ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
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Assessment of risk management practices in power transmission projects: The case of Ethiopian Electric Power

By
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Statement of Declaration

I, Tesfamichael Assefa, hereby declare that 'Assessment of risk management practices in power transmission projects: the case of Ethiopian Electric Power' was carried out independently by myself with the guidance and support of project work advisor Dr. Tewodros Mesfin. Any other contributors or sources are referenced and listed in the reference section. I also declare that this project work is original and has not been presented in any other university.

Approval Sheet

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Abstract

In project management, Risk management is the practice of identifying, evaluating and preventing or mitigating risks to a project that have the potential to impact the desired outcome. Risk management contributes to projects' success to a wider range and ensures potential risks can be identified, mitigated and resolved within the given time frame.

Power transmission projects are projects that are undertaken under the power sector in order to achieve socio economic goal of a country. They serve as a mid-link between power generation and power distribution systems.

The purpose of this paper is to assess risk management practices in power transmission projects of EEP (Ethiopian Electric Power).

Online questionnaire was administered for a sample of 103 purposely selected employees working in 16 different power line transmission projects that are currently under construction and near completion. A response rate of 78.3 % was obtained. The questions covered risk management processes including risk identification, risk analysis, risk response and risk monitoring.

The findings of the research showed that all of the processes are practiced at a moderate (neutral) level.

Considering the high capital outlay and different risks associated with power transmission line projects, recommendations were made based on the findings showing where special attention should be given in order to enhance the risk management process.

Key words: Power transmission project, risk management process

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Acronyms

EEPCo – Ethiopian Electric Power Corporation

EEP – Ethiopian Electric Power

EEU – Ethiopian Electric Utility

GTP I – Growth and Transformation Plan I

GTP II - Growth and Transformation Plan II

GWH - Giga Watt Hour

HV – High Voltage

IEA - International Electric Agency

KV – Kilo Volt

MoWIE – Ministry of Water Irrigation and Energy

MW – Mega Watt

PTP – Power Transmission Project

ROW – Right of Way

TL – Transmission Line

Chapter One

1 – Introduction

1.1 - Background of the Study

Risk generally signifies an uncertain event, situation, or condition which may occur. The risks associated-to could have a potential positive or negative impact on project goals, objectives or performance (Flanagan, Norman and Chapman, 2006). Risk is inherent to any project regardless the utilities and thus risk management should be of interest to any project manager.

Risks differ between projects due to the fact that every project is unique, especially in the industries (Gould and Joyce, 2002). In that regard, risk management has become an important part of the management process for any project. Nevertheless, with engineering projects, risk management is not commonly used (Klemetti, 2006).

Electricity plays a driving role in social-economic development and improvement of the quality of life of a society and it is also linked to all sectors of the economy. Lack of access to electricity is seen as a major constraint to economic growth and increased welfare in developing countries. It drives economic and social development by increasing productivity, incomes, and employment; reducing workloads and freeing up time for other activities; and facilitating the availability of higher-quality or lower-priced products through local production (Ana and Ramy, 2015).

Power Transmission projects are one of the projects undertaken under the power sector in order to meet those socio-economic development targets. They comprise projects that are undertaken with the aim of delivering bulk electrical power from the generating station up to distribution level. They serve as a mid-link between generating and distributing systems.

Generally, Power Transmission project management is challenging because of the presence of High Voltage Power Transmission lines, particularly right of way (ROW), which makes power transmission projects significantly different (in terms of scope) to non-power projects (Gordon-Watt, 2009; Pall, Bridge, Skitmore & Gray, 2016)

Ethiopian power sector is owned by the state. The Ethiopian Electric Light and power Authority (EELPA) which was established in 1956, after having undergone restructuring was recognized as the Ethiopian Electric Power Corporation (EEPCO). EEPCO later divided in to two companies: Ethiopian Electric Power (EEP) and Ethiopian Electric Utility (EEU) in 2013. EEP was established by the Council of Ministers regulation No. 302/2013 having responsibility of generating, transmitting and wholesale of electricity for nationwide and neighboring countries.

The theme of this research, thus, is only limited to selected Power Transmission projects which are currently being constructed under EEP (Ethiopian Electric Power).

The Government of Ethiopia has an ambitious target of raising the power generation capacity of the country from 4478 MW to 19,900 MW; to increase power transmission lines from 18400 km to 29,900 km; to increase electricity export from 2803 GHW to 7184 GWH; to increase the number of electricity customer from 5.8 million to 24.3 million; to increase the coverage of grid based electricity from 33% to 96% and to reduce off grid from 11% to 4% in a span of ten years between 2000/21 and 2029/30 according to the Ten Years Development plan prepared by planning and Development commission.

1.2 - Statement of the Problem

Ethiopia is endowed with huge renewable energy resources including hydro, wind, geothermal, solar and bio-energy. According to MoWIE (2015), the gross hydro-energy potential of the country is 45,000MW, wind (1035GW) geothermal (7,000 MW), solar (5.2 kWh/m2). However, the country has not utilized insignificant amount of its energy resource potential. As per the report from International energy agency, in Ethiopia, 55.2% of the population is living without access to electricity. The rural area is suffering from the lack of access to electricity with the rate being 32% coverage, compared to the urban area with 92% connection to electricity (IEA, 2021).

According to Pall (2021) worldwide power transmission projects experience delay. Delays in PT projects have a significant adverse effect on economic development of a country and although billions of dollars are invested globally in PT projects, costly delays are common.

Same is true when we look at power sector projects in Ethiopia. A research conducted by Getachew (2018) has identified that most of government's energy sector plan on GTP I were not realized due to lack of proper planning, weak implementation capacity and coordination among different institutions in the sector, lack of finance and implementation capacity.

GTP II report indicated that the average performance of all power projects in Ethiopia in the term was 52%.

According to EEP's annual performance report bulletin, overall power transmission projects' performance of 2013 E.C fiscal year was 65.38%. Further examination of the report shows that from the listed sixteen power transmission projects that are currently under construction, projects which had progress greater than sixty (>60%) at the end of the previous fiscal year have an average of 74.42% progress in 2013; projects which had 30-60 percent progress at the end of previous fiscal year have an average progress of 57.91% in 2013 and projects which had less than (<30%) progress at the end of the previous fiscal year have an average of 37.72% progress in 2013.

The figures described above shows that there is grave underperformance with regard to power transmission projects in Ethiopia.

Wamukonya (2013) indicates that the reason for the underachievement of the Power sector relates to the incompetence to complete projects effectively. Diverse activities involved in power sector projects demand the need to manage the all aspects of the project in a meticulous way.

One of the areas that need to be managed effectively is project risk. According to Assaf and Al-Heji (2006) variations in implementation of projects are result of unmanaged risks during the life cycle of a project and especially in its initial stage. A research that supports this very idea presented by Nnadi, Enebe and Ugwu (2018) shows that less involvement of stakeholders in managing risks can lead to cost and time overrun and even failure.

No.	Name of Project	Progress up to end of 2012 E.C	Planned progress for 2013 E.C	Actual progress of 2013 E.C	Performance (%)
1	Ethio-Kenya Interconnection project	92.01	7.99	7.99	100
2	Genale Dawa III-Yirgalem-Welaita Sodo PTP	96.19	3.81	2.74	71.9
3	Bahirdar-Weldia-Combolcha 400/230 PTP	66.49	29.99	18.89	62.97
4	Akaki-Debrezeit-Mojo-Ginchi PTP	98.1	1.9	1.9	100
5	Gibe II-Addis Ababa Double Circuit PTP	82	18	0.05	0.28
6	Gimbi-Tulu-Kapi 132 KV PTP	17.4	50.14	18.05	35.99
7	Akaki-Koye-Abo-Qilinto-Bole lemi PTP	98.13	1.87	1.87	100
8	Mekelle-Dalol 230KV PTP	62.25	37.75	20.33	53.86
9	Semera-Afdera PTP	61.2	38.8	27.88	71.84
10	Adama II PTP	27.36	72.64	54.66	75.25
11	Azezo-Chilga, Fincha-Shambu, Metu-Masha PTP	44.99	45.01	28.11	62.45
12	Addis Ababa HV TL PTP	63.82	28.68	24.41	85.13
13	Electricity grid southern expansion PTP	10.88	18.19	9.01	49.52
14	Dejen-Debremarkos, Ashegoda, Dessie, Hormat PTP	33.25	36.75	24.04	65.41
15	Beles Sugar Factory Power supply PTP	97.67	2.33	2.33	100
16	Awash-Weldiya railway power supply PTP	1.5	87.05	10.07	11.57

Table 1.1 – List of power transmission projects currently under construction by EEP

Even though managing risk has a severe benefit for project success, Morris and Hough (1987) distinguished that in many projects, risk management practices are not extensively applied, and many project managers are still having the habit of assuming that projects will be completed successfully.

Raz et.al. (2002) studied risk management practices in hundreds of projects in variety of industries. The result of the study suggested that risk management is not widely used; the projects that most likely had a risk management plan were those that were to be perceived high risk; when the project management practices were applied to the projects, they seemed to be positive concerning the success of the project; the risk management approach influenced the programs and objectives of the project costs, but exerted a smaller influence on the quality of the project products and proper risk management increases the likelihood of a successful project.

Despite the fact that risk management is one of the factors that contribute to the success of projects in power sector of Ethiopia, no previous studies were done on the topic.

This research tries to examine whether or not there are practices of risk management in power transmission projects and their level of application in selected projects which are currently under construction by the Ethiopian Electric Power Company.

1.3 - Objectives of the research

1.3.1 - Main objective

The main objective of this research is to assess risk management practices in Selected Power transmission projects of EEP

1.3.2 - Specific objectives

- To assess risk identification practices of power transmission projects in EEP
- To assess risk analysis practices of power transmission projects in EEP
- To assess risk response practices of power transmission projects in EEP
- To assess risk monitoring practices of power transmission projects in EEP

1.3.3 Research Question

- What level of application do risk management processes have in power transmission projects in EEP?

1.4 - Scope of the study

This study focuses on power transmission projects which are currently being constructed and are in different stages of construction (initial to closure) by Ethiopian Electric power

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1.5 Organization of the paper

The research is structured into five chapters. Chapter one discusses the introduction part. It contains background of the study, statement of the problem, study objectives, research question and organization of the research paper. Chapter two presents theoretical and empirical literature review. Chapter three covers research paradigm, research design, research methodology, sampling design and method of analysis selected. Chapter four discusses data analysis and findings and the final chapter talks about conclusion and recommendation.

Chapter Two

2 – Literature Review

2.1 - Introduction

This chapter presents different theoretical and empirical review regarding risk, risk management and its process. Variety of published papers, books and other necessary documents are used as a basis for the literature review.

2.2 - Theoretical Review

2.2.1 - Defining Risk and Project Risk Management

Risk is defined in terms of uncertain events which may have positive or negative effect on project objective. Risks include circumstances or situations, the existence or occurrence of which, in all reasonable foresight, results in an adverse impact in any aspect of the implementation of the project (Hessami, 2019).

Risk can be defined as a condition where there is unwanted happening of a particular event or result (Periasamy, 2008). It can also be defined as the probability that unfavorable outcome may appear and could change the prospects for the probability of a given investment (Nasir et al., 2003). Reduced earnings, loss or other financial consequences may appear as a result of risk (Vasavada, Kumar, Rao & Pai, 2005). The undesired outcome due to the uncertain event could also be loss of reputation or image (Sharma, 2003).

Risk and uncertainty are often used synonymously. However, risk differs from uncertainty in that its likelihood of happening and degree of impact can be quantified (Sharma, 2003). Obsorne (2012), has indicated that

> "Risks can arise as a result of our business's activities or as a result of external factors such as legislation, market forces, and interest or exchange rate fluctuations, the activities of others or ever the weather. They can be a product of business environment, the natural environment, and the political or economic climate or of human inadequacies, failing or errors. The bottom line is that risk may impact on our ability to meet our business objectives or even threaten the business itself".

Risk is a multi-faceted concept (Wang et al, 2014), which is defined as the probability of damaging event occurring in the project affecting its objectives (Yu, 2002; Baloi and Price, 2003) however, not always associated with negative results. Risk may also represent opportunities, but the fact that most of the risk usually has negative results has led individuals to only consider the negative side of the risk (Baloi and Prince, 2003; Hillson, 2011)

In order to minimize or mitigate the possible threat due to risks, it has become important to have a management process in place in addition to all other management processes necessary for a successful project completion.

Project Risk Management is a process followed to reduce the likelihood of risk occurring or its negative impact on the project. Suleiman claims that formal risk management has become common practice in the construction sector only within the recent 20 years (Suleiman, 2001). However, it has always been present in the industrial environment (Olsson, 2007). The need to integrate risk management practice to the traditional project management has gained attention in recent decades because of an increased awareness about the relationship between efforts to reduce risk and project performance (Miles and Wilson, 1998).

2.2.2 -Risk Classification

Risks can be divided into different classifications or categories. In broad classification risks can be categorized into three according to their nature.

Known risks: these risk events are frequently occurring in all construction projects and are inevitable, thus including minor fluctuations in material costs and productivity (Smith et al., 2006). It is the cognitive condition of risk, where the identification of the risk source has been made and the probability of occurrence regarding the risk event has been assigned (Winch, 2010).

Known unknowns: these risk events are somewhat predictable meaning there is some knowledge regarding either the probability of occurrence or their effect (Smith et al., 2006). It is the cognitive condition of uncertainty, where at least the risk source has been identified.

Unknown unknowns: it is the cognitive condition of uncertainty in which somebody might have knowledge about the risk source and probabilities but keeps the information private. The risk source is not identified and the risk event can therefore not be known (Winch, 2010). Thus, these risk events are incidents whose effect and probabilities of occurrence are unforeseeable, even by the most knowledgeable and experienced members of a project (Smith et al., 2006).

In addition to the above broader classification, diverse lists of risks have been prepared for certain types of projects individually. Examples of these lists can be found in different literature. Gajaewska & Ropel (2011) has compiled a list of risks from different sources. Monetary risks (Financial, Economical or Investment), Political or Legal risks, environmental or natural resource related risks, technical risks, contractual risks, human related risks (labor, stakeholder, cultural etc.), market risks, safety or security risks and material risks (resources or logistics) were identified in most of the sources studied by the researchers.

2.2.3 - Risk Management and Project Performance

A project is said to have a good project performance if it has attained its cost, time and quality goals. Performance in this regard has similar meaning as project success. But project success may have broader meaning including organizational benefit and benefit for the stakeholder community (Atkinson, 1999).

Zhou, Zhang and Wang (2007) indicated that time, cost, quality, safety and environmental sustainability objectives are project performance indicators. Whereas Egan (1998) stated cost, time, client satisfaction, safety, profitability and productivity are project performance indicators.

The impact of having a project risk management practice on project has been a subject of different authors. An article authored by Alter and Ginzbeg states that the likelihood of a successful project completion can be maximized by identifying key uncertainties in the planning stage and having a strategy for handling the uncertainties (Alter and Ginzberg, 1978)

Literature shows that risk management in construction projects is full of deficiencies that affect its effectiveness as a project management function and in the end projects' performance (Olsson, 2004). Olsoon further states that previously reductionist approach was taken for risk management in construction projects. The risks were handled by applying contingencies (money) or floats (time) without comprehensive analysis. This, Olsson concludes, has led to late completion and cost overruns.

2.2.4 - Risks in Power Transmission Projects

There are a number of risks which can be identified in the construction industry and are common regardless the project's size and scope. Changes in design and scope along with extended time frames are the most common problems in engineering construction given investment size. Depending on the project scope, type of risks may differ among investments.

Power Transmission Projects, being construction projects, face some common problems as the other types of construction projects. There are also distinctive problems that could only be attributed to Power Transmission Projects.

According to Pall et al. (2019) Power Transmission Projects characteristically cross many different owners land and, hence, new transmission line (TL) construction is usually a conflicting issue to local people and land lords. It is noticed that the main causes of delays in construction of new transmission lines are authorization processes, right of way issues, project stakeholders' agreement, and public and political support. Power lines crossing environmentally and culturally sensitive areas frequently cause delays in PT project implementation.

Power transmission projects face social, political, environmental, management, and technical risks. Moreover, in a complicated restructured electricity market, the planning processes of new transmission lines usually take an extended time.

Risk evaluation done on Ultra High Voltage (UHV) power transmission construction project in china has identified five categories of risks associated with power transmission projects. The risks identified are: policy and law risk, management risk, technological risk, natural environment risk and society risk (Huiru Zhao and Nana Li, 2015).

Another research done by Global Infrastructure Hub to investigate risks encountered in power transmission projects has identified Land Availability risk, Access and Site risk, Social risk, environmental risk, design risk, construction risk, variations risk, operating risk, demand risk, financial markets risk, strategic/partnering risk, disruptive technology risk, force majeure risk, change in law risk, Early termination risk and condition at hand back risk (Global Infrastructure Hub, 2019)

2.2.5 - Risk Management Process

Copper et al (2005) explains risk management process as

> "The risk management process involves the systematic application of management policies, processes and procedures to the tasks of establishing the context, identifying, analyzing, assessing, treating, monitoring and communicating risks"

The concept of risk management process has evolved through the years. Different scholars tried to come up with their version of alternatives for managing risks. For example, Chapman has introduced a nine phased risk management process (Chapman, 1997). Other alternatives were brought by Tummala and Burchett which comprises of five phases (Tummala and Burchett, 1999) and Dey (2000) which has four steps. PMBOK (2004) identifies 6 steps in project risk management which include risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning and risk monitoring & control. Whereas, according to partnership victoria guidance material (2001) the steps followed for risk management process are: risk identification, risk assessment, risk allocation, risk mitigation and monitoring and reviewing of risk.

Although there are many variations of risk management process steps available in literature, for the purpose of this model we will follow the model of risk management process described by Smith et al. (2006) and Hillson (2004). The model follows risk identification, risk analysis, risk response and risk monitoring.

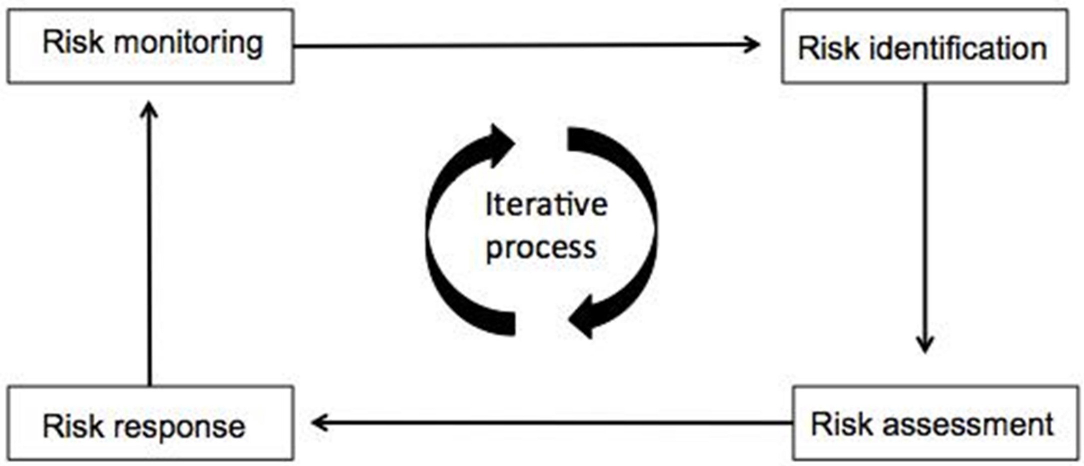

Fig 2.1 - The iterative process of Risk Management (Hillson, 2004)

2.2.5.1 - Risk Identification

Risks are easier to eliminate or manage when they are identified. Risk identification is helpful not only in solving problems in advance but also to be prepared for potential threats that could happen as a surprise. Identified risks could also be used as opportunities that could lead to profitability and advantage for the organization (Winch, 2002). For risk identification various ways can be used depending on the organization and the project. It is mainly done by using information from past experiences and is usually informal.

The objective of identifying risks is to find a list of risks that must be managed in a project. (PMI, 2004) The project team then could be aware of the highlighted threats in advance and take action to manage them.

Many alternative methods have been forwarded by scholars to identify risks. Information obtained by Workshops, interviews, questionnaires, brainstorming, benchmarking, consulting experts, past experiences, Delphi technique, risk breakdown structure, location visiting , previous documentations and new research could be used to identify potential risks.

2.2.5.2 - Risk Analysis

Risk analysis is the following step in the risk management process after identifying possible threats. It can be described as short listing of risks with their degree of impact on the project (Cooper et al, 2005). Once the risks are identified, there are two methods of analyzing risks: qualitative and quantitative.

Qualitative risk analysis will be mainly based on the correct estimation of project's risk probability and scale of accompanied effects. It will also help determine which of the potential hazards should be analyzed and verified first and which of them can be "put away" in time due to slight probability occurrence.

The qualitative methods are most applicable when risks can be placed somewhere on a descriptive scale from high to low level. There are a variety of techniques used to undertake qualitative risk analysis. Some of the methods used to perform qualitative analysis are described below.

Probability & impact assessment - can be applied in order to evaluate the likelihood of a specific risk to occur. The risk impact on project objectives is assessed in terms of opportunities and positive effects as well as threats and negative effects. It is important to adapt and define the probability and impact to the specific project.

The risk matrix method - can be used additionally by having probability and impact as a basis for further analysis. The priority score can be computed as the average of the probability and impact and the priority score range, rate and color are given to illustrate each risk's significance.

The high priority score threats, meaning high impact and likelihood, are viewed as high-risk and could necessitate an urgent response while low scored threats could be further monitored and given attention only if needed.

Risk categorization - is applied as a way to systemize the threats according to their sources, in hopes of identifying areas with the highest exposure to those risks. The usage of this method breaks down activities into small units and creates hierarchical series of activities, additionally this method can include risk dependencies and a prioritization of them depending on how quick response they require.

The quantitative methods are used to determine the probability and impacts of the risks identified, and are based on numeric estimations (Winch, 2002). Companies tend to use a qualitative approach since it is more convenient to describe the risks than to quantify them (Lichtenstein, 1996).

The quantitative risk analysis is defined as the process of evaluating and quantifying risk exposure by assigning numeric values to the risk probabilities and impacts as illustrated by Heldman (2005). However, some of the quantification techniques are closely related to qualitative techniques because it required the overall score that needs to be obtained through the application of the probability and impact scales. In addition, there is also one approach called semi-quantitative analysis, which combines numerical values from quantitative analysis and description of risk factors, the qualitative method (Cooper et al, 2005). There are varieties of methods used to perform quantitative risk analysis and some of them are described below.

Sensitivity analysis - is implemented in order to identify uncertain components in the project, which will have maximum impact on the outcome. The aim is to look at the sensitivity of various elements of the risk model on project outcome, by changing the values of one variable at a time and then showing the impact on the project.

Probabilistic analysis - is a method used to show the potential impact of different level of uncertainties on project objectives. It quantifies the effect of risks on project schedule and budget and it uses three point estimates such as worst case scenario, most likely scenario and finally best case scenario for each task. Monte Carlo Simulation is most often used for this type of analysis.

Decision trees - is a useful method to frame the problem and evaluate various options. The usage of this method consists of decision tree diagrams used to represent the project and show the effects of each decision (Mhetre et al., 2016).

2.2.5.3 - Risk Response

The third step in the process of risk management signifies what actions should be taken towards the various risk and threats previously identified (Mhetre et al., 2016). The planning process of risk response is defined by PMBOK as the development of options and determining actions to enhance opportunities as well as reduce threats to the project objectives. The process involves the assignment of parties to take responsibility for each agreed risk response, and the efficiency of this phase will determine if the risks increase or decrease the performance of the project.

There are mainly four response strategies followed to reduce exposure to risk in projects

Avoidance – One can use avoidance by changing project plan by reappraisal or cancelling which will make the risk irrelevant. It promotes changing project plan to facilitate the elimination of the risk or to protect the project from the potential negative impact. An example might be avoiding an unfamiliar subcontractor (PMI, 2000).

Transfer – It involves forwarding risks or consequences to another body that is willing to accept the responsibility. This method is most effective in regards to dealing with financial exposure to risk. It includes the use of both contracts and insurance to transfer liability to other parties, for instance by contractor to subcontractor and often involves payment of risk premium to the party that is taking on the risk and responsibility of the consequences (PMI, 2000). The main purpose is to ensure that the risk is owned and managed by the party best able to handle the task successfully (Mhetre et al., 2016).

Mitigation and Reduction – This method is used to mitigate or minimize the probability of a damaging event happening (Winch, 2010). Flanagan et al (2007) describes implementing an altered construction method and the use of other materials to reduce potential risks, or executing a new or more detailed planning. Additional reduction strategies include contingency planning, quality insurance, separation or relocation of activities and resources.

Acceptance – If it is impossible to take advantage of all the methods described above, at least it is possible to be aware of the treats through documentation and identification of them.

2.2.5.4 - Risk Monitoring

Continuous monitoring and review of potential risks throughout the project life cycle is essential part for proper implementation of the risk management process. It makes sure that novel risks are identified in advance and managed. The project manager should monitor a list of the major risks that have been identified for risk treatment action, which should be a primary tool used management meetings (Cooper et al., 2005).

Risk management should start early in the project life cycle and continue to project closure phase. It must be an ongoing process throughout the entire the project life cycle as risks will continually change.

2.3 - Empirical Review

Raz et.al. (2002) studied risk management practices in hundreds of projects in variety of industries. The result of the study suggested that

- Risk management is not widely used;
- The projects that most likely had a risk management plan were those that were to be perceived high risk;
- When the project management practices were applied to the projects, they seemed to be positive concerning the success of the project;
- The risk management approach influenced the programs and objectives of the project costs, but exerted a smaller influence on the quality of the project products and
- Proper risk management increases the likelihood of a successful project.

Even if the researcher was unable to find studies performed on risk management practices in power transmission projects, researches undertaken in other construction and other sectors have shown that risk management practices

According to a preliminary research in Chile on companies that hire construction services on a recurring basis and do not apply risk management practices have shown negative performances on projects (Wolbers, 2011; Howard and Serpell, 2012). A research conducted on claims and contract disputes on selected construction projects by Palma (2007) had revealed one of the main causes for the claims and disputes were unmanaged and unanalyzed risks by parties, customers or contractors.

Research was conducted by Roque and Marly (2013) to understand the impact of project risk management on project performance which involved a survey of 415 projects with different levels of complexity and diverse sectors in Brazil showed that applying risk management has a positive impact on project success. One of the additional findings of the research was that having a risk manager has a positive impact for the project performance. Another case study that was carried out in South Africa by Mudau and Pretorus (2009), with the objective of assessing the contribution of control and risk management for project success, showed that risk management and project controlling had a significant positive influence on project performance. They also indicated that by strengthening control and risk management practices better results could be achieved.

A study undertaken by Mardiana, Puji and Ayuu (2018) with an objective of evaluating risk management on financial performance of 5 companies in Indonesia found out that risk management had a positive significant impact on financial performance. The study used corporate governance as a moderation variable. The findings showed that better returns were achieved with better risk management practices.

A study carried out by Laurence (2006) to determine the impact of risk management practices in planning stage of construction projects in Rwanda showed that even if informal risk management was practiced widely the lack of its implementation in the cost and schedule development phase of planning has led to negative project performance.

2.4 – Conceptual Framework

This research tried to assess application of risk management practices in 16 currently under construction and near completion power transmission projects. The proposed framework for the research is illustrated in the figure below. It shows the iterative process of risk management practices and how each process is used to examine the overall risk management practice in the aforementioned projects.

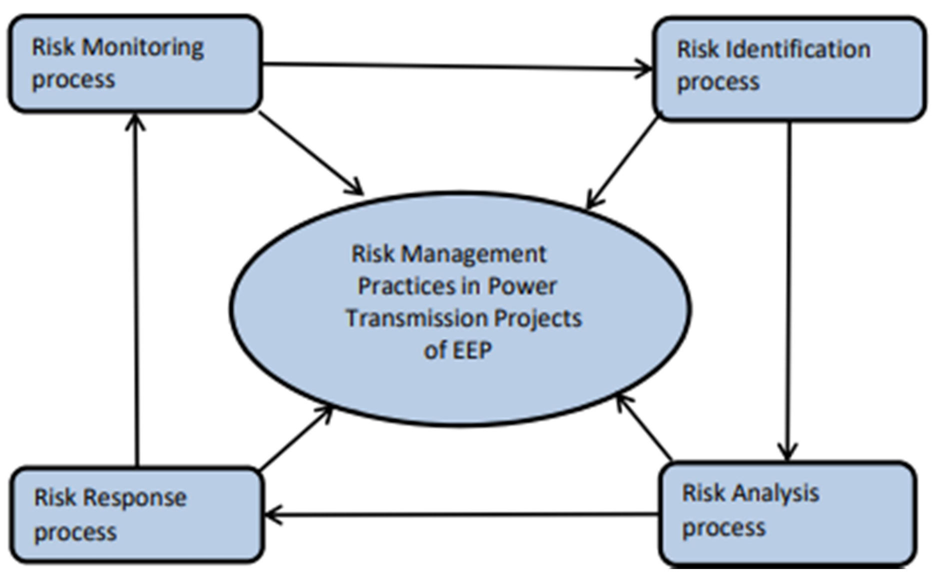

Fig 2.2 Own Conceptual Framework

Chapter Three

3 - Research Design and Methodology

This chapter explains what methodology was used in doing the research. The research design, issues associated with sampling and techniques used for the sampling process, data collection methods and data analysis preferences will be discussed thoroughly.

3.1 - Choice of Study

This research is conducted based on previous experience gained from working in power transmission projects at different capacity. Recently, risk management is becoming essential part of any business. In engineering construction projects, where here is a huge capital investment, having a risk management practice along with the traditional project management practice is becoming essential. Power transmission projects are among one of the construction projects where there lies a huge economic significance. Nonetheless, the researcher couldn't find previous studies carried out on the topic.

3.2 - Research Paradigm and Research Method

3.2.1 - Research Paradigm

According to Guba and Lincoln (1994),

> "A paradigm may be viewed as a set of basic beliefs (or metaphysics) that deals with ultimate or first principles. It represents a worldview that defines, for its holder, the nature of the "world," the individual's place in it and the range of possible relationships to that world and its parts, as, for example, cosmologies and theologies do. The beliefs are basic in the sense that they must be accepted simply on faith"

Research paradigms are 'the entire constellation of beliefs, values, techniques, and so on shared by members of a given community' (Kuhn, 1970) .The three most common paradigms are positivism, constructivism or interpretivism and pragmatism.

Positivism is guided by the principle of objectivity and deductive logic. The positivist framework operates from the assumption that society can and should be studied empirically and scientifically. Most of the scientific or quantitative research use positivism as a conceptual framework for research. Quantitative research always follows positivist approach because positivists believe in the empirical hypothesis testing.

Constructivism posts that the truth varies. Truth is different based on what you ask, and people change definitions of truth all the time based on their interaction with other people. Most of the qualitative research in social science use interpretivism approach to research. Interpretivists believe that human behavior is multilayered and it cannot be determined by predefined probabilistic models.

Pragmatism research philosophy states that research question is the most important determinant of the research philosophy. Pragmatics can combine both, positivist and interpretivism positions within the scope of a single research according to the nature of the research question.

This study will follow a pragmatic research perspective.

3.2.2 - Research Methodology

There are two types of research methodologies: qualitative and quantitative. When a research uses objective measurement and statistical analysis of numeric data to explain a given phenomenon it is called quantitative research (Ary, et al., 2002). The primary aim of quantitative research is seeking evidence about a characteristics or relationship by using statistical inference and generalizes results from the studied population (Patrick, 2008). On the other hand, qualitative research refers to a research that uses verbal or visual data instead of numeric data gathers information through interview and observation and try to provide insight about a given phenomenon (Ary, et al., 2002).

For the purpose of this research both qualitative and quantitative research methodologies are followed.

3.3 - Research design and Research Approach

Research design is the conceptual framework that the research is based on. Kothari (1990) defines research design as an arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure.

Research design is a blueprint or empirical research aimed at answering specific research questions through specifying the methods and procedures for collecting and analyzing the needed information (Bhattacherjee, 2012). Therefore, use of an appropriate research design is something that could not be subjected to compromise if a viable research finding is sought to be achieved.

There are three types of research designs. Namely; exploratory, descriptive and explanatory research designs. Exploratory study is a research conducted with the goal of shedding new light on a new subject and is often generic. Descriptive study is conducted to describe occurrences and situations. Whereas, Explanatory studies are undertaken to show relationships between variables with the aim of explaining certain problems or events (Saunders, et al., 2007). For this research, a descriptive research design is followed.

Research approaches are plans and procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation (Creswell, 2014, p. 43). According to Mark, et al., (2009) there are two general ways of approaching a research problem, namely the deductive and inductive approaches.

The deductive approach is based on the logical way of thinking and the conclusion drawn from the theory. Thus, the deductive approach means that the research starts from already existing theories and model, from which propositions are developed and subsequently tested through empirical studies.

The inductive approach means the research starts from empirical studies and these studies are subsequently related to existing theories.

This research follows a deductive by referring different literatures, theories and models that were previously discussed by different authors.

3.4 - Data Collection

Both primary and secondary sources of data/information will be used for the purpose of conducting this research. The main tools for collecting primary data will be questionnaire. The data collection method is selected because it offers considerable advantages in the administration. It can also be administered to a large number of respondents simultaneously. Gay (1992) maintains that questionnaires give respondents freedom to express their views or opinion and also to make suggestions.

The questionnaire will have close-ended questions for respondents that are currently working on 16 power transmission projects that are currently under construction. The responses will be rated on Likert scale with score ranging from 1 up to 5. The questionnaire will have sections that will examine the level of application of risk management processes in power transmission projects.

Secondary data will be gathered from the projects performance reports and other different sources of relevant documentations written on the topic.

3.5 - Sampling Design

3.5.1 - Sample Size and Sampling Technique

Purposive sampling is used for the study so as to make sure the respondents are familiar with the case projects at hand and risk management processes in the context of those projects. To determine the number of sample respondents for my study, formula developed by Cochran (1963) to determine sample size when the population size is finite He

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Where:

n_0 = is the sample size when population is infinite and is given by z2pq/ e^2

z = is the selected critical value of the desired confidence level 1.96 (at 95% confidence level)

p = is the estimated proportion of an attribute that is present in the population the (assumed to be 0.5 since this would provide maximum sample size)

q = 1-p and e is the desired level of precision

e = the desired level of precision or margin of error (5% error or 0.5)

N = population size (140)

By using the above formula and substituting the values, the sample size for our population size will be 103.

3.6- Data Analysis

Statistical procedures will be followed and Statistical Package for Social Science (SPSS) will be used to analyze the data. Data analysis will be done both by descriptive statistics. Frequencies, percentages, means, standard deviations etc. will be used for descriptive statistics.

3.7 - Ethical Considerations

Ethics in research context refers to the appropriateness of one's behavior in relation to the rights of those who the subject one's work or those who are affected by it (Lewis and Thornhill, 2001)

The data was collected from willing respondents without any influence on them. Respondents are not disclosed and their response will solely be used for academic purposes. The research will try to use the responses without alteration or exaggeration.

Chapter Four

4 - Data Analysis and Findings

4.1 - Introduction

This chapter will discuss data presentation, analysis and research findings. Data analysis was done based on questionnaires administered through online survey using Google form to 103 staff members of Ethiopian Electric Power. For the purpose of analysis, I have used SPSS version 20 software. The chapter starts by discussing the nature of the study sample, profile of the respondents and descriptive statistics. Cronbach's alpha of 0.7 was used to identify reliability of the data (Guar A. and Guar S., 2009).

The results were analyzed to assess the objective of the study which is identifying the level of practices of risk management processes in power transmission projects which are currently under construction and near completion in EEP.

4.2 - Response rate

As indicated in previous part of this study, from the target population of 140 employees that are currently working on power transmission projects in EEP and assigned in different work positions, we have taken a sample of 103 employees and 81 of them has responded to the questionnaire administered online using Google Forms. This shows that 78.6% of response rate was achieved.

The response rate of is considered statistically sufficient for further analysis.

4.3 - Reliability

Reliability of a research refers to how variables are measured in a consistent way. It indicates absence of a random error which will enable other researchers to arrive at similar findings when conducted along similar steps (Yin, 2003). One of the ways to investigate a research's reliability is using Chronbach Alpha coefficient. A Cronbach Alpha coefficient of 0.7 and higher is commonly taken as a reasonable test of reliability (Gaur A. and Guar S., 2009). If the coefficients is higher it demonstrates that items that make up the scale "hang together" and measure the same underlying construct.

For the purpose of this research, I have examined Cronbach alpha for the overall data collected from respondents and for each related items of the same construct in the survey. The results shows that the overall data has a Cronbach alpha of 0.962, risk identification 0.706, risk analysis 0.848, risk monitoring 0.912, and risk response 0.784. The results are presented in a table below.

Description	No. of items	Cronbach Alpha
Risk Management process overall	19	0.962
Risk Identification	6	0.706
Risk Analysis	4	0.848
Risk response	5	0.784
Risk Monitoring	4	0.912

Table 4.1- Cronbach alpha coefficient results (Source: Own survey)

4.4 - General Background of the respondents

Demographic information of respondents is presented in table 2 below. The information gathered includes their gender, age group, level of education, responsibility in the company and experience in years. The information was collected using structured survey administered online and analyzed using SPSS software.

From a total of 81 respondents of the survey, 70 of them (86.4%) were male and 11 of them (13.6%) of them were female. The distribution of the respondents in accordance to their gender is presented in the table below.

The result clearly shows male is a significant majority in the study. The selected respondents were purposely selected for the research purpose and hence may not imply that male gender has majority role in overall power transmission projects' employment.

The other background information gathered for the study was age group and according to the findings, from 81 total respondents, 56 of them (69.1%) of them are 31-35 years age, 21 of them (25.9%) are 36-40 years age and 4 of them (4.9%) are above 41 years age.

When we look at the level of education of the respondents, 48 (59.3%) respondents have received their first degree, 20 (24.7%) respondents have received their diploma and 13(16%) respondents have received their post grad degrees.

The data gathered regarding respondents' responsibility in the company indicates that 15 (18.5%) of them are project managers, 16 (19.8%) of them are site engineers, 17 (21%) of them are site managers, 17 (21%) of them are supervisors and 16 (19.8%) of them are technicians.

The information collected concerning respondents' work experience reveals that 30 (34.6%) respondents has a work experience between 1-5 years, 28 (34.6%) respondents have work experience between 6-10 years and 23 (28.4%) respondents have a work experience above 10 years. All of the demographic information data collected and analyzed in presented in a table below.

Gender	Frequency	Percentage (%)
Male	70	86.4
Female	11	13.6
Age	**Frequency**	**Percentage (%)**
31-35	56	69.1
36-40	21	25.9
Above 41	4	4.9
Level of Education	**Frequency**	**Percentage (%)**
Degree	48	59.3
Diploma	20	24.7
Post grad	13	16
Company Responsibility	**Frequency**	**Percentage (%)**
Project Manager	15	18.5
Site Engineer	16	19.8
Site Manager	17	21

Supervisor	17	21
Technician	16	19.8
Experience (in years)	**Frequency**	**Percentage (%)**
1-5	30	37
6-10	28	34.6
Above 10	23	28.4

Table 4.2 – Demographic data of the respondents (Source – own survey)

4.5 - Descriptive Analysis of the data

The respondents were asked to indicate the degree to which risk management processes are used in power transmission projects in EEP using different questions. The questions were prepared to evaluate the extent to which each four risk management processes namely risk identification, risk management analysis, risk management monitoring and risk management response are practiced in the projects.

The results from the SPSS software has shown the following descriptive result about each risk management process

Risk Mgt. Process	Measuring Indicators	Mean	Std. Deviation	Freq. Inclined to Agree (Agree + Strongly Agree)	Perc. Inclined to Agree (Agree + Strongly Agree)	Freq. Inclined to Disagree (Disagree+ Strongly Disagree)	Perc. Inclined to Disagree (Disagree+ Strongly Disagree)	Freq. Neural/Moderate	Perc. Neutral/Moderate
RI	RI1	3.21	0.945	46	56.8	29	35.8	6	7.4
	RI2	3.25	0.942	48	59.3	28	34.6	5	6.2
	RI3	2.94	0.78	22	27.2	27	33.3	32	39.5
	RI4	3.77	0.952	39	48.1	3	3.7	39	48.1
	RI5	3.07	0.905	36	44.4	30	37	15	18.5
	RI6	3.73	0.912	54	66.6	8	9.9	19	23.5
RA	RA1	2.96	0.813	25	30.9	28	34.6	28	34.6
	RA2	3.81	0.937	41	50.6	2	2.5	38	46.9
	RA3	3.06	0.899	35	43.2	30	37	16	19.8
	RA4	3.65	0.839	53	65.4	8	9.9	20	24.7
RR	RR1	2.9	0.93	31	38.3	39	48.1	11	13.6
	RR2	2.48	0.673	8	9.9	50	61.7	23	28.4
	RR3	2.7	0.766	15	18.5	39	48.1	27	33.3
	RR4	3.64	0.899	51	63	10	12.3	20	24.7
	RR5	2.7	0.766	15	18.5	39	48.1	27	33.3
RM	RM1	3.09	1.002	44	54.3	37	45.7	0	0
	RM2	3.63	0.901	44	54.3	8	9.9	29	35.8
	RM3	3.19	0.937	44	54.3	29	35.8	8	9.9
	RM4	3.72	0.869	54	66.6	9	11.1	18	22.2

Table 4.3 – Descriptive statistics result (Source: SPSS)

4.6 - Findings and result interpretation

According to the outputs of the processed data from SPSS, the following findings have been obtained. To interpret the data to equivalent numeric range, the researcher has adopted the scoring range table from a publication by Canadian center of science and education.

Responses on Likert Scale	Numeric Range	Level of Risk Management Process Practice
Strongly Disagree	1.00 - 1.80	Very Low
Disagree	1.81 - 2.60	Low
Neither/Nor Agree/Neutral	2.61 - 3.40	Moderate
Agree	3.41 - 4.20	High
Strongly Agree	4.21 - 5.00	Very High

Table 4.4 Scoring range of likert scale survey (Source: Erol S. & Ufuk G, 2019)

The results under risk identification process have shown that the maximum mean value found from four questions given to respondents is 3.81 and the minimum value 2.96. The minimum score from the statements the respondents rated was about awareness level in risk management.

The statement with the highest score was about whether risk management is critical to the organization performance. Referring to the scoring range of the likert scale, it can be seen that from the administered six questions about risk identification process, two of them fall on the ‘agree’ range and four of them fall on ‘neutral’ range. Therefore, the overall results tend to show that risk identification process is practiced somehow between moderate and above average moderate level in power transmission projects. Similar conclusion can be drawn by looking at the frequency and percentile results from the SPSS.

The results for risk analysis process have a maximum mean value of 3.81 and minimum mean value of 2.96. The minimum score from the statements the respondents rated was about whether risk analysis process is periodically carried out in the projects or not.

The statement with the highest score was about whether proper risk analysis tools and techniques are used to analyze identified risks. Referring to the scoring range of the likert scale, it can be seen that from the administered four questions about risk analysis process, two of them fall on the 'agree' range and two of them fall on 'neutral' range. Therefore, the overall results tend to show that risk analysis process is practiced somehow between moderate and above average moderate level. Similar conclusion can be drawn by looking at the frequency and percentile results from the SPSS.

Under risk response, the maximum mean value obtained is 2.60 and minimum mean value obtained is 3.64. The minimum score from the statements the respondents rated was about whether risk proper risk response tools and procedures are used.

The statement with the highest score was about whether application of risk response process benefited power transmission projects or not. Referring to the scoring range of the likert scale, it can be seen that from the administered five questions about risk response process, three of them fall on the 'neutral' range, one of them fall on 'disagree' range, and one of them fall on 'agree' range. Therefore, the overall results tend to show that risk response process is practiced at moderate level. Similar conclusion can be drawn by looking at the frequency and percentile results from the SPSS.

For risk monitoring process, the maximum mean value obtained is 3.72 and the minimum mean value obtained is 3.09. The minimum score from the statements the respondents rated was about whether risks are monitored throughout the project lifecycle. The statement with the highest score was about whether application of risk monitoring process benefited power transmission projects or not.

Referring to the scoring range of the likert scale, it can be seen that from the administered four questions about risk monitoring process, two of them fall on the 'neutral' range and two of them fall on the 'agree' range. Therefore, the overall results tend to show that risk monitoring process is practiced between moderate and above average moderate level. Similar conclusion can be drawn by looking at the frequency and percentile results from the SPSS.

In order to obtain the overall scores of each risk management processes in risk management, average values of each entries in the processes was computed to their average using SPSS and the results obtained is presented in the table below.

Risk Mgt. Process	Mean	Std. Deviation
Risk Identification	3.32	0.688
Risk Analysis	3.37	0.587
Risk Response	2.88	0.614
Risk Monitoring	3.4	0.681

Table 4.5 – overall descriptive statistics of risk management processes (Source: SPSS)

As can be seen from table 4.4, the overall mean values of risk identification, risk analysis, risk response and risk monitoring are 3.32, 3.37, 2.88, 3.40 consecutively. Referring to the scoring range of the likert scale, it can be seen that all of the risk management processes fall on the 'neutral' range.

Risk monitoring has highest score being just at the end range of the 'neutral' score range and risk response has lowest score being below average moderate score which is 3. Risk identification and risk analysis has similar level of score above average moderate score.

The overall mean results obtained concur with the results we have got from the individual process statement entries.

The standard deviation results of risk identification, risk analysis, risk response and risk monitoring are 0.6884, 0.5878, 0.61477 and 0.6818 consecutively. Hence, we can conclude that most of the respondents are in agreement when answering the questions addressed to them.

Chapter Five

5 - Conclusion and Recommendation

This chapter presents summary of results, conclusions and recommendation for further study in the topic.

5.1 - Summary of Findings

- ✓ The respondents of the survey were purposely selected from power transmission projects currently under construction in Ethiopian Electric Power. Hence, they are in good position to address the questions of the research.
- ✓ The findings show that all of the risk management processes fall under the neutral (moderate) level of numeric score for the 5 points likert scale range.
- ✓ Most of the respondents have responded that there is a bit above 'average moderate level' application of risk identification practices in the company at large and in power transmission projects in particular.
- ✓ Risk analysis process has a bit higher application above 'average moderate level'.
- ✓ Risk response process has a bit lower application under 'average moderate level'.
- ✓ Risk monitoring has a bit higher application above 'average moderate level'
- ✓ The process with the highest score is risk analysis and lowest risk response.
- ✓ The results of the standard deviation show there is a strong agreement from the respondents on the questions presented to them.
- ✓ The frequency and percentile results also show similar results to the above findings.

5.2 - Conclusion

As discussed in the theoretical framework chapter, risk management practices have contributed to the betterment of project targets.

When we look at the assessment results of this research we will see that there is lack of strong awareness among employees of EEP about risk management practices, there is no consistency in using the risk management processes; there are no proper tools and techniques in place that facilitate its application; there is no permanent assigned officer for its implementation and continuous monitoring. If further efforts can be taken on such downsides, risk management process implementation can be increased to a significant degree and the company can be beneficial of its advantage.

5.3 - Recommendation

Risk management is one of the nine bodies of knowledge areas in project management. Previous researches have shown that projects that have integrated risk management practices in their traditional project management processes have gained substantial benefit from it. Yet, there is lack of practice in the area. The researcher has identified that there is lack of literature regarding risk management practices in power transmission projects. The findings of this research also showed that there is only a moderate level of practice in power transmission projects currently under construction in EEP.

The researcher recommends that there should be an effort to better incorporate risk management processes in overall project management processes and continuous monitoring of the result to benefit from its application stipulated in previous theoretical studies and some empirical studies.

The researcher suggests the points which scored minimum in the results and should be given special attention and they are:

- Awareness creation and having proper tools, techniques and procedures in risk identification process
- Periodically analyzing potential risks and carrying out impact analysis
- Having proper tools, techniques and procedures for risk response and periodically undertaking risk response activity
- Monitoring risks throughout the project life cycle and having a risk manager in place

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Appendices

Appendix A - Questionnaire

Addis Ababa University

School of Commerce

Dear respondent,

My name is Tesfamichael Assefa; I am a graduate student of Addis Ababa University College of Commerce Project management program. Currently, I am conducting a research on 'Risk Assessment practices in power Transmission Projects: The case of Ethiopian Electric Power 'in partial fulfillment of Master of Science in project management.

The purpose of the research is to identify whether or not risk management practices are part of overall project management practice in power transmission projects of Ethiopian Electric Power Company and if there is a relation between risk management practice in the organization with project implementation or success.

You are selected as part of the research to help me in identifying the above research objectives by responding to the attached questions. Please be assured that all the answers you provide will be kept confidential and will be used only for academic purposes. Your cooperation and prompt response will be highly appreciated.

Tesfamichael Assefa

Section -1 - General Respondent Information

For this section, Please tick the category that applies to you

1 - Gender

Male ☐ Female ☐

2 - Age group

Code	1	2	3	4	5
Years	21-25	26-30	30-35	36-40	≥41
Tick					

3 - Level of Education

Code	1	2	3	4	5
Level	Elementary	High School	Diploma	First Degree	Post Grad
Tick					

4 - Responsibility in the company

Project Manager ☐ Site Engineer/Contractor ☐ Technician ☐

Site Manager ☐ Supervisor ☐

5 - Position in the company

Project Manager	☐	Supervisor	☐
Site Engineer	☐	Technician	☐

Section 2 - Risk Management Practices

No.	**Risk management practice**					
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
1	**Risk Identification**					
1.1	Risk identification process is followed in project inception and planning phases to identify potential risks that could affect the project					
1.2	Risks identified in planning stage are analyzed to determine their likelihood of occurring and impact					
1.3	There is awareness about importance of using risk management in projects in your organization					
1.4	Risk management practices are very critical to your organizations performance					
1.5	The organization uses proper tools and techniques to identify, analyze, respond and document project risks					

1.6	Application of risk identification practices has benefited power transmission project performance or success					

No.	**Risk management practice**					
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
2	**Risk Analysis**					
2.1	Risk analysis in undertaken periodically in projects					
2.2	Formal risk analysis tools and procedures are used in the organization					
2.3	All identified risks are analyzed for their potential impact					
2.4	Application of risk analysis has benefited power transmission project performance or success					

No.	**Risk management practice**					
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
3	**Risk Response**					
3.1	Risk response practice is undertaken periodically in projects					
3.2	Formal risk response tools and procedures are used in the organization					

3.3	Risk response strategy is used for all identified and analyzed risks					
3.4	Application of risk response process has benefited power transmission project performance or success					
3.5	Risks are prioritized and given attention according to their impact and probability					

No.	**Risk management practice**					
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
4	**Risk Monitoring**					
4.1	Risks are monitored throughout the project lifecycle					
4.2	lessons learned are using to enhance and update the risk management process					
4.3	There is assigned risk officer (risk manager) for the projects					
4.4	Application of risk monitoring practices has benefited power transmission project performance or success					

Appendix B – SPSS Result Output

1 - Demographic data of the respondents

Statistics

		Gender	Age group	Level of Education	Responsibility in the company	Experience in years
N	Valid	81	81	81	81	81
	Missing	0	0	0	0	0

Frequency Table

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	11	13.6	13.6	13.6
	Male	70	86.4	86.4	100.0
	Total	81	100.0	100.0	

Age group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	31-35	56	69.1	69.1	69.1
	36-40	21	25.9	25.9	95.1
	Above 41	4	4.9	4.9	100.0
	Total	81	100.0	100.0	

Level of Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Degree	48	59.3	59.3	59.3
	Diploma	20	24.7	24.7	84.0
	Post Grad	13	16.0	16.0	100.0
	Total	81	100.0	100.0	

Responsibility in the company

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Project manager	15	18.5	18.5	18.5
	Site engineer	16	19.8	19.8	38.3
	Site manager	17	21.0	21.0	59.3
	Supervisor	17	21.0	21.0	80.2
	Technician	16	19.8	19.8	100.0
	Total	81	100.0	100.0	

Experience in years

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-5	30	37.0	37.0	37.0
	6-10	28	34.6	34.6	71.6
	Above 10	23	28.4	28.4	100.0
	Total	81	100.0	100.0	

- Descriptive Statistics – Risk Identification

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Risk identification process is followed in project inception and planning phases to identify potential risks that could affect the project	81	2	4	3.21	.105	.945
Risks identified in planning stage are analyzed to determine their likelihood of occurring and impact	81	2	4	3.25	.105	.942
There is awareness about importance of using risk management in projects in your organization	81	2	4	2.94	.087	.780
Risk management practices are very critical to your organizations performance	81	2	5	3.77	.106	.952
The organization uses proper tools and techniques to identify, analyze, respond and document project risks	81	2	4	3.07	.101	.905
Application of risk identification practices has benefited power transmission project performance or success	81	2	5	3.73	.095	.912
Valid N (listwise)	81					

- Frequency Table

Risk identification process is followed in project inception and planning phases to identify potential risks that could affect the project

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	46	56.8	56.8	56.8
	Disagree	29	35.8	35.8	92.6
	Neutral	6	7.4	7.4	100.0
	Total	81	100.0	100.0	

Risks identified in planning stage are analyzed to determine their likelihood of occurring and impact

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	48	59.3	59.3	59.3
	Disagree	28	34.6	34.6	93.8
	Neutral	5	6.2	6.2	100.0
	Total	81	100.0	100.0	

There is awareness about importance of using risk management in projects in your organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	22	27.2	27.2	27.2
	Disagree	27	33.3	33.3	60.5

	Neutral	32	39.5	39.5	100.0
	Total	81	100.0	100.0	

Risk management practices are very critical to your organizations performance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	13	16.0	16.0	16.0
	Disagree	3	3.7	3.7	19.8
	Neutral	39	48.1	48.4.0	67.9
	Strongly Agree	26	32.1	32.1	100.0
	Total	81	100.0	100.0	

The organization uses proper tools and techniques to identify, analyze, respond and document project risks

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	36	44.4	44.4	44.4
	Disagree	30	37.0	37.0	81.5
	Neutral	15	18.5	18.5	100.0
	Total	81	100.0	100.0	

Application of risk identification practices has benefited power transmission project performance or success

	Frequency	Percent	Valid Percent	Cumulative Percent

	agree	41	50.6	50.6	50.6
	disagree	8	9.9	9.9	60.5
Valid	neutral	19	23.5	23.5	84.0
	strongly agree	13	16.0	16.0	100.0
	Total	81	100.0	100.0	

- Descriptive Statistics – Risk Analysis

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Risk analysis in undertaken periodically in projects	81	2	4	2.96	.090	.813
Formal risk analysis tools and procedures are used in the organization	81	2	5	3.81	.104	.937
All identified risks are analyzed for their potential impact	81	2	4	3.06	.100	.899
Application of risk analysis has benefited power transmission project performance or success	81	2	5	3.65	.096	.839
Valid N (listwise)	81					

Frequency Table

Risk analysis in undertaken periodically in projects

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Agree	25	30.9	30.9	30.9
	Disagree	28	34.6	34.6	65.4
	Neutral	28	34.6	34.6	100.0
	Total	81	100.0	100.0	

Formal risk analysis tools and procedures are used in the organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	14	17.3	17.3	17.3
	Disagree	2	2.5	2.5	19.8
	Neutral	38	46.9	46.9	66.7
	Strongly Agree	27	33.3	33.3	100.0
	Total	81	100.0	100.0	

All identified risks are analyzed for their potential impact

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	35	43.2	43.2	43.2
	Disagree	30	37.0	37.0	80.2
	Neutral	16	19.8	19.8	100.0
	Total	81	100.0	100.0	

Application of risk analysis has benefited power transmission project performance or success

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	41	50.6	50.6	50.6
	disagree	8	9.9	9.9	60.5
	neutral	20	24.7	24.7	85.2
	strongly agree	12	14.8	14.8	100.0
	Total	81	100.0	100.0	

- Descriptive Statistics – Risk response

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Risk response practice is undertaken periodically in projects	81	2	4	2.90	.103	.930
Formal risk response tools and procedures are used in the organization	81	2	4	2.48	.075	.673
Risk response strategy is used for all identified and analyzed risks	81	2	4	2.70	.085	.766
Application of risk response practices has benefited power transmission project performance or success	81	2	5	3.64	.911	.869

Risks are prioritized and given attention according to their impact and probability	81	2	4	2.70	.085	.766
Valid N (listwise)	81					

Frequency Table

Risk response practice is undertaken periodically in projects

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	31	38.3	38.3	38.3
	Disagree	39	48.1	48.1	86.4
	Neutral	11	13.6	13.6	100.0
	Total	81	100.0	100.0	

Formal risk response tools and procedures are used in the organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	8	9.9	9.9	9.9
	Disagree	50	61.7	61.7	71.6
	Neutral	23	28.4	28.4	100.0
	Total	81	100.0	100.0	

Risk response strategy is used for all identified and analyzed risks

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Agree	15	18.5	18.5	18.5
	Disagree	39	48.1	48.1	66.7
	Neutral	27	33.3	33.3	100.0
	Total	81	100.0	100.0	

Application of risk response practices has benefited power transmission project performance or success

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	40	49.4	49.4	49.4
	disagree	10	12.3	12.3	61.7
	neutral	20	24.7	24.7	86.4
	strongly agree	11	13.6	13.6	100.0
	Total	81	100.0	100.0	

Risks are prioritized and given attention according to their impact and probability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	15	18.5	18.5	18.5
	Disagree	39	48.1	48.1	66.7
	Neutral	27	33.3	33.3	100.0
	Total	81	100.0	100.0	

Descriptive Statistics – Risk Monitoring

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Risks are monitored throughout the project lifecycle	81	2	4	3.09	.111	1.002
lessons learned are using to enhance and update the risk management process	81	2	5	3.63	.100	.901
There is assigned risk officer (risk manager) for the projects	81	2	4	3.19	.104	.937
Application of risk monitoring practices has benefited power transmission project performance or success	81	2	5	3.72	.106	.869
Valid N (listwise)	81					

Frequency Table

Risks are monitored throughout the project lifecycle

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	44	54.3	54.3	54.3
	Disagree	37	45.7	45.7	100.0
	Total	81	100.0	100.0	

lessons learned are using to enhance and update the risk management process

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Agree	29	35.8	35.8	35.8
	Disagree	8	9.9	9.9	45.7
	Neutral	29	35.8	35.8	81.5
	Strongly Agree	15	18.5	18.5	100.0
	Total	81	100.0	100.0	

There is assigned risk officer (risk manager) for the projects

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	44	54.3	54.3	54.3
	Disagree	29	35.8	35.8	90.1
	Neutral	8	9.9	9.9	100.0
	Total	81	100.0	100.0	

Application of risk monitoring practices has benefited power transmission project performance or success

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	41	50.6	50.6	50.6
	disagree	9	11.1	11.1	61.7
	neutral	18	22.2	22.2	84.0
	strongly agree	13	16.0	16.0	100.0
	Total	81	100.0	100.0	