to prevent failures in future designs.

Damage to Equipment. Promptly after a Responsible Officer learns that any Facility Equipment is damaged, and if such Facility' Equipment can be repaired in accordance with the terms of the applicable Facility Contract so as to restore the same to good and working order, Borrower shall cause such repairs to be made in accordance with the terms of such Facility Contract. 70.6% of the respondents were strongly agreed; 14.7% of the respondents were undecided and 29.4% of the respondents were disagreed on the risk factors of Damage to equipment. Labor injuries is one of the physical risk factors type and the respondent's level of agreement 70.6% were agreed; 20.6% were undecided and the remaining 8.8 were disagreed on this type of risk factors. Those result shows that Damage to equipment and Labor injuries were the main risk factors that affect the project from physical risk factors point of view but Damage to structure had less impact on this type of risk group.

Table 4.5 Identified risk factors for socio-political and physical risk group

Socio-political risks	**Change in laws and regulations**	Strongly disagree	5	14.7
		Disagree	8	23.5
		Undecided	9	26.5
		Agree	4	11.8
		Strongly agree	8	23.5
		Total	34	100.0
	Pollution and safety rules	Strongly disagree	3	8.8
		Disagree	5	14.7
		Undecided	8	23.5
		Agree	12	35.3
		Strongly agree	6	17.6
		Total	34	100.0
	Bribery/ corruptions	Strongly disagree		
		Disagree	1	2.9
		Undecided	4	11.8
		Agree	14	41.2
		Strongly agree	15	44.1
		Total	34	100.0
	Language and cultural barrier	Strongly disagree		
		Disagree	4	11.8
		Undecided	11	32.4
		Agree	11	32.4
		Strongly agree	8	23.5
		Total	34	100.0
	Requirement for permit then approval	Strongly disagree		
		Disagree	3	8.8
		Undecided	12	35.3
		Agree	15	44.1
		Strongly agree	4	11.8
		Total	34	100.0
Physical Risks	**Damage to structure**	Strongly disagree	8	23.5
		Disagree	3	8.8
		Undecided	9	26.5
		Agree	7	20.6
		Strongly agree	7	20.6
		Total	34	100.0
		Strongly disagree		

	Damage to equipment	Disagree	5	14.7
		Undecided	5	14.7
		Agree	11	32.4
		Strongly agree	13	38.2
		Total	34	100.0
	Labor injuries	Strongly disagree		
		Disagree	3	8.8
		Undecided	7	20.6
		Agree	13	38.2
		Strongly agree	11	32.4
		Total	34	100.0

Source own survey (2019)

. According to 4.6, table on the Construction risk group point of view, all the listed risk factors affect the tower construction projects. According to Wikipedia (2002) Workforce productivity. Workforce productivity is the amount of goods and services that a group of workers produces in a given amount of time. It is one of several types of productivity that economists measure. Workforce productivity, often referred to as labor productivity, is a measure for an organization or company, a process, an industry, or a country. 70.6% of the respondents were strongly agreed on the labor productivity risk factors from construction risks; 17.6% were undecided and 11.8% were disagreed on this survey. Labor disputes are one of the risk factors on construction risk groups and 64.7% of the respondents were strongly agreed and agree; 17.6% were undecided and 17.6% were disagreed.

According to De la Cruz *et al*. (2006) opined that, any time risk factors are to be considered, events such as the conditions of the ground and likely contaminants and site conditions should be notes as well as time restrictions imposed on the project by the client. 70.6% of the respondents were agreed on site condition risk factors; 17.6% were undecided and the remaining 11.8% were disagreed**.** Equipment failure is one the risk factors on construction risk groups and 70.6% of the respondents were agreed on these risk factors; 20.6% were undecided and the remaining of the 8.8% respondents was disagreed. This finding shows that the risk factors of the construction risk groups were known by the whole respondents and those risk factors were the main risk factors categories that affect the tower construction project.

According to table 4.6 it shows that 47.1% of the respondents were agreed on design change type of risk factors; 32.4% percent of the respondents were undecided and the remaining 20.6% of the respondents were disagreed. 64.7% of the respondents were strongly agreed on new technology; 23.5% were undecided and the remaining 11.7% were disagreed. This implies that new technologies risk factors of the construction risk groups were the main problem of the tower construction project failure for the change of different technologies. According to James L. (2017). Today, new technologies in construction are being developed at a breakneck pace. What seemed like future tech 10, 20 years ago like connected equipment and tools, telematics, mobile

apps, autonomous heavy equipment, drones, robots, augmented and virtual reality, and 3D printed buildings are here and being deployed and used on jobsites across the world.

Table 4.6 Identified risk factors for construction risk group: (Source own survey 2019).

Construction risks	**Labor productivity**	Strongly disagree		
		Disagree	4	11.8
		Undecided	6	17.6
		Agree	14	41.2
		Strongly agree	10	29.4
		Total	34	100.0
	Labor disputes	Strongly disagree		
		Disagree	6	17.6
		Undecided	6	17.6
		Agree	13	38.2
		Strongly agree	9	26.5
		Total	34	100.0
	Site conditions	Strongly disagree		
		Disagree	4	11.8
		Undecided	6	17.6
		Agree	14	41.2
		Strongly agree	10	29.4
		Total	34	100.0
	Equipment failure	Strongly disagree	1	2.9
		Disagree	2	5.9
		Undecided	7	20.6
		Agree	10	29.4
		Strongly agree	14	41.2
		Total	34	100.0
	Design changes	Strongly disagree	3	8.8
		Disagree	4	11.8
		Undecided	11	32.4
		Agree	7	20.6
		Strongly agree	9	26.5
		Total	34	100.0
	New technologies	Strongly disagree	1	2.9
		Disagree	3	8.8
		Undecided	8	23.5
		Agree	12	35.3
		Strongly agree	10	29.4
		Total	34	100.0

4.4 Risk Analysis Techniques

The evaluation of respondents‟ perceptions towards risk analysis techniques were interpret by the below table 4.7 level of agreement.

According to Nguyen et al. (2004), The success and failure of any project depends upon many factors, the project manager is considered to be the key contributor to the success of any project, as well as a guide for the team members to achieve the project completion and the client satisfaction (Cost, Time and Quality). It shows on table 4.7 that 61.7% of the respondents were strongly agreed and agreed of the Evaluation for multidisciplinary groups; 20.6% of the respondents were undecided and the remaining 17.7% of the respondents were strongly disagreed and agreed. This result shows that tower construction project staffs are believed that Evaluation for multidisciplinary groups is an important part of the risk analysis techniques. According to PMBOK, The phrase expected monetary value analysis refers to a specific analytical technique in which a calculation is made to determine the average of all potential outcomes when the future includes a number of particular scenarios that may or may not ultimately happen. Hence, 61.8% of the respondents were agreed and strongly agreed on Expected Monetary Value (EMV) analysis of risk analysis techniques; 23.5% of the respondents were undecided and 14.7% of the respondents were strongly disagreed and disagreed. This result implies that Expected Monetary Value (EMV) analysis is one of the risk analyses techniques on the tower construction projects according to those respondents believed. According to table 4.7 shows that 50% of the respondents, they strongly agreed and agreed on Using Questionnaire and structured interviews risk analysis techniques; 29.4% of the respondents, they said that they undecided about Questionnaire and structured interviews risk analysis techniques and 20.6% of the respondents were disagreed and strongly agreed. This has a result considerable number of respondents accepted Questionnaire and structured interviews.

According to (Nguyen et al. 2004). The Delphi method also known as Estimate-Talk-Estimate (ETE)) is a structured communication technique or method, originally developed as a systematic, interactive forecasting method, which relies on a panel of experts. The technique can also be adapted for use in face-to-face meetings, and is then called Mini-Delphi or Estimate-Talk-Estimate (ETE). Delphi has been widely used for business forecasting and has certain advantages over another structured forecasting approach, prediction. Hence, 73.5% of the respondents were strongly agreed and agreed on Judgment of specialists and experts (Delphi Technique) of the risk analysis techniques; 20.6% of the respondents were undecided due to these risk analysis techniques and 5.9% of the respondents were disagreed. This implies that most of the respondents were believed that the Delphi techniques are the main part of risk analysis techniques. Comparing analysis (compare similar projects through similar site) questionnaire survey were strongly agreed and agreed by 52.9% of the respondents; 35.3% of the respondents were undecided and 11.7% of the respondents were disagreed on this types of risk analysis techniques. According to table 4.7 table shows that 61.8% of the respondents were strongly

agreed and agreed on Probability analysis (analyze historical data) of the risk analysis techniques risk categories; 29.4% of the respondents were undecided and the remaining 38.2% were strongly agreed on the risk analysis techniques. This implies that the tower construction project performance was depending on this risk analysis technique. 50% of the respondents were agreed on the Probability Analysis risk analysis techniques; 44.1% of the respondents were undecided and 5.9% of the respondents were disagreed.

According to Haiyi L. Lisa A. (2003). Computer simulation as a screening tool for ecological risk assessment can assist environmental managers and policy decision-makers in the planning and implementation of potentially highly focused assessments and remediation, should the ERA dictate the need. Hence, table 4.7 table shows that 73.5% of the respondents were strongly agreed and agreed on Using Computer simulation of risk analysis techniques; 20.6% of the respondents were undecided and 5.9% of the respondents were disagreed. This implies that most of the respondents were believed that this type of risk analysis techniques is the main part of risk analysis techniques. According to Kangari, R. & Boyer, L. T. (1989). Using expert systems (decision-support programs containing a large body of knowledge from field experts) to resolve the difficulties associated with traditional risk management models. In doing so, it explains the benefits of using an integrated expert system in risk management and details a process for developing this system, one that involves identifying risks, describing goals, allocating risk, evaluating risk. Hence, 79.4% of the respondents were strongly agreed and agreed on the Expert Systems (including software packages, decision support systems) of the risk analysis techniques; 8.8% of the respondents were undecided from those respondents and 11.8% of the respondents were disagreed. This result shows that most of the tower construction project staffs were believed that this is the major part of risk analysis techniques. Using Sensitivity analysis techniques of questionnaire survey, 47% of the respondents were agreed; 38.2% of the respondents were undecided and the remaining 14.7% of the respondents were disagreed on this type of risk analysis techniques.

According to Hulett, D. T. (2006), The decision tree analysis technique for making decisions in the presence of uncertainty can be applied to many different project management situations. For instance: Should we use the low-price bidder? Should we adopt a state-of-the-art technology? Using a decision tree analysis is one of the types of risk analysis techniques. Hence, table 4.7 shows that, 64.8% of the respondents were strongly agreed on these types of risk analysis techniques; 26.5% of the respondents were undecided and the remaining 8.8% of the respondents were disagreed. This implies that decision tree analysis the important part of risk analysis techniques on tower construction project.

Table 4.7 Risk analysis techniques of Ethiotelecom tower construction project

Items	*Responses*	*frequency*	*percent*
Using Questionnaire and structured interviews	Strongly Disagree	2	5.9
	Disagree	5	14.7
	Undecided	10	29.4
	Agree	11	32.4
	Strongly Agree	6	17.6
	Total	34	100.0
Evaluation for multidisciplinary groups	Strongly Disagree	2	5.9
	Disagree	4	11.8
	Undecided	7	20.6
	Agree	15	44.1
	Strongly Agree	6	17.6
	Total	34	100.0
Expected Monetary Value (EMV) analysis	Strongly Disagree	1	2.9
	Disagree	4	11.8
	Undecided	8	23.5
	Agree	14	41.2
	Strongly Agree	7	20.6
	Total	34	100.0
Judgment of specialists and experts (Delphi Technique)	Strongly Disagree		
	Disagree	2	5.9
	Undecided	7	20.6
	Agree	13	38.2
	Strongly Agree	12	35.3
	Total	34	100.0
Comparing analysis (compare similar projects through similar site)	Strongly Disagree	1	2.9
	Disagree	3	8.8
	Undecided	12	35.3
	Agree	13	38.2
	Strongly Agree	5	14.7
	Total	34	100.0
Probability analysis (analyze historical data)	Strongly Disagree		
	Disagree	3	8.8
	Undecided	10	29.4
	Agree	14	41.2

	Strongly Agree	7	20.6
	Total	34	100.0
Probability Analysis	Strongly Disagree		
	Disagree	2	5.9
	Undecided	15	44.1
	Agree	15	44.1
	Strongly Agree	2	5.9
	Total	34	100.0
Analysis of consequences	Strongly Disagree		
	Disagree	2	5.9
	Undecided	8	23.5
	Agree	9	26.5
	Strongly Agree	15	44.1
	Total	34	100.0
Using Computer simulation	Strongly Disagree		
	Disagree	2	5.9
	Undecided	7	20.6
	Agree	8	23.5
	Strongly Agree	17	50.0
	Total	34	100.0
Expert Systems (including software packages, decision support systems)	Strongly Disagree		
	Disagree	4	11.8
	Undecided	3	8.8
	Agree	6	17.6
	Strongly Agree	21	61.8
	Total	34	100.0
Using Sensitivity analysis	Strongly Disagree		
	Disagree	5	14.7
	Undecided	13	38.2
	Agree	8	23.5
	Strongly Agree	8	23.5
	Total	34	100.0
Using a decision tree analysis	Strongly Disagree		
	Disagree	3	8.8
	Undecided	9	26.5
	Agree	11	32.4
	Strongly Agree	11	32.4
	Total	34	100.0

Source own survey 2019

4.5 Risk Management Techniques

There are different types of risk management techniques on different construction project site. According to Ethiotelecom tower construction project the respondents use mainly preventive techniques and mitigated techniques. Those respondents' level of agreements towards preventive and mitigated techniques mentioned on the below table 4.8 and 4.9 respectively.

According to different literature and previous study, there are different types of risk management techniques. However, he researcher were selected only two types of risk management techniques. Those are preventive and mitigated techniques.

According to project insight, The project schedule is the tool that communicates what work needs to be performed, which resources of the organization will perform the work and the timeframes in which that work needs to be performed. The project schedule should reflect all of the work associated with delivering the project on time. Without a full and complete schedule, the project manager will be unable to communicate the complete effort, in terms of cost and resources, necessary to deliver the project. Hence, table 4.8 shows that 79.4% of the respondents were strongly agreed and agreed on Produce a proper schedule by getting updated project information questionnaire survey; 11.8% of the respondents were undecided and the remaining 8.8% of the respondents were disagreed. This result shows that most of the tower project staffs had a good preventive technique on Produce a proper schedule point of view by getting updated project information.

According to David H. (2003), one of a risk reduction method, which shifts the risk from the project to another party and involves collaborating with others to share responsibility for the risk activities. Hence, 38.2% of the respondents were agreed on Transfer or share risk to/with other parties of preventive techniques; 29.4% of the respondents were undecided on these preventive techniques and the remaining 32.4% of the respondents were strongly disagreed. This result shows that most of the respondents were not agreed to transfer the project for other parties. According to table 4.8 shows that, 88.2% of the respondents were strongly agreed and agreed on Refer to previous and ongoing similar projects for accurate program of the preventive techniques; 8.8% of the respondents were undecided on this type of preventive techniques and 8.8% of the respondents were disagreed on this preventive technique. This implies that most of the respondents were believed that this preventive technique is the major preventive techniques on tower project.

According to Siddiqui, Abhishek N. & Bikarama P., (2018), Hazard Identification and Risk Assessment (HIRA) is carried for identification of undesirable events that can lead to a hazard, the analysis of hazard of this undesirable event, that could occur and usually the estimation of its extent, magnitude and likelihood of harmful effects. Hence, 85.3% of the respondents were strongly agreed and agreed on recognizing the Identify hazards of preventive techniques; 8.8% of the respondents were undecided and the remaining 5.9% of the respondents were disagreed. This

result shows that recognizing the Identify hazards is the major preventive techniques of tower construction project. Standards on Protective Equipment (Equipment care) questionnaire survey were strongly agreed and agreed by 82.3% of the respondents; 8.8% of the respondents were undecided and 8.8% of the respondents were disagreed. This implies that Equipment care is the one of the major preventive techniques that identified by the respondents.

According to table 4.8 shows that 76.4% of the respondents were believed that Organization should have a good training program as part of its safety plan on preventive techniques; 8.8% of the respondents were undecided and the remaining 14.7% of the respondents were disagreed. This result implies that Organization should have a good training program as part of its safety plan is one the major preventive techniques on tower construction project.

Furthermore, some of the top managements and one director replied on their interview period, the major preventive techniques should be conducted frequently training programs when the new technology and a new risk might be analyzed. According to Jeffrey, D. (2006), Training presents a prime opportunity to expand the knowledge base of all employees, but many employers find the development opportunities expensive. Employees also miss work time while attending training sessions, which may delay the completion of projects. Despite the potential drawbacks, training and development provides both the company as a whole and the individual employees with benefits that make the cost and time a worthwhile investment.

Table 4.8 preventive techniques of risk management practices of the respondents

Items	*Responses*	*frequency*	*percent*
Produce a proper schedule by getting updated project information	Strongly Disagree		
	Disagree	3	8.8
	Undecided	4	11.8
	Agree	8	23.5
	Strongly Agree	19	55.9
	Total	34	100.0
Refer to previous and ongoing similar projects for accurate program	Strongly Disagree	2	5.9
	Disagree	1	2.9
	Undecided	3	8.8
	Agree	18	52.9
	Strongly Agree	12	35.3
	Total	34	100.0
Utilize different risk analysis techniques for accurate time estimate	Strongly Disagree	1	2.9
	Disagree	3	8.8
	Undecided	7	20.6
	Agree	11	32.4
	Strongly Agree	13	38.2
	Total	34	100.0
Add risk premium to time estimate	Strongly Disagree	1	2.9
	Disagree	2	5.9
	Undecided	9	26.5
	Agree	16	47.1
	Strongly Agree	6	17.6
	Total	34	100.0
Depend on personal judgment to produce a proper program.	Strongly Disagree	2	5.9
	Disagree	4	11.8
	Undecided	12	35.3
	Agree	8	23.5
	Strongly Agree	8	23.5
	Total	34	100.0
Transfer or share risk to/with other parties	Strongly Disagree	4	11.8
	Disagree	7	20.6
	Undecided	10	29.4
	Agree	8	23.5
	Strongly Agree	5	14.7
	Total	34	100.0

Treat every circuit as if it is energized and work de-energized	Strongly Disagree	2	5.9
	Disagree	1	2.9
	Undecided	14	41.2
	Agree	8	23.5
	Strongly Agree	9	26.5
	Total	34	100.0
Recognizing the Identify hazards	Strongly Disagree		
	Disagree	2	5.9
	Undecided	3	8.8
	Agree	17	50.0
	Strongly Agree	12	35.3
	Total	34	100.0
Standards on Protective Equipment (Equipment care)	Strongly Disagree		
	Disagree	3	8.8
	Undecided	3	8.8
	Agree	13	38.2
	Strongly Agree	15	44.1
	Total	34	100.0
Organization should have a good training program as part of its safety plan.	Strongly Disagree	1	2.9
	Disagree	4	11.8
	Undecided	3	8.8
	Agree	8	23.5
	Strongly Agree	18	52.9
	Total	34	100.0

Source own survey 2019

The second part of risk management technique is mitigated techniques. Some the risk management mitigated techniques are listed in the table 4.9 below.

According to table 4.9 shows that 88.2% of the respondents were strongly agreed and agreed on recognizing an identified risk as a potential threat to success mitigated techniques; 8.8% of the respondents were undecided and the remaining 2.9% of the respondents were disagreed. This implies that this part of mitigated techniques is the major part of risk management techniques. According to Troy, Scavella (2015), a successful Threat and Vulnerability Management Program includes a comprehensive, well-maintained asset inventory, vulnerability management processes that incorporate threat modeling, integration with enterprise risk management processes, and penetration testing. According to wolters, Kluwer (2017), Today, ensuring visibility and effective management over increasing internal and external risks, (including operational, financial, brand and strategic risks) while maintaining the ability to achieve key objectives, is a high priority for organizations. Providing pertinent risk information is an equally essential step towards ensuring informed strategic decision-making and efficient resource allocation. Hence,

79.4% of the respondents were strongly agreed and agreed on Purchase technology/software to capture and display critical information of mitigated techniques; 17.6% of the respondents were undecided and the remaining 2.9% were disagreed. This also implies that it is the second part of mitigated techniques that the project managers frequently used that said when the interview conducted period. Hire or assign internal staff questionnaire survey were strongly agreed and agreed by 73.5% of the respondents; 26.5% of the respondents were undecided. This result shows that most of the respondents were believed that this mitigated technique is the major risk management techniques but the remaining respondents have no idea about this risk mitigated technique.

According to Peter J. (2006), Manpower management focuses on the accurate identification of human resource requirements (in terms of both quantity and quality) necessary to perform specific tasks and upon the organization and position structure in which they will be most efficiently and economically used. Hence, table 4.9 show that respondents on the below 4.9 table 76.5% of the respondents were strongly agreed and agreed on adding extra budget and additional man power; 23.5% of the respondents were have not idea about this type mitigated techniques. Also by adding extra budget and additional labor during risk management is the first choice said that respondents when conducting the interview. According to Delay or adjust project timing point view 35.3% of the respondents were agreed; 35.3% were undecided and the remaining 29.4% the respondents were disagreed. This implies that most of the respondents according to these mitigated techniques respondents were not believed for this mitigated technique.

Finally, from the “Seek out the experts and use them” pint of view 79.4% of the respondents were agreed; 14.7% of the respondents were undecided and 5.8% of the respondents were disagreed. According to Aldo Benini and Patrice Chataigner, (2017), Experts are indispensable in modern organizations. They fill gaps in data and in the understanding of existing or missing data. They introduce, apply and teach techniques and methods, some of which staff of the experts’ principals - and ultimately others - will continue to employ and disseminate. Technical experts reduce uncertainty by working out consensus opinions and probability ranges. Policy experts unravel the preferences and capacities of stakeholders. This shows that seek out the expert and use them are the main mitigated techniques of those risk management techniques. Almost all the above-identified mitigated techniques were being practices on tower construction project.

Table 4.9 mitigation techniques of risk management practices of the respondent

Items	*Responses*	*frequency*	*percent*
Recognizing an identified risk as a potential threat to success	Strongly Disagree		
	Disagree	1	2.9
	Undecided	3	8.8
	Agree	13	38.2
	Strongly Agree	17	50.0
	Total	34	100.0
Purchase technology/software to capture and display critical information	Strongly Disagree		
	Disagree	1	2.9
	Undecided	6	17.6
	Agree	20	58.8
	Strongly Agree	7	20.6
	Total	34	100.0
Pre-qualified and partnered with union locals and/or contractors	Strongly Disagree		
	Disagree	1	2.9
	Undecided	13	38.2
	Agree	11	32.4
	Strongly Agree	9	26.5
	Total	34	100.0
Request a budget increase	Strongly Disagree		
	Disagree	5	14.7
	Undecided	13	38.2
	Agree	12	35.3
	Strongly Agree	4	11.8
	Total	34	100.0
Use of a standardized approach	Strongly Disagree		
	Disagree	2	5.9
	Undecided	12	35.3
	Agree	17	50.0
	Strongly Agree	3	8.8
	Total	34	100.0
Hire or assign internal staff	Strongly Disagree		
	Disagree		
	Undecided	9	26.5
	Agree	10	29.4
	Strongly Agree	15	44.1
	Total	34	100.0

Use hedging budget and man power	Strongly Disagree		
	Disagree	1	2.9
	Undecided	8	23.5
	Agree	15	44.1
	Strongly Agree	10	29.4
	Total	34	100.0
Delay or adjust project timing	Strongly Disagree	3	8.8
	Disagree	7	20.6
	Undecided	12	35.3
	Agree	7	20.6
	Strongly Agree	5	14.7
	Total	34	100.0
Seek out the experts and use them	Strongly Disagree	1	2.9
	Disagree	1	2.9
	Undecided	5	14.7
	Agree	8	23.5
	Strongly Agree	19	55.9
	Total	34	100

Source own survey 2019

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary of findings

This study was conducted for the purpose of assessing the risk management practices on the case Ethiotelecom tower construction project. The descriptive method of research was utilized and the primary and secondary data collection technique was used for gathering data. The questionnaire and interview served as the instrument for collecting data. Questionnaires were administrated to 34 ZTE, HUAWEI and Ethiotelecom staff. And also an interview was conducted on the top management from those three organizations. The study was conducted during the School year 2018/19 G.C.

One of the finding of this study specified that to identify the major risk factors that affect the tower construction project in Ethiotelecom. So starting from the process of literature review, categories of different risk groups and risk factors related to tower construction project was done. 37 types of risk factors, 13 types of risk analysis techniques, 10 types of preventive techniques and 9 types of mitigated techniques were selected under this study.

Most of the identified risk factors above 70% were categorized under a type of high risk factors on this study; 40%-70% were categorized under medium risk factors and below 40% were categorized under low risk factors.

The finding of the risk categories including the list of risk factors, socio-political risk category was the first higher risk categories from the others of tower construction project and from this categories bribery/corruption risk factor was also the higher type of risk factor from all 37 risk factors. Financial risk category was the second type of higher risk category and also from this category increase material cost and availability and fluctuation in foreign exchange were the second and the third risk factors respectively from the 37 risk factors.

Environmental, management related risk, physical and construction risk categories were the third type of higher risk categories and also from this categories weather and seasonal implications, attitude of participants, damage to equipment and labor productivity were the third risk factors from the others. The remaining technical and logistics type of risk categories were under medium risk factors but one of the risk factor, change in low and regulations was categorized under low risk factors.

The second part of the finding of this study specified that to assess the risk analysis techniques on tower construction project. Most of the risk analysis techniques, above 70% were categorized under highly used; 60%-70% were categorized under medium and below 60% were used rarely.

The findings of the risk analysis techniques expert system, using computer simulation and Delphi techniques were categorized under highly used risk analysis techniques. Using decision tree, probability analysis and expected monetary value were categorized under medium. The remaining's were categorized under rarely used.

The third and the final finding of this study were the risk management techniques on tower construction project. In this study there are two types of risk management techniques, the first risk management techniques of this study were preventive techniques. Most of the preventive techniques, above 70% were categorized under high preventive techniques; 60-70% was categorized under medium preventive techniques and below 60% were low preventive techniques. The finding of this preventive techniques Produce a proper schedule by getting updated project information, Recognizing the Identify hazards, Standards on Protective Equipment (Equipment care), Produce a proper schedule by getting updated project information, Organization should have a good training program as part of its safety plan and Utilize different risk analysis techniques for accurate time estimate were categorized under high preventive techniques practices. Add risk premium to time estimate preventive techniques was categorized under medium and the remaining Depend on personal judgment to produce a proper program, Transfer or share risk to/with other parties and Treat every circuit as if it is energized and work de-energized were categorized under low preventive technique practices.

According to mitigated techniques of risk management techniques finding recognizing an identified risk as a potential threat to success, Purchase technology/software to capture and display critical information, seek out the experts and use them, Hire or assign internal staff and Use hedging budget and man power were categorized under high mitigated techniques of risk management techniques. Pre-qualified and partnered with union locals and/or contractors, Use of a standardized approach and Request a budget increase were categorized under low mitigated techniques of risk management techniques.

5.2. Conclusion

This study was to survey an assessment of risk management practice in the case of Ethiotelecom tower construction project. The results of this study tells that most of the Ethiotelecom tower construction project staff didn't have sufficient knowledge about risk management and also they were new for risk factors and risk management techniques. Without ZTE and HUAWEI top management staff, all of the Ethiotelecom staff could not practices and used risk analysis techniques. This implies that all Ethiotelecom staff could not predict the coming potential risk.

From the study finding, the identified risk factors reviewed affect the tower construction project; especially that found on the socio-political risk categories (bribery/corruption). In addition, on financial risk category (increase material cost) were the major risk factors on tower construction project. In addition to this questionnaire survey, most of the interviewers were decided on the period of interview the bribery/corruption and increase material cost were also discussed

frequently by them. The communication between ZTE, HUAWEI and Ethiotelecom staffs also the main obstacles to achieve the goal of project; because of the communication, risk factors between them the working culture, time and language were totally different. This results the site condition, construction procedure and design change risk factors were exposed to misunderstanding between them and the tower construction project wouldn't be achieved its goal. According to the interviewed result, finding there was no any formal type of discussion about the risks and the general attitude about the construction risk management had a traditional way of knowledge.

Unwanted competition between contractors' between ZTE and HUAWEI increase material cost, new technology and Availability of resources-particularly construction equipment spare parts risk factors point of view were affected the tower construction project mainly. On Ethiotelecom side, Damage to equipment and equipment failure were the highest risk factors because of waiting much amount of time on the central warehouse without any protection exposed to sun light.

5.3. Recommendations

This part of the study goes to offer some possible resolutions to be taken by Ethiotelecom tower construction project department. To avoid or minimized the gap of this study the researcher recommends some points but could not avoid the risks totally from any construction project.

Starting from the central warehouse problem Ethiotelecom must have at list twenty warehouses the current available is only six. Due to this shortage of warehouse, almost all tower construction equipment and materials were out of service.

Ethiotelecom top management must deal with the contractors frequently about risks before that happen and use a standard risk management simulation software. In addition to this Ethiotelecom recruit highly expert manpower on this project.

Competition between the contractors must be avoid on material cost and labor costs because it forces them to use low skilled work force and non-original materials.

The tower construction project department should be use and practices risk analysis techniques to forecast the future risks on the project.

To avoid the Bribery/ corruptions from the project, Ethiotelecom should be buy all the necessary equipment and materials once before the project initiation; and it decreases material cost inflation and logistics process.

Ethiotelecom staffs those involves on the project must be participate and take any type of risk management training program; it is the main risk minimization and protection method tower construction project

Generally, Ethiotelecom, ZTE and HUAWEI top managements should be needed follow up risk management software and departments. In addition, Ethiotelecom should give careful attention for risk management practices and techniques.

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Appendix 1: Questionnaire

ST. MARY'S UNIVERSITY SCHOOL OF GRADUATES STUDY DEPARTMENT OF PROJECT MANAGEMENT

An Assessment of risk management practices: in the case of Ethiotelecom tower construction projects.

To the respondents,

My name is fasil mekonnen I am a postgraduate student of St, Mary University (SGS) department of project management. This questionnaire aim is to identify and assess the most common and frequently used the risk management practices of Ethiotelecom tower construction projects. Therefore, I kindly request you to spend some time and to honestly respond to all the questions. All the information you provide will kept in strict confidentiality and it will be only used for this study. Please answer each questions carefully. I have a big value for your participation and great thanks for the commitment of time, energy and effort. If you have any additional question related to the questionnaire, you can contact in the below addresses.

Thanks for yours cooperate.

Fasil mekonnen
St, Mary university SGS
Addis Ababa, Ethiopia

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Section A: Respondent's Bibliography

1. Respondent's Title_____
2. Contact _____
3. For how long have you been in the tower construction project? _____ Years.
4. Your organization _____.

Section B: Risk groups and Factor's

1. By ticking the box in the table indicate your level of agreement or disagreement to which the given risk groups and factors of risk management on your project.

Key:

5=strongly agree; 4=Agree*; 3= undecided; *2=Disagree*; *1=strongly disagree

Risk group	Different types of risk factors	**5**	4	3	2	1
Technical	Inadequate site investigation					
	Incomplete design					
	Inadequate of specifications					
	Uncertainty over the source and availability of materials					
	Construction procedures					
Logistics	Availability of sufficient transportation facilities					
	Availability of resources-particularly construction equipment spare parts.					
	Difficulty to give permits					
Management related risks	Uncertain productivity of resources Monopolizing of materials due to closure and other unexpected					
	Industrial relations problems					
	Contractual relation					
	Contractors experience					
	Attitude of participants					
	communication					
Environmental risks	Weather and seasonal implications					
	Natural disasters					
Financial	Availability and fluctuation in foreign exchange					
	Delays in Payment					
	Inflation					
	Local taxes					
	Improper estimation					
	Increase material costs					
Socio-political risks	Change in laws and regulations					
	Pollution and safety rules					
	Bribery/ corruptions					
	Language and cultural barrier					
	Requirement for permit then					

	approval					
Physical Risks	Damage to structure					
	Damage to equipment					
	Labor injuries					
Construction risks	Labor productivity					
	Labor disputes					
	Site conditions					
	Equipment failure					
	Design changes					
	New technologies					

Section C: Techniques of risk analysis in project management

2. **By ticking the box in the table, indicate your level of agreement or disagreement how to use the given risk analysis techniques of risk management in your project.**

Key:

5=strongly agree; 4=Agree*; 3= undecided; *2=Disagree*; *1=strongly disagree

Risk Analysis Techniques of Risk Management	5	4	3	2	1
Using Questionnaire and structured interviews					
Evaluation for multidisciplinary groups					
Expected Monetary Value (EMV) analysis					
Judgment of specialists and experts (Delphi Technique)					
Comparing analysis (compare similar projects through similar site)					
Probability analysis (analyze historical data)					
Probability Analysis					
Analysis of consequences					
Using Computer simulation					
Expert Systems (including software packages, decision support systems					
Using Sensitivity analysis					
Using **a decision tree analysis**					

Section D: Preventive Techniques of Risk Management

3. **By ticking the box in the table indicate your level of agreement or disagreement to which the given preventive techniques of risk management on your project.**

Key:

5=strongly agree; 4=Agree*; 3= undecided; *2=Disagree*; *1=strongly disagree

Preventive Techniques of Risk Management	5	4	3	2	1
Produce a proper schedule by getting updated project information					
Refer to previous and ongoing similar projects for accurate program					
Utilize different risk analysis techniques for accurate time estimate					
Add risk premium to time estimate					
Depend on personal judgment to produce a proper program.					
Transfer or share risk to/with other parties					
Treat every circuit as if it is energized and work de-energized					
Recognizing the **Identify hazards**					
Standards on Protective Equipment (**Equipment care)**					
Organization should have a good training program as part of its safety plan.					

Section E: Mitigated Techniques of Risk Management

4. **By ticking the box in the table indicate your level of agreement or disagreement to which the given mitigated techniques of risk management on your project.**

Key:

5=strongly agree; 4=Agree*; 3= undecided; *2=Disagree*; *1=strongly disagree

Mitigated Techniques of Risk Management	5	4	3	2	1
Recognizing an identified risk as a potential threat to success					
Purchase technology/software to capture and display critical information					
Pre-qualified and partnered with union locals and/or contractors					
Request a budget increase					
Use of a standardized approach					
Hire or assign internal staff					
Use hedging budget and man power					
Delay or adjust project timing					
Seek out the experts and use them					

Appendix 2: Interview questions

1. How do you deal with project risks in your organization?

_____
_____
_____
_____.

2. Have you attended any risk management workshop in Ethiotelecom tower construction project?

_____
_____
_____
_____.

3. Do you have any risk management model for your projects?

_____
_____
_____.

4. If the answer to question 3 is Yes, what control method do you apply?

_____
_____
_____.

5. When are the most frequent risks encountered in your projects?

_____
_____.

6. What is the general attitude toward construction risks in Ethiotelecom tower?

_____
_____
_____.

Thank you for your cooperation!