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RISK ANALYSIS AND MANAGEMENT PRACTICE IN ROAD CONSTRUCTION PROJECT

THE CASE OF OMO RIVER -TERCHA AND DURAME- MAZORIA ROAD PROJECTS

By

WOSEN FUFA (SGS/0419/2009A)

MAY, 2018

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APPROVAL PAGE

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I, WOSEN FUFA declare that this research entitled project risk analysis and management practice in Roads construction Projects the case of omo river -tercha and durame- mazoria road projects the outcome of my own effort and study. All sources of materials used for the study have been duly acknowledged. This study has not been presented for a degree in any university.

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This is to certify that, this research work **"risk analysis and management practice in Roads *construction Projects* the case of omo river -tercha and durame- mazoria road projects**" undertaken by Wosen Fufa for the partial fulfillment of Masters of Project Management at St. Mary University, is an original work and not submitted earlier for any degree either at this University or any other University.

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ABBREVIATIONS

ECDSWC	Ethiopian Constriction Design Supervision Works Corporation
ERA	Ethiopia Road Authority
FIDIC	Federation International Des Ingenious Conceals
NPV	Nat Preset Value
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institution
RCP	Road Construction Project
RM	Risk Management
TDSWS	Transport Design Supervision Works Sector

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ABSTRACT

Construction projects such as road involve many partners with different objectives, who are subjected to many risks in an uncertain environment. Hence, proper risk analysis and management is precursor to mitigate risks such as cost overruns and schedule delays. Therefore, the objective of the study was to analyze risk factors and management practice associated to Omo River -Tercha and Durame- Mazoria river road construction projects. Methodologically, the study employed descriptive research design. Data were collected from 49 respondents which were decomposed to client (8), consultants (20), and contractor (21). The survey data were analyzed using descriptive statistics and Liker scale parameters. The results of the study revealed that majority of the respondents have a good understanding about risk management but 50% of the respondents replied that there is no risk management practice. Risk factors were identified from the three sides: (i) From the client side: Scope changes, payment delays and schedule pressure;(ii) From consultant side: delay in contractor's payment certification, poor quality of design and design Change from the consultants side, and;(iii) From the contractors' side: exchange rate fluctuation, inflation and sudden changes in price and insufficient cash flow. There is little effort to identify, analyze, respond, monitor and manage risks but they not consistently made. The project under Chinese construction management (Omo-Tercha) has mean scores of 3.61, 4.03, and 3.61 respectively for the client, consultant and contractor associated risks respectively. On the other hand, a project under domestic contractor (Durame – Mazoria - Durgi) has mean scores of 3.06, 2.92, and 2.98 respectively for the client, consultant and contractor associated risks. The former are relatively risk taker compared to projects under local contractors. To conclude, ERA has better risk management score in its road construction projects which are managed by domestic contractors compared to projects handled by Chinese contractors. The advantage of proper risk analysis is not well understood by the clients, contractor and consultants. Therefore such understanding should be improved. Involving the various stakeholders (consultants, the contractors and the insurance companies) in discussing the risk management process at the planning stage is indispensable. Arranging capacity building programs for the clients, contractor and consultants play role in improving risk analysis and management skills. Finally, determining the relative importance of other project management knowledge areas towards mitigating risks can be an interesting investigable issue of future research.

Keywords: *Risk analysis, risk management, scope change, Road project, Ethiopia.*

CHAPTER ONE
1. INTRODUCTION

1.1 Background

Risks are an inseparable part of every phase of the construction process (Makui, et al 2009). Risk in construction has been described as exposure of construction activities to economic loss, due to unforeseen events or foreseeing events for which uncertainty was not properly accommodated (Joshua and Jagboro, 2007). Whenever a construction project is embarked upon, there are some risk elements inherent in it, such as financial failure of the contractor, defective design, delayed payments on contract, inflation, undocumented change orders, poor communications between the head office and project offices (contractor side), inaccurate quantities, design changes, undefined scope of working, adverse weather conditions. These risk factors are not the same in their magnitude and their frequency of occurrence as well as the way how to manage them.

It is generally recognized that those within the construction industry are continually faced with a variety of situations involving many unknown, unexpected, frequently undesirable and often unpredictable factors. Ashley, Kangari and Riggs (2010) argued that, these situations are not limited to the construction industry; it is recognized that risk is built into any commercial organization's profit structure and is a basic feature of a free enterprise system.

It is apparent that quality of infrastructure has a direct impact on the quality level of people's life, and a well-functioning construction industry has an important role towards this end. The contribution of the Ethiopian construction industry to the economy has now reached 8.2%, and public construction projects share an average annual rate of 60% of the government's capital budget. However, the present state of the construction industry falls short of meeting domestic and international quality standards and the performance demand expected from the sector (MoWUD, 2006).

In the context of Ethiopia's geography, patterns of settlement and economic activity, road transport plays a vital role in facilitating economic development as 95% of the movement of people and goods are still carried out by road transport. Road transport also provides a means for the utilization of land and natural resources, improved agricultural production and marketing, access to social services, and opportunities for sustainable growth (ERA, 2014).

Recognizing the importance of the road transport in supporting social and economic growth and its role as a catalyst to meet poverty reduction targets, the Government of Ethiopia has placed increased emphasis on improvement of the quality and size of road infrastructure in the country. However, there are challenges to achieve the required quality and size of the road infrastructure.

Compared with many other industries, construction projects are exposed to a high degree of risk due to the nature of construction business activities, processes, environment, and organization. Because of complexity and dynamic nature of construction projects, they are exposed to the effects of plentiful factors leading to uncertainty in the timing and sequence of the project activities (Chan, Scott and Chan, 2004).Many construction projects do not achieve all their intended goals. Such failure could be realized in terms of severe project delay, cost overruns and poor quality. The presence of risks and uncertainties inherent in project development and implementation plays significant role in such a failure intrinsic in all stages of project (Nasirzadeh, Afshar, &Khanzadi, 2008).

Road construction projects involve many partners with different objectives, who are subjected to many risks in an uncertain environment. Since the construction industry is highly risk prone with complex and dynamic project environments creating an atmosphere of high uncertainty and risk, they tend to exhibit cost overruns and schedule delays. Project delays, poor quality and cost overrun in the construction industry are common and taken as a global phenomenon (Mahamid, 2014).

The pressure on project delay and cost, the need for improved performance in the construction industry and the increasing contractual obligations lead to the necessity of a more effective risk management approach. As the size and complexity of projects have increased, ability to manage risks throughout the construction process has become a central element preventing unwanted consequences. Owing to its increasing importance, Risk Management (RM) has been recognized as a necessity in today's construction industry, and a set of techniques and strategies have been developed to control the influences brought by potential risks.

Though the risk has gained immense attention from construction project managers because of both time and cost overruns occurred in almost all construction projects, most of project

risks are not properly identified and likelihood, impact on cost and time are not analyzed before project construction to control the impact of project risks on project performance (Khodeir and Mohamed, 2015).

1.2 Statement of the Problem

The Ethiopian Roads Authority undertakes various Road Construction projects by allocating a huge budget. Omo River -Tercha Road upgrading and Durame- Mazoria river Road project are among those projects under construction in Southern Nations and Nationalities Region of Ethiopia. These projects faced a problem of time and cost overrun as well as lacking defined scope of the project. Thus, the performance of these projects is not as the client and the beneficiaries expects. This situation initiates this paper to conduct risk analysis and management in Omo River -Tercha Road upgrading and Durame- Mazoria river Road project. To this end, the research has attempted to answer the following questions in the study area.

In Ethiopia the result of the mid-term and final reviews of the RSDP (Road Sector Development Program) shows that there are problems of delay and cost overrun in almost all road construction projects (RCP). Most of the projects undertaken in Ethiopia are delayed beyond the expected time for completion and also are requiring additional budget more than the envisaged during the commencement of respective projects (ERA, 2015).

Since the effect of risks plays a significant role in influencing the project performance, it is essential to effectively analyze the risks in construction projects in order to enhance the overall performance (Wang and Yuan, 2014).This shows that project risk management (PRM) is essential to construction activities in minimizing losses and enhancing profitability as there is a direct relationship between effective risk management and project success (Issa,2013). The road construction project risks are complex, dynamic and systemic in nature and hence they are difficult to understand and control.

This study, therefore, has assessed and explored road projects risk analysis and management practices with respect to Omo River -Tercha and Durame- Mazoria

1.3 Research Questions

- What are the potential risk factors influencing road construction projects with particular reference to Omo-Tercha and Durame-Mazoria road project?
- Which risk factors have the highest probability of occurring?
- To what extent the potential project risk factors are critical for the successful project management?
- How does the project risk analysis and management performed on these projects?

1.4 Objectives of the Research

The research was intended to assess risks that occur in road construction in the case study of the two selected projects, and to point out some of the counter measures that has to be taken by the stakeholder to minimize the impact of detrimental effect of unpredictable factors.

1.4.1 General objective

The general objective of the study was to analyze the risk factors, risk analysis and management practice associated to Omo River -Tercha and Durame- Mazoria road construction projects and provide recommendations to effectively and efficiently manage potential road project risk factors.

1.4.2 Specific objectives

On the basis of the general objective the following specific objectives are outlined:-

- To describe the risks factors influencing road construction projects with respect to Omo River-Tercha and Durame- Mazoria road project.
- To identify and analyze those risk factors with high probability of occurring.
- To identify the criticality of those risk factors.
- To assess project risk analysis and management methods performed on those projects mentioned above

1.5 Significance of the Study

Construction projects are usually a one-off endeavor with many unique features such as multiple project participants, long gestation periods (between conception-design-construction), complex procurement methods, large financial requirements and dynamic organization structures. All these have made risk and uncertainties common in the sector. Road construction projects could not be exceptions from being affected by risk and uncertainties. Although it has been recognized that construction risk cannot be eliminated, it can be mitigated and managed effectively, if project risks and uncommon characteristics are identified and assessed at the early stages of the project.

Risk management is of great importance to project stakeholder (contractor, client and consultant) because it will minimize the possibility of conflicts, disputes, cost and time overruns, abandonment, disputes, and quality related issues associated with construction project. It is also all about being able to deliver results with a certain degree of certainty and competitive advantage. Furthermore, it will help project stakeholders (clients, consultants and contractors) achieve projects objectives of cost, time, quality and safety. Although risk analysis and management is a basic issue for the road construction projects, it is not well researched due to its complexity nature.

Thus, the findings of this study will provide insights about the risk factors, their criticality, and their frequency and management strategies for road construction stakeholders and policy makers. Further, it will provide empirical data as a reference for other researchers to address risk in other projects with a wider coverage and in-depth analysis.

1.6 Scope and Limitation of the Study

Although the Federal Government and Regional States Road Authorities have undertaken various road construction projects by allocating huge budget, this study has focused only on Omo River-Tercha and Durame- Mazoria Road construction projects owned by Ethiopian Roads Authority (ERA). Besides, this research is delimited to analysis of risk factors and risk management practices associated to the two road construction projects. Due to the limited time given for conducting the study, the survey has considered only the key stakeholders (client, consultant and contractor) though there are other parties who have could have stake in the execution of the two projects.

The researcher excessively loaded with her regular duties of working in her respective undertaking, with post graduate studies that possess time limitation. Limited resources/ references in the area of road construction risk management practice and shortage of time and finances were other limitation.

1.7 Organization of the paper

This research paper is organized into five chapters. A brief introduction is presented in chapter one followed by Chapter two comprising of theoretical and empirical literature as well as conceptual framework of the study to identify gaps. Chapter three dealt with research approach and methodology. The next chapter focused on data analysis, presentation and discussion of the results. Finally, in chapter five summaries of major findings, conclusion made and possible recommendation are forwarded.

CHAPTER TWO
2. LITRATURE REVIEW

2.1 Theoretical Literature Review

2.1.1 Definition, Classification and Sources of Risks

2.1.1.1 Definition of Risk

The word risk is quite modern, it entered the English language in the mid-17thcentury, coming from the French word risqué and in the second quarter of the18th century the Anglicized spelling began to appear in insurance transactions [Flanagan, 1993].

The Oxford Advanced Learners Dictionary [2010] defines risk as the possibility of something bad happening at some time in the future; a situation that could be dangerous or have a bad result. Unlike the usual dictionary definition of "risk" which refers only to undesirable events; interpretation of risk includes both down side and upside variations in the values involved. Bowen [2005] stated that despite the largely negative connotation of risk that prevails today, it has to be conceded that one person's risk maybe another's opportunity to profit.

A project is a sequence of unique, complex, and connected activates that have one goal or purpose and that must be complicated by a specific time, within budget, and according to specification (wysoki, 2014). Project management institute (2013), define project as a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of project indicates that a project has a definite binging and end. Tayntor (2010) and Levine (2002), also describes it as a unique, finites set of activates in a definable time period intended to accomplish a specific goal. Levine (2002), also states that project likely to require the use of multiple resources in order to meet a specific set of objectives.

Risk can be defined as an uncertain event or condition that, if it occurs, has a positive or a negative effect on a project objective. A risk has a cause and, if it occurs, a consequence (Office of project management process improvement, 2003). Jaffari (2001) defined risk as the exposure to loss/gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude.

The Project Management Institute (1996) introduced a simple definition for risk as a discrete occurrence that may affect the project for better or worse. In order to emphasize the

major objectives of survey on risk management actions, risk has been defined as the probability of occurrence of some uncertain, unpredictable and even undesirable events that would change the prospects for the profitability on a given investment (Kartam, 2001).

Therefore, Risk has different meanings to different people; that is, the concept to frisk varies according to view point, attitudes and experience. Engineers, designers and contractors view risk from the technological perspective; lenders and developers tend to view it from the economic and financial side; health professionals, environmentalists, chemical engineers take a safety and environmental perspective. Risk is therefore generally seen as an abstract concept whose measurement is very difficult (Baloi & Price, 2003).

2.1.1.2 Classification of Risk

Dynamic and static risks

Dynamic risk is concerned with making opportunities; for instance it might concert developing a new and innovative product. Dynamic risk means that there will be potential gains as well as losses. Dynamic risk is risking the loss of something certain for gain of something uncertain (Flanagan & Norman, 1993) and (NAO, 2001).

Static risk related only to potential losses where people are concerned with minimizing losses by risk aversion (Flanagan & Norman, 1993). The unsystematic and arbitrary management of risks can endanger the success of the project since most risks are very dynamic throughout the project life time (Baloi & Price, 2003).

2.1.1.3 Sources of Risk

There exists no comprehensive study explaining the Sources of risks among construction companies; moreover research covering the subject matter has tended to identify the following sources or categories of risks. (Estate Management Manual, 2001): Commercial risk, financial risk, Legal risks, Political risks, Social risks, Environmental, risks, Communications risks, Geographical risks, Geotechnical risks, Construction risks, Technological risks, Operational risks, Demand/product risks and Management risks

These sources of risk relate to project-specific and non-project-specific risks, as both these types of risk need to be considered when identifying the risks in a project or a process. The institution, assisted by the project team, need to define the boundaries of these sources and

to break down these sources into detailed risk elements. This will allow a common understanding amongst those attempting to identify the risks in a project.

The division of risks into source elements can be difficult. It also creates the potential for increased personal subjectivity. It can also lead to the possibility of "double-counting" some risks by attributing the same risk to more than on source. This may, however, beneficial in understanding the relationships between risk sources and elements (Estate Management Manual, 2001). The obvious problem with categorizing risk, apart from the cultural perceptions noted by the royal society report, is that there is a danger of confusing sources, causes, effects and fields of study for the risk domain. It is proposed that the risks can be considered with respect to six categories: financial and economic, political and environment, design, site construction, physical and Environmental factors. While the list of potential risks in every category is neither complete nor exhaustive, it does represent the majority of typical project risks and demonstrates the advantage of a logically developed classification scheme (Enshassi& Mayer, 2001).

2.1.2 Risks in construction projects

Every human endeavor involves risk and the success or failure of any venture depends crucially on how those risks are dealt with (Deyand Ogunlana, 2004). According to Ogunsami, Salako and Ajayi (2011) it was argued that risk occurs in every dimensions of human life and as such construction projects are not an exception from this as they are characterized by activities that are prone to different types of risks ranging from political to construction risk. According to Oxford Advanced Learner's Dictionary (1995), it defined risk as the 'chance of failure or the possibility of meeting danger or of suffering harm or loss. In specific relation to construction, Hackett and Statham(2007) defined risk as 'the possible loss resulting from the difference between what was anticipated and what finally happened'.

Common consequences of project risks are cost overruns, time overruns, poor quality, and disputes among parties to a construction contract. Risk is an important issue to all stake holders of the industry. However, the problems of risk assessment are complex and sometimes, poorly understood in practice. According to Baloi and Price (2003), different people attach different meanings to the concept of risk and it also varies according to view point, attitudes and experience. Engineers, designers and contractors view risk from the

technological perspective; financial managers and developers tend to view it from the economic and financial side; health professionals, environmentalists, chemical engineers view risk from safety and environmental perspective.

Risks specific to a project are interactive and sometimes cumulative that they affect cost and benefits associated to the project (Smith,1999). Furthermore, risks in construction projects arise from a variety of sources; environmental/political; health and safety/hazard; market conditions; and technical/functional sources. Fong (1987) argued that those risks sources generally recognized within the construction industry are continually faced with a variety of situations involving many unknowns, frequently undesirable and often unpredictable factors that include timing schedule slippage of the project tasks, technological issues, people-oriented issues, finance, managerial and political issues (Lockyer and Gordon, 1996). According to Osama and Salman (2003), three kinds of construction risks were highlighted and they include: financial-where project exceeds its budget and endangers the financial health of the company, time and design–related risks.

It has been generally established that in the execution of building project, the final contract sum often varies from the budgeted sum of the contract. This could be caused by either a decrease or an increase to the original contract sum and sometimes it is due to the complex nature and time span required for the execution of projects.

Risk factors Affecting construction Projects

Risks can be related to business, operational or technical part of projects. Construction industry risk factors are best categorized in to:

a) Technical risks: unfinished design, unsatisfactory site investigation, Suitability of specification, Uncertainty over the source and availability of materials

b) Financial risks: changes/fluctuation in foreign exchange, Return of funds, delays in payment, local Taxes and Inflation.

c) Management related risks: industrial related problems, unsure productivity of resources, clash of interest and wrong decisions.

d) Logistical risks: availability of necessary facilities for transportation and construction equipment that will be needed for the progress of the work.

e) Socio-political risks: difficulties in disposing of plant and equipment; limitations on the availability and employment of emigrant staff; and persistence on use of local firms, methods and agents

f) Environmental risks: climate changes, weather implications, and natural disasters

With regard to road construction projects the technical and financial risk factors are more prominet than the other risk factors.

2.1.3 Risks and Major stakeholders involved

2.1.3.1 Risks Related to Client

Four key risks were identified as related to client including tight schedule in projects, client change order, high performance or quality expectation and in complete or delays in approval and other documents.

2.1.3.2 Risks Related to consultant

Four risks were also identified as related to designers namely: variations in design, in accurate cost estimate, poor program scheduling and poor soil test and site survey.

2.1.3.3 Risks Related to Contractors

Seven key risks were identified in relation to contractors which are: poor program planning, program change, poor coordination among participants, unavailability of sufficient professionals and managers, shortage of skilled labor, dispute between participants, noise pollution from construction and accident occurrence.

2.1.3.4 Risks Related to Sub-contractors

Incompetency of sub-contractors is the main and only key risk associated to sub-contractors. Normally sub-contractors allocate their resources and man power to different projects at the same period in order to gain maximum possible profit. Without good management skills and experience they cannot meet different project's requirements simultaneously.

2.1.3.5 Risks Related to Government Bodies

Delays in approval procedures by departments and bureaucracy of government are the two risks associated with government. These are out of stakeholder's control Government need to create environmental friendly approval procedures to attract investment within the territory.

2.1.4 Theories of Risk Management

2.1.4.1 Contingency theory

Although the contingency approach refuses the existence of" one best way" for managing risk, it proposes that there is" one most appropriate "approach for each specific situation (Contingencies).The word" contingency" indicates how the environment (external source of risk) relates with the system, and determines the activities and construction of an organizational system (Longenecker and Pringle, 1978).

Improvement in organizational effectiveness is what contingency theory aims at in order to respond to uncertainty in performance. Contingency is mainly generated for removing or decreasing the negative out comes of unforeseen events. Then overly of contingency theory, as recognized by Steiner (1979), is adaption of a new way to be identified for specific structures and activities which are the most appropriate for the current requirement of the organization. This illustrates that it is no longer suitable to utilize all-purpose theories or one-size-fit-all integrative frame works in management and studies.

The aim of the contingency theory has been identified as two-fold by Ritchie and Marshall (1993):

a) Determining the probability of existence of relationships between specific elements in the environment of organizations

b) Identification of various organizations "responses to these elements in order to provide guide lines for other organizations with similar environmental influences (these influences should not be necessarily identical)

Contingency theory has been criticized by authors like Galbraith (1973) and Schoon hoven (1981) on the ground that it has problems such as lack of clarity in its theoretical statement.

As a consequence of this problem, theoretical statements also fail to provide any clues about the specific form of the interaction intended.

2.1.4.2 Contingency theory in context of construction risk management

As mentioned above, contingency theory recognizes that the rearrange of contextual variables (risks), each influencing the project that the theory is going to be applied to. Examples of these variables are external environment, technology, organizational structure and size, cost, culture, people involved, supply chain, strategy.

Adaptation in contingency theory mostly happens through organizational learning which can be defined as any modification of an organization's knowledge occurring as a result of its prior experience (successful or unsuccessful). Madsen and Desai (2010) believe that "organizational knowledge is not static; It is created, refined, altered, and discarded as organization members experience reality and attempt to update their individual and shared understandings of it to reflect the lessons they draw from their experience. Panthi et al. (2009) have pointed out that construction projects are complex and unique, and because it is difficult to evaluate the level of risks in construction projects, It is therefore also hard to apply risk management activities appropriately. One of the unavoidable outcomes of a construction project is variation that may lead to adverse impacts on time, cost and quality. Hence, utilizing contingency theory in projects is useful for mitigating these variations that arise later, through organizational learning which uses past experiences and applies them to current situations where possible. These guide lines can be communicated vertically within an organization and horizontally between organizations.

As Figueiredo and Kitson (2009) have presented "contingency is a cost element of an estimate to cover the probability of un foreseeable events to occur and that if they occur, they will likely result in additional costs within the defined project scope." Some costs in the projects cannot be readily determined or they are significant in the aggregate but too small to be estimated individually ;so in order to account for these costs it is useful to include contingency in any cost estimate such as cost estimation for construction projects (Humphreys and Wellman, 1996).

It should be noted that contingency is different from allowances in the projects. The events which are expected to occur and are within the scope of the project drive the allowances and as a result the allowances are not risk-based or dependent (Noor and Tichacek, 2009).

Contingency, as an estimated value of the risks which are not covered by contract terms or insurance but may be encountered during the project's implementation, can be determined through various approaches. Affixed value of 5-10% of total costs has been suggested by many text books to be added to project cost she contingency cost. Smith and Bohn

(1999) have also reported the same fixed percentage (5-10%) of the contract value for the contingency cost. This is also in agreement with assertion of many other authors about accuracylevelofthecontingencyestimationfortheconstructionprojectsbeingremainedat around 10%levelfor the past four decades (McCaffer, 1976; Flanagan and Norman, 1983; Morrison,1984;Gunner andSkitmore,1999;LingandBoo,2001). Likewise, Blok (1982) and Yeo (1990) have considered this fixed percentage of the estimated budget as contingency to be 10-15%. However, given the complicated nature of construction projects; the common traditional practice of allocation of a fixed percentage (rangingfrom5% to15%) of the estimated budget or the contract value as the contingency may not be appropriate. From the research eraser of sessional experience, complexity of the projects and in the return certainty in theprojectexecutionandinvolvedpartiesperformancemakeitverydifficulttoforecast the exact budget of the construction projects precisely. As are cult of this, it is required to include contingency as a funding source in projects budget in order to provide the flexibility for the managers to address these deviations. So, how is it ever possible to estimate fixed percentage of the project budget as the contingency when the budget itself is not precisely estimated? Moreover, there are other factors that contingency allocation is dependent on such as the attitude of involved people towards risk (risk averse, risk neutral, risk taking),the expected return, how well these cope of the project is defined at the time of cost estimation, the level of risks on a project, organization's state in relation to available work, the type of contract chosen for the project, the economic situation of the country in which the project is taking place (Ranasinghe, 1994).

Therefore, contingency estimation should be considered as one part of the risk management process (Figueiredo and Kitson, 2009) and the contingency cost should be large enough to cover the impacts of risks but not to exceed the needs of the project. Allocating contingency is largely based on the estimate or's perception of the project risks and therefore a matter of judgment. Contingency may be derived through statistical analysis of past projects, by applying experience or through a project on based on assessed probability of what may occur. Risk assessment can provide the data which can be used for determining the degree

of contingency to be assigned to each risk associated with a new project but because it is hard to estimate et hem on eatery impact to these risk sin a deterministic manner, arrange is given to them (MinassianandJergeas,2009). This is the reason why the same fixed range (5-15%) cannot be allocated to all construction projects as the range for each project dependent on various factors specific to that project as mentioned above. Even though each of the techniques may be used for any type of contingency prediction and estimation; the most common approach is still using previous experience that is them a in characteristic of contingency the or through organizational learning (GunhanandArditi, 2007). Since the contingency theory is risk-based, it can be sufficient to manage the realization of risks and as are station has been chosen as the theoretical frame work of this thesis which is focusing on the risks associated with construction projects. As discussed above, the theory is the fit between organizations and contextual variables with the environment being considered as one of the important variables for any organization and subsequently the project which the organization is implementing.

2.1.5 Risk Management in the Construction Industry

Risk management is now widely accepted as a vital tool in the management of projects, although risk management has become firmly in situation lazed across the industry sectors, it is only comparatively recently that this has extended to include the construction industry [Norman, 1993].As the most common and typical project types, construction projects have several characteristics such as specific objective, time limit, financial constraints and economic requirements, special organizational and legal conditions, complexity and systematic characteristics and for that each investment project itself is a complex system.

The PMI's project management book of knowledge [2013] describes risk management as the systematic process of identifying and analyzing and responding to project risk. It includes maximizing the probability and consequences of positive events and minimizing the probability and consequences of events adverse to project objectives. Each components of risk management are discussed here under in the perspective of construction projects.

2.1.5.1 Risk Identification

Risk identification is the process of identifying risks that can adversely affect the project cost and schedule and also the opportunities that can reduce project costs or result in a reduction in project duration [Touran, 2006].

The objectives of risk identification are to identify and categorize risks that could affect the project and to document these risks and the outcome of risk identification is a list of risks [NCHRP, 2009].The main objective is to see that the major risks that could impact on the project most adversely are not left unidentified. Most commonly a relatively small percentage of key risks are likely to account for the majority of the time and cost implications of the entire risk [Mead, 2007].

Risk identification on is often under taken through a variety of methods which may include checklists, brainstorming, visits to site, corporate experience (or drawing upon consultants or subcontractors who have experience in the particular industry segment), analysis of prior projects, the use of organization AL chart store view internal structures and flow charts to review process issues and through research, interviews and surveys of parties likely to be impacted by the proposal [Mead, 2007].

The process of identification and analysis of risks should be continuous process from concept to operation phase of the project to maximize the risk control mechanism of the project and ensure the completion of the project on time and budget. There sultof this process will be recorded in the risk register for subsequent identification process [Asnake, 2010].

2.1.5.2 Risk Classification

Risk classifications a significant step in the risk management process, as it attempts to structure the diverse risks affecting a construction project. There are many approaches in literature for construction risk classification. Owing to the various nature of risks which may be encountered in a major project and the differing weights which may attach to their consequences, it is not uncommon for parties to seek to identify these risks under major headings or categories [Mead, 2007].

Bunni [2003] further identified a group of risks connected with the political, financial, and sociological and status of the country in which the site is located. They can be enumerated as: external stability of government; political risks; internal stability of government; financial stability and economic risks; red tape (formalities); transit to site and condition of infrastructure; taxes; and legislation and stability of the legal system. Nadeem [2010] classified risks as technical, operational or business as pacts of projects; acceptable or unacceptable; manageable and unmanageable. It is suggested that it is wise for each of the

participants to con side reach and every risk which they identify as being relevant to the project as a whole, and there after seek to categorize those risks by them an renin which they are proposed to be "treated", rather than seeking to "fit" risks in to general categories or even more alarmingly seek to allocate the mat the outset to the respective parties as matters of concern for the other project participants [Mead, 2007].

2.1.5.3 Risk Analysis

Risk analysis involves quantifying the impact and the probability of occurrence of risks. After identification and classification of the probable risks, their impacts on the project objectives need to be assessed to develop proper response. Risk analysis can also be described as short listing risks with the highest impact on the project, out of all threats mentioned in the identification phase [Cooper et al. 2005].

It has been concluded that the nature of risks under consideration is determinant in the selection of modeling and analysis techniques [Baloi, 2012]. There are two methods to determine risks in a project, 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 qualitative approach, on the other hand, relies on judgments and it uses criteria to determine outcome. The two broad categories of risk analysis techniques are presented briefly as follows;

2.1.5.4 Methods of Risk Analysis

a) Qualitative Risk Analysis

Qualitative risk analysis assesses the priority of identified risk suing their probability of occurring, the corresponding impact on project objectives if the risks do occur, as well as other factors such as the time frame and risk tolerance of the project constraints of cost, schedule, scope, and quality [OSPMI, 2007]. It involves assessment of risks using risk matrix to determine their likelihood and potential effect on the project objectives.

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 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 [Nadeem, 2010].

b) Quantitative Risk Analysis

The quantitative risk analysis process, although not very common in construction projects, is very useful to support project management decisions. This process uses techniques such as sensitivity analysis, probability analysis, Monte Carlo simulation and decision analysis to determine many project assumptions [PMBOK, 2013].

Quantitative risk analysis is the most sophisticated technique and involves determination of the level of impact and probability of occurrence of projects risks [Thomson,1992].The quantitative analysis is required for risks that are analyzed in qualitative analysis and have significant effect. The quantitative analysis usually uses the project program and cost estimates to quantify the effect of risk son time and cost constraints of the project.

The output of the quantitative analysis includes the probability of achieving the project objectives including, cost, time and quality. The result can be used by contractors and employers in estimating the contingency a mount that may be required to respond for the probable risks to achieve the project objectives. The analysis of the project risk must include the overall impact of the risks on the whole life of the project and this can be achieved by computing the net present value (NPV) of each possible combination of risk impacts using computer based analysis such as Monte Carlo simulation [ERA-SMEC, 2008].

2.1.5.5 Risk Response

Risk response envelopment is a critical element in the risk management process that determines what action (if any) will be taken to address risks evaluated in the identification, qualification, and quantification efforts. Once the risks of the project have been identified and analyzed appropriate risk response strategy must be adopted in order to take the necessary steps to minimize the negative effects of risk on project objectives.

Mead [2007] stressed that instead of simply pricing for risks, there are other opportunities for mitigating risks including: risk elimination (e.g. not proceeding or proceeding on a different basis); risk reduction (e.g. by under taking further investigations/ due diligence); risk transference(e.g.by legal, contractual and insurance); risk retention (e.g. self-insurance, bearing a large deductible, internal management of risk). Risk response occurs to eliminate, mitigate, deflect or accept the risk and logically will reflect the cost benefit of the risk management process [Fewings, 2005].

Risk mitigation: it involves the activities used to reduce the probability or impact of the risk. Risk reduction can be achieved through taking proactive action to reduce the negative effects of risk.

Mitigation is action taken to reduce the risk and deflection is act ion taken to transfer the risk. They are not mutually exclusive, but deflection one is not a way of reducing the probability. Mitigation may have the effect of reducing probability and impact [Fewings, 2005].

Risk avoidance: is a strategy for negative risks or threats that involves changing the project plan to eliminate the risk or to protect the project objective s(time, cost, scope, quality) from its impact [OSPMI,2007]. This can be achieved through activities including using suitable procurement option, change the method of execution and etc. However, risk avoidance in construction is generally recognized to be impractical as it may lead to projects not going ahead or a contractor submitting an excessively high bid for a project [Akintoye, 1997].

Risk transfer: it involves shifting the responsibility to respond for risk to another party who is in the better position to deal with it. Risk transfer is not aimed to eliminate or reduce risk. The transfer of risk can be achieved by using the relationship between client, contractor, sub-contractor and in surer. If more risk is allocated to the contractor, the greater the project cost as inflated amount of contingency budgeted for risk response by the contractor. Thus, transferring all the project risk too there party is not economical as some of the risks may be better managed by the transferee.

Many large scale project spur chase insurance for risks ranging from theft to fire to transfer project risks and by doing so; the risk is effectively transfer red to the insurance company in such a way that if a disaster occurs, the insurance company would be liable to pay the costs associated with the disaster.

Risk retention: it involves activities used to absorb the effect of risk. Risks that have no significant effect and are repetitive can be effectively managed through retaining the responsibility by the owner of the project. There are two types of risk retention ,i.e. passive retention and active retention[Rahman, 2013].

Passive risk retention (sometimes called non-insurance), acknowledges the existence of risk without responding fur the rand occurs through negligence, ignorance or absence of

decision, e.g. a risk has not been identified and handling the con sequences of that risk must be borne by the contractor performing the work.

Active risk retention (sometimes referred to as self-insurance) is a deliberate management strategy after a conscious evaluation of the possible losses and costs of alternative ways of handling risks to allocate an essential allowance to support a contingency strategy for projects whenever necessary.

2.1.5.6 Risk Monitoring and Control

Risk monitoring is the final stage of risk management cycle. The major role of risk monitoring is to ensure the effectiveness of the risk management system including identification; analysis and response are applied to the project [IRM, 2002].

Risk monitoring system is required to maximize the effectiveness of risk response towards meeting the project objectives. Risk monitoring process also used to indicate the need for revision of cost and program in relation to the response for risk [ERA-SMEC,2008]. Another important aspect of risk monitoring is to ensure that actual events are recorded for use in future projects. Risk register is are cord system in which the information including the identified risk sand the proposed strategy as well as its result will be recorded for use of subsequent risk management activities.

Risk monitoring and control involves implementing the risk plan, which should be an integral part of the project plan. Two key challenges are associated with monitoring and control. The first is putting the risk plans in to action and ensuring that the plans are still valid. The second is generating meaningful documentation to support the process. IRM (2002), suggested that any monitoring and review process should also determine whether:

2.1.5.7 Risk Allocation

The process of determining and allocating risk is fundamentally linked to the drafting of the conditions of contract, which is effectively the choice of standard form of conditions of contract and any amendments thereto [Premaraj, 2005].Whether the contract is for construction, construction engineering and inspection, design, design-build, or some other aspect of highway construction management, it defines the roles and responsibilities for risks. Risk allocation in any contract affects cost, time, quality, and the potential for

disputes, delays, and claims [FHWA, 2006].Engineering and construction contracts in corporate specifications, drawings and schedules to communicate the objectives of the contract. The contract is the vehicle for risk allocation.

The purpose of a contract is to establish the rights, duties, obligations and responsibilities of the parties and to allocate the risk [Norman, 1993]. Contracts have evolved as a method of documenting commercial transactions between parties and expressing the conditions that regulate these transactions. Contracts are part of a legal system that seek to balance freedom and control, and dispense justice and they are perceived as an efficient method of protecting the interests of the parties participating in commercial transactions [ERA-SMEC, 2008].

2.1.6. Construction projects' risk and risk management practice in various countries

Research conducted by Mills (2001) in Sydney, Adams (2008) in United Kingdom, Dey (2009) in India, Grace(2010) in United States, and Ghoddousi and Hosseini (2012) in Iran are mostly focusing on the categorization of risk. Therefore, for the purposes of this literature the pertinent researches in which important risks and also risk management strategies have been proposed are provided below.

Cruz *et al.* (2006) have conducted are searching Spain about downside risks in construction projects. The findings demonstrate lack of project management and project risk management maturity in Spain, and political issues have been marked as the main obstacles preventing a higher maturity level.

In a paper by Tang *et al*. (2007),they have compared criticality of the risks and have evaluated the methods and risk responses used by project parties in Chinese construction industry.Theyrankedthefivemostimportantrisksas"poorqualityofwork","premature failure of the facility", "safety","‌ in adequate or in corrected sign", and "financial risk". They believe that the existing risk management systems are not sufficient for managing risks and the key barrier to proper risk management is lack of joint management mechanism. Their research suggested a need to introduce an information managements he me and the partnering

principles to risk management process, encouraging the open communication among participants in order to manage the project risks jointly and collaboratively.

In are search carried out by Hassanein and Afify (2007), they aimed at investigating contractors "perceptions of construction risks and their attitude toward risk identification and management based on a case study of PowerStation projects in Egypt. The results show a lack of consistency in contractors "risk identification behave our and also point out previous experience with the same own eras a factor having significant effect on the contractor "risk identification effort.

Liu *et al*. (2007) have studied key issues and challenges of risk management and insurance in Chinese construction industry. According to the results of their research, managers" knowledge and understanding about risk management is very little in Chinese construction projects. Great percentage of the respondents who had participated in this research be lieve that risk managements kills are essential or project management activities but have not developed in China as much as project management. Unsupportive culture was identified as the biggest barrier in development of risk management in China's construction industry, followed by other factors such as attitude and perception of the contractors.

Perera *et al*. (2009) "s research on construction projects in Sri Lanka has ranked scope change and tentative drawings as the two most influential risks in construction projects. Authors have concluded that one best way for responding to risk does not exist and various risk handling strategies should be employed for dealing with the risks.

Zou *et al*. (2006) in their paper have identified and analyzed the risks associated with the development of construction projects from the perspectives of stakeholders and project life cycle in Australia. The results indicate that many risks occur Atmore than one phase and it was also concluded that construction phase is the most risky phase, followed by the feasibility phase.

2.1.7 Risk Management in the Ethiopian Road Construction Industry

Ethiopia's transport system relates predominantly to road transport. However, as one of the developing countries, the country has least developed road transport even among the lowest in Sub Sahara Africa. So, there is high demand of efficient transport system to improve

accessibility to mostly rural population and for the overall economic and social development of the country [Asnake, 2010].

The Ethiopian road construction industry is moving towards supporting the poverty reduction activity and to the development of the economy as the Country's economy is based on agriculture, transport infrastructure allows the agricultural communities to access both domestic and international markets; besides, it enables the people get access to hospitals, schools and other public service facilitates in a better way.

The road construction industry is mainly administrated by the Ethiopian Roads Authority that is the largest road construction employer in the country. There are a number of local and foreign contractors and consultants participating in design, construction and maintenance of road projects. The foreign contractors have been the major implementer of road sector development program during the first phase of the RSDP Program [1997 – 2002]. However, the local firms have shown involvement from second to fourth phases of the program [2002-2015] and as a result the construction industry as well as the capacity of local firms has been substantially improved both financially and technically[ERA, 2013].

There are some local firms working in association with foreign firms in large projects which is helpful to build their experience and capacity. To this end, there are steps being taken by the Government in order to attract more foreign firms to participate in the construction industry. Currently, contractors from China, Korea, India, Japan, Yemen and from others countries are participating in the Ethiopian road construction industry [ERA, 2013].

Even if there are recent attempts to shift to Design and Build procurement strategy in some projects, the Ethiopian road construction industry uses dominantly traditional procurement option (design- bid- build) where there are three parties involvement (employer, contractor and the consultant). In this procurement option, the contractor is not responsible for the design but only for the delivery of operations or undertaking works in supervision of the consultant who certifies the executed work. The design work usually carried out by design consultants assigned by the employer and as a result, the client takes responsibility for the design works which is executed by consultant assigned by the client in the relation between the contractor and the client. The selection of contractors is usually made based on least evaluated bidder among those who fulfill the pre- qualification requirements.

Usually, contract documents are developed by the employer or by its representative based on the FIDIC General Conditions of Contracts published in 1987 and 1999. Accordingly, the contracts follow the FIDIC procedures and risk allocation principles. Apart from that, there are some particular conditions of the contract introduced over the FIDIC General Conditions of Contracts to suite to the country and project situation.

Hence, ideally the contract document should be clear, precise, unambiguous, and comprehensive, suitably grouped and with proper site references. However, most of the contract documents are found to be inconsistent, lacking necessary detailed specification and drawing with under estimation of quantities and even though rarely, with specification which are not practical [ERA-SMEC, 2008]. These are mainly a result of poor service by the design consultants and non pro-active approach to the issues during the construction period by the supervision consultants [Zerfu, 2009].

It is not surprising to find projects suffering of cost overrun and delay in completion mainly caused by lack of risk management system in the construction industry. This problem affects not only the performance of the projects but also the road sector development program and in general the overall economic growth of the country [Asnake, 2010].

Turkey [2011] based on the result of a desk study on the Ethiopian Federal Road Projects, indicated that out of 30 upgrading and rehabilitation road projects investigated, 24 projects (80%) suffered cost overrun in their execution. For these road construction projects, the average cost overrun was found to be 26.95% of the contract amount.

In the Ethiopian road construction industry, formal risk identification and analysis has not been developed to the required level and carried out adequately for projects. Usually decision makers use their experience gained from previous projects to identify and assess the level of impact and the likelihood of occurrence of risks to the project in the industry [Asnake, 2010].

All parties in the Ethiopian road construction industry need to improve their understanding of risk and contingency allowances to cover risks that should be included in the cost estimates, and provide appropriate contingency allowances for each project based on the assessed and expected level of risk instead of arbitrarily allocation[Turkey, 2011].

Hence, it is required to take the necessary steps to curb the prime problems of the projects so as to minimize the negative effects of risks on projects' objectives. This can be achieved

through application of effective risk management to projects. Chapman and Ward (1997) out lined a generic risk management process consisting of nine phases:

1. Define the key aspects of the project;
2. Focus on a strategic approach to risk management;
3. Identify where risks may arise;
4. Structure the information about risk assumption and relationships;
5. Assign owner ship of risks and responses;
6. Estimate the ex-ten to fun certainty;
7. Evaluate the relative magnitude of the various risks;
8. Plan response;
9. Manage by monitoring and controlling execution.

According to the Project Management Body of Knowledge (PMI, 1996), risk management forms one of the so-called nine functions of project management (the other eight being integration, communications, human resources, time, cost, scope, quality and procurement management).The traditional view is that these functions should form the basis of planning and that each should be the focus of attention in each phase of the project. In the PMBOK, PMI (1996) presents four phases of the risk management process: identification, quantification, responses development and control. Risk Management covers the process of identification, assessment, allocation, and management of all project risks (APM, 2000). Healycitedin (Shen, 1997) suggested a systematic process including risk identification, risk analysis and risk response, where risk response has been further divided in to the four actions: risk retention, risk reduction, risk transfer and risk avoidance.

2.2 Review of Empirical Literature

There are many possible risks which could lead to the failure of the construction project, and through the project, it is very important what risk factors are acting simultaneously. Besides, too many project risks as undesirable events may cause construction project delays, excessive spending, un satisfactory project results or even total failure. There are four alternative strategies–risk avoidance, risk transfer, risk mitigation, and risk acceptance, for treating risk sin a construction project.

According by Zaghloul and Hartman [2010], there is no possibility to eliminate all the risks associated with a specific project. All that can be done is to regulate the risk allocated to different parties and then to properly manage the risk. Twenty risk factors were established

to be sign if I can tender the internal risks categories. Under the design risk category, design errors/ omissions and design process delays were the most frequently mentioned risk factors attributed to the contractors.

Under the project management risk category, scheduling errors and failure to comply with contractual quality requirements were the most frequently mentioned risk factors. Under the construction risk category, construction cost overrun sand technology changes were the most frequently mentioned risk factors attributed to the contractors.

An effective risk management process encourages the construction company to identify and quantify risk sand to consider risk contain men and risk reduction policies. Construction companies that manage risk effectively and efficiently enjoy financial savings, and greater productivity, improved success rates of new projects and better decision-making. To manage the risk effectively and efficiently, the contractor must underst and risk responsibilities, risk event conditions, risk preference, and risk management capabilities. (Banaitiene and Banaitis, 2011)

According to the study conducted in Gaza,Palestine by (Hmaid,2005) risk factors were identified and the mostten sever risk factors are appeared as from the contractors and clients side. From the contractors side, Financial failure, Working at hot (dangerous) areas, Closure, Defective design, Delayed payments on contract, Segmentation of Gaza Strip, Un stable security circumstances (Invasions), Poor communication between involved parties, Un managed cash flow, Awarding the design to unqualified designers. On the other hand, the top ten sever risk factors according to owners are Awarding the design to un qualified designers, Defective design (incorrect), Occurrence of accidents because of poor safety procedures, Difficulty to access the site (very far, settlements), Inaccurate quantities, Lack of consistency between bill of quantities, drawings and specifications, Working at hot(dangerous)areas, Financial failure of the contractor, Closure and High competition in bids.

Contractors and owners still depend on traditional approaches to manage risk factors and their consequences; the use of direct judgment to control risk factors was the most applied method used to control risk events (sections 4.7 and 4.8).These results as sure the need to develop the used methods for managing risk factors.

In are cent study conducted to assess the risk management practices of top contracting firms in United States, Shofoluwe and Bogale (2010) found that contractors use a wide variety of techniques in their risk management practices. However, for risk analysis, traditional

method of analysis involving in tuition, judgment and experience were found to be the most predominantly used.

Ritchie and Brindley (2007) have identified factors influencing the formation of risk perception as educational background, practical experience, individual cognitive characteristics, project team and avail ability of information. Other commentators have identified these variables – physical, environment, design, and logistics, legal, political and operation–as sources of risk central to construction activities (Perry and Hayes 1985, Mustafa and Al-Bahar1991). Clients and contractors were found to be risk averse even though they claimed to have formal written procedures for risk management. Their ware ness of the importance of risk management in construction business is more of lip services. (UDITH, 2014)

It is, therefore, extremely relevant for the construction industry and those involved in it to understand the concept of risk and to know how to properly manage the risk matrix generated when a construction project is in it iated [Bunni,2003]. Since risk cannot be eliminated, but should be managed, it is better to be proactive than reactive [CIDB,2004]. From client's perspective, the risk management process should start from briefing of project to the hand over to users. Clients are the first party to conduct the risk management process and involve contractors and consultants during the construction stage or at an earlier stage according to the procurement method.

According to the study conducted by (Getachew, 2014) all respondents have some knowledge of risk management through reading and practice but the implementation level of risk management among respondents varies. Mainly, contractors and consultants understand risk management through reading and practice than the client and insurance companies.

The client (ERA) mainly uses the opinion of external consultants (design and supervision consultants) as the number one method of risk identification. The consultants and the contractors, on the other hand, mainly use site visit as the number one method of risk identification. By past experience or analysis of prior projects was ranked as second most used risk identification method by consultants and contractors.

In A case study of Iran made by (Ghahramanzadeh,2013)a questionnaire was designed and twenty-five risks were identified and categorized in five main categories as Political and

Govern mental, Managerial and Technical, Economic and Financial, Cultural and Social, and Natural. Findings of the research revealed that Economic and Financial risk shave the greatest influence on construction projects in Iran. Moreover, there is a serious lack of risk management knowledge and expertise among all the three key categories of actors. The conclusion raw from the evaluation of risk management strategies was that due to high volatility of the economic and political situation of the country, reactive risk management is practiced more than proactive risk management.

Thethreemostcriticalriskswhichareinfluencingconstructionprojectssignificantly revealed to be one of the following risks: cash flow, lack of financial resources, inflation, price fluctuations, and late payment which in a sense all can be considered to be out comes of instable economy –E&F category of risk.

A research conducted in Nigeria by Bashir (2011) have explored the application of risk management in Nigeria, the barriers of risk management or factors that limit its application on and also the factors that will influence risk management development. It identifies that the main problem of risk management application in Nigeria is knowledge. All the factors that lim it the application are caused by lack of knowledge. It was found that the best know led get hat will effectively manage project risks in the country is cost management and quality management. Materials price fluctuation has been identified as the most certain risk which occur in every construction project in Nigeria. Although increase in inflation rate hashing he possibility but its major effect is on the price of material which makes it the highest occurring risk factor in Nigeria. The attitude of construction participants is another problem to risk management. It was seen that contractors bid for risk prone projects with normal price which in turn affect their profit margin.

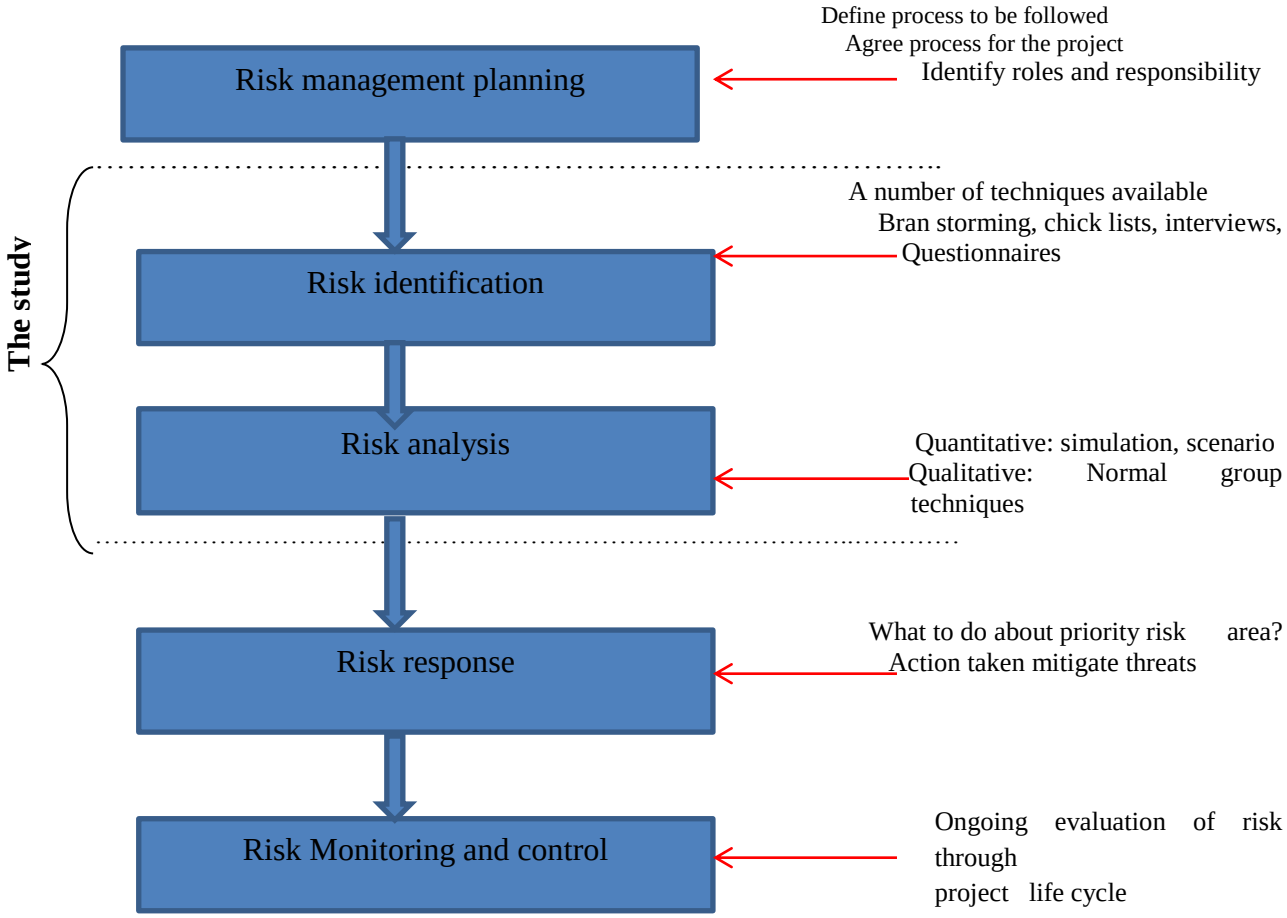
2.3 Construction risk management approach

This model placed risk management in the context of project decision making while considering the over-lapping contexts of behavioral responses, organization structure, and technology. The objectives of project and construction risk management should be clearly established with in the context of project decision-making, and will be governed largely by the risk attitude of the project proponent. In discussing human judgments in decision-making, proposes a sociological and organizational context for risk analysis. The construction risk management conceptual model provides an effective systematic frame

work for quantitatively identifying, analyzing, and responding to risk in construction projects. With this model emphasis is placed on how to identify and manage risk sbefore, rather than after, they materialize in to losses or claims (Enshassi & Mayer,2001). It includes maximizing the probability and consequences of positive events and minimizing the probability and consequences of events adverse to project objectives. Each components of risk management are discussed here under in the perspective of construction projects.

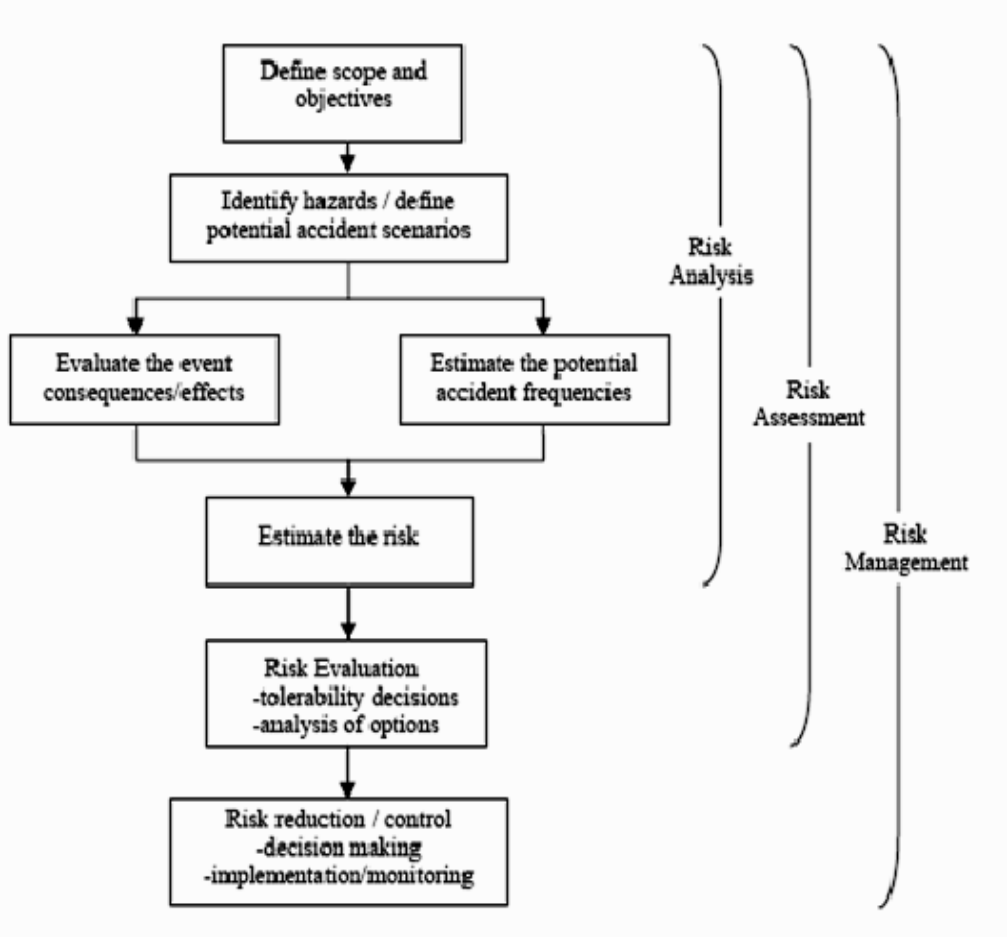
Action taken mitigate threats

Figure 2:1 Risk Management Frame work (Source:PMIPMBoK,2013)



In relation to this, Abrahams son (2002) illustrated Simplified relationship between risk analysis, risk assessment and risk management as follows:-

Figure 2.2 Simplified relationships between risk analysis, risk assessment and risk management. Adapted from Abrahamsson (2002).



CHAPTER THREE
3. RESEARCH METHODOLOGY

3.1 Introduction

It is understood that this paper is aimed at Risk analysis and Management in relation to Road construction projects with particular reference to Durame –Mazoria Road construction projects. To attain this objective, descriptive survey research is employed. Thus, this chapter discusses overview of the study area, the research approach and design, data type and source, target population and sample size, sampling procedure, methods of data collection and the tools employed for data analysis.

3.2 Description of the study Area

3.2.1 Mazoria-Durame Road Project

The project road Mazoria-Durame (Km 71+200) to Gibe River (Km 130+200) Road Project, Contract I:Durgi (Km71+200) - (Km 97+700) is located in the Southern Nations, Nationalities and Peoples Regional States (SNNPRS) and it connects two major link roads, namely Alemgena – Hosanna – Sodo and Alaba – Sodo – Arbaminch. The project starts at Durgi Town, 335 km South West of Addis Ababa. This road project benefits the surrounding community to exchange their agricultural, commercial and industrial products among different regions of the country and makes them accessible to social services like health, education, tourism and others.

For the implementation of the construction supervision of the Mazoria Road Project, Lot II: Durgi – Gibe River Km 71+200 – km 97+700 road project, Rama Consult plc. has signed the consultancy service agreement with Ethiopian Roads Authority on April 22, 2013 after being responsive bidder through local competitive bidding. Accordingly rendering the required services of the consultancy activities were started on April 29, 2013 after the Employer notice to commence the services and the service were continued until an official termination and signing new agreement made with ECDSWC, TDSWS for the continuation of construction supervision service on 1st January 2017. The works contract agreement for the project is signed on 23rd of January 2013 between Ethiopian Roads Authority and Kiflom Gebrehiwot General Contractor with a contract amount of Birr

376,996,880.19. The contract time for completion of the project is 1095 calendar days with commencement date of 1st of May 2013 and completion date of 30th of April 2016. However, at the present time the physical sytatus of the project is about 85% while two years are elapsed from the date of competion based on the contract agreement. This is an indication of time and cost overrun in the execution of the project. The location map of the project area and the project layout are shown on the next pages.

Figure 3:1Durame- Mazoria Durgi, Lot II: Durgi –Gibe River location map

3.2.2 Description of Omo River – Tercha Road Upgrading project

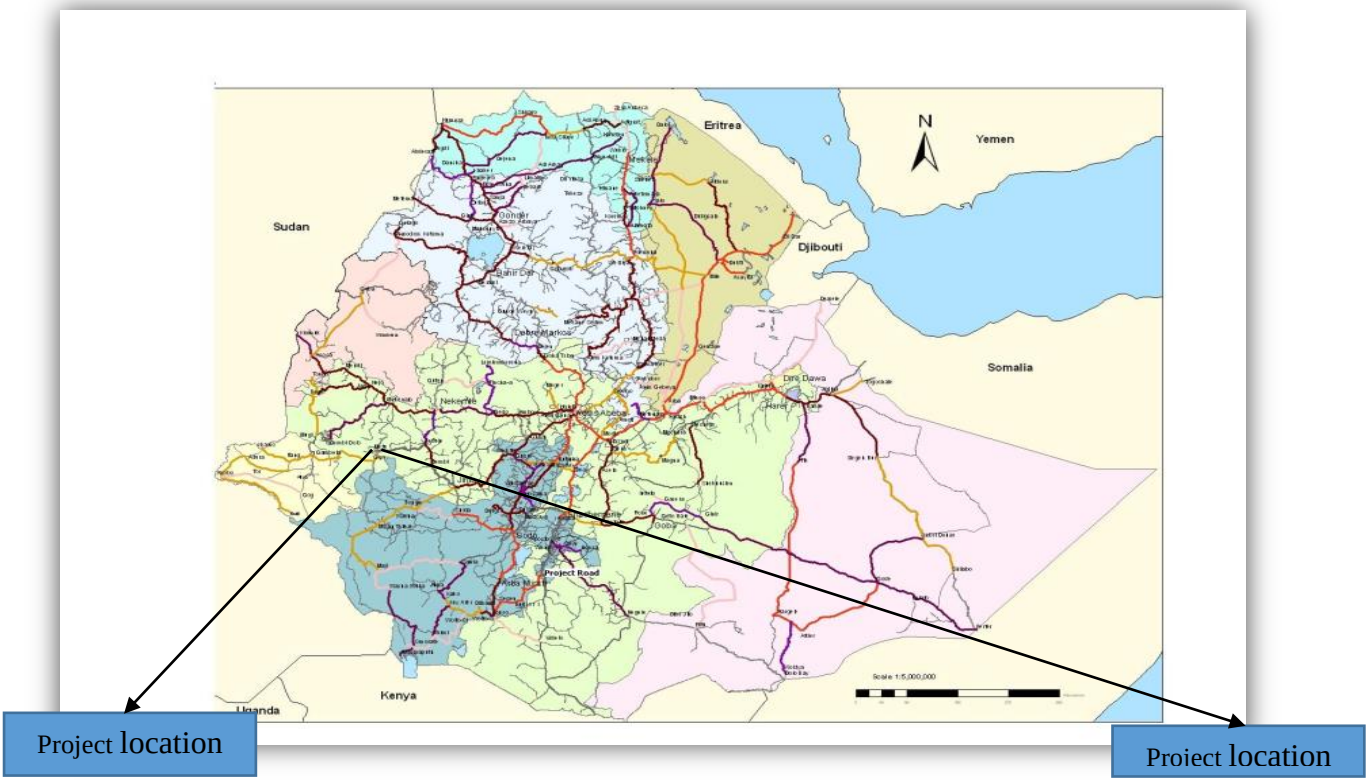
The Omo River – Tercha Road Upgrading project is located in the Southern Nations, Nationalities & Peoples Regional State mainly in Dawuro zone and the project is expected to solve connectivity problems between Sodo and Dawuro zone and creating short access between Sodo and Tercha of Dawuro Zone and South western corridor.

The beginning of the project road is found at Tercha Town located at a distance of 479.3Km and 133.3 Km from Addis Ababa &Jimma City respectively and terminates some 404Km and 82km from Addis Ababa and Welaita Sodo Town via Addis Ababa - Hosahina - Sodo main road. The total length of the project is about 83.4km. Geographically, the road starts at UTM Zone 37N of Easting 311,432 Northing 755,948 and ends at Easting 298,670, Northing 789,919.

The road project is found in the places where most of the population engaged on production of crops. Hence the corridor of this road project is covered by farm lands. However, some portion of the route corridor passes through Town sections and bushes. Generally the route traverses through farm land covers (73.55%), bush covers (18.03%) & town section covers (8.42%).

The Construction Contract agreement is signed between Ethiopian Roads Authority and China Railway Seventh Group Co. Ltd. on 14th of April 2015 and expected to be completed on November 3, 2018. Similarly, the Construction Supervision Agreement is signed between Ethiopian Roads Authority and ECDSWS, Transport Design and Supervision Works Sector on the 5th June 2015. At present the physical status of the project is about 53% of the total construction work accomplished while the remaining time of the contract is only five months. Thus, the project is expected to request time extension due to time and cost overrun.

Figure 3.2 location of Omo River - Tercha



3.3 Research Design and Approach

To determine the validity and credibility of the research and thereby to materialize its objective and the identified research questions, descriptive research approach was adapted and used. As one of widely and commonly used research designs, the reason for applying this approach is it helps to clearly understand the study phenomenon and fully examine the road project risk analysis and management trends and practices with regard to Omo River - Tercha and Durame- Mazoria river road project, and ultimately address the research objectives and questions. Besides, descriptive research approach serves to describe the attitudes, opinions, perceptions and understanding of the road project activities and risk assessment practices.

3.4 Data Type and Source

In order to materialize the research objectives and fully deal with the research questions, both primary and secondary data will be used. The primary data was collected from all relevant data sources, including professionals working on the consultant side, project managers and other professionals on the contractor side, counterpart Engineers and other staffs from the client's part who follow the projects under study. On the other hand, the secondary data was obtained from different data sources, mainly research publications, articles, project concept notes, project planning reports, risk assessment reports, quarterly and annual progress reports of Omo River -Tercha and Durame -Mazoria road project, published and unpublished documents in the construction sector, as well as web-based journals and documents from other sources.

3.5 Target population and Sample size Determination

3.5.1 Target population

The overall target population of the study includes professionals working on the consultant side/ Transport design and supervision works sector, project managers and other professionals on the contractor side, counterpart Engineers of the project and other staffs of Ethiopian Roads Authority/project owner/.

3.5.2 Sampling technique and Sample size

To select the study subjects and respondents, purposive sampling technique is employed. This is because the target population of the study is limited in number and it is possible to obtain reliable data from the concerned professionals of the three parties (the three C's).Since purposive sampling technique is employed for selecting samples, 18 professionals from the consultant's side who closely supervise the projects, 26 professionals who execute the construction work from the contractors side and 8 professionls from the Ethiopian Roads Authority Side (ERA) who follow up the progress of the projects. Hence, a total sample of 52 professionals are taken as the samples for the study from both projects (Omo River -Tercha and Durame -Mazoria road project).

3.6 Data Collection Methods and tools

The study used both quantitative and qualitative data, gathered from all the relevant primary and secondary data sources. To collect primary data, different data collection methods will be applied; essentially data will be gathered using both open and closed-ended questionnaires, key informant interviews from the target respondent's i.e. those who are closely working on the Omo River-Tercha and Durame- Mazoria road projects. A questionnaire was developed to assess the perceptions of clients, consultants, and contractors on the occurrence and criticality of risk factors as well as risk management processes related to the concerned road construction projects.

The questionnaire has four main sections having their sub-divisions. The first section comprised of four items about the respondents general information and the second section includes three items which describes respondents understanding about risk management. The third section being divided in to three sub-sections consists of 27 identified risk factor (ten client related, eight consultant related and nine contractor related) related to road construction projects and respondents were requested to rate their degree of occurrence, probability of occurrence and the extent of their criticality. The last section comprises of five sub-sections including risk identification methods used (five items), risk analysis methods used (five items), risk response methods used (seven items), risk monitoring methods used (three items) and elements of body of knowledge areas (five items) and the respondents were requested to level them the extent to which they are implemented in relation to Omo River -Tercha and Durame- Mazoria projects. Secondary data, on the other

hand, were collected and reviewed from different research articles, journals, books, and quarterly and annual progress reports, published and unpublished documents in the construction sector, as well as web-based journals and documents from other sources. The majority of sections of the questionnaire were prepared using A 5 point likert scale since it is feasible to measure the attitudes and opinions of respondents towards the issue under discussion and it is convenient for quantitative analysis. Thus, a total of 121 items were included in the questionnaire. The survey result was also supplemented by the information gathered from the key stakeholders through structured interview using seven items as a guideline.

3.7 Data Analysis and Presentation

After the relevant qualitative and quantitative data gathered, descriptive method of data analysis was employed. While Likert-Scale is used to measure individual risk factor, averages of risk factors affecting the road construction projects were computed from three perspectives: client, contractor and consultant. Mean scores and thresholds are adapted from Uebersax (2006). Accordingly, mean risk scores below 2.5 are categorized under 'low' risk category, between 2.5 and 3.5 within 'medium' risk category, and above 3.5 within 'high 'risk category. The The quantitative data was organized and analyzed using Microsoft Excel and Statistical Package Software (SPSS) Version 23. On the other hand, qualitative data analysis techniques including content analysis and triangulation were used to identify the risk factors that define project risk analysis and management, and strengthen the interpretation of the quantitative findings. Finally, the analyzed data was presented using frequencies, percentages, mean values, ranks, tables and different types of figures.

CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.1 Introduction

This chapter deals with the presentation, analysis and interpretation of the data which was collected from respondents.

To analyze the collected data in line with the overall objective of the research, statistical procedures were carried out using SPSS Version 23.0 software. To assess risk analysis and management practice at Omo River - Tercha and Durame- Mazoria Road construction projects executed by Ethiopian Roads Authority, a total of 52 questionnaires were distributed to a selected sample of respondents in the two road construction projects which comprise 8 from the client (ERA), 20 from the consultant, and 24 from the contractors side. Sample of the questionnaires are attached in Appendix 2.The questionnaires were distributed to key stakeholders of the two road construction projects that are considered to have direct relation with the execution of the projects. These include client (ERA), consultants and contractors.

4.2. Analysis of response rate

A total of 52 questionnaires were distributed to the three groups of respondents in the above mentioned two road construction projects. Out of 52 questionnaires, 49 of them were returned comprising 8 from client (ERA), 20 from consultants, and 21 from contractors. This gives a response rate of 94.2% which is a good response rate for the study.

4.3. General information about respondents

General information about the respondents were summarized and described in different figures and tables. These variables include: project name engaged, company type, work experience and respondent's position in the project

Table 4:1 General information about respondents

	Description	Frequency	Percent
The project to which the respondents belong			
	Omo tercha	24	49.0
	Durame-Mazoria	25	51.0
	Total	**49**	**100.0**
The company type the respondent belongs			
	CLIENT	8	16.3
	CONTRACTOR	21	42.9
	CONSULTANT	**20**	**40.8**
	Total	**49**	**100.0**
Work experience of the respondents			
	1-5 years	15	30.6
	6-10 years	11	22.4
	11-15 years	12	24.5
	16 and above years	11	22.4
	Total	**49**	**100.0**
Position of the respondents			
	Team leaders	4	8.16
	Project managers/ Resident Engineer	4	8.16
	Construction Engineers	2	4.08
	Counterpart Engineers	4	8.16
	Intermittent staffs	8	16.33
	Technical/ support staffs	23	46.94
	Total	**49**	**100**

Source: survey data

The above table has shown general information about respondent's project engaged, company type, work experience and position of the respondents. Among the sampled respondents, 24 (49%) of them belong to Omo River - tercha road construction project while the remaining 25 (51%) represent Durame Road construction project. The major

stakeholders in road construction projects i.e. client, consultant and contractor comprise 8 (16.3%), 20 (40.8%) and 21(42.9%) professionals respectively as samples of the study. The other features of the respondents is work experience and about 1/3 of the respondents have less than 5 years of work experience followed 6-10 years' experience (24.5%) and 11-15 years and above 16 years' experience each (22.4%). With regard to respondent's position in the project nearly 47% of them are technical staffs while the remaining are team leaders, project managers/ Resident Engineer, counterpart Engineers, construction engineers and intermittent staffs. This implies that the respondents have access to the projects and relevant experience to judge the risk factors.

4.4 Respondent's general information about Risk management

Before requesting respondents about the risk factors affecting the road construction projects, it is better to know their level of understanding about risk management and related issues. Thus, the survey data collected from respondents is analyzed using descriptive statistics mainly frequencies and percentages as shown below.

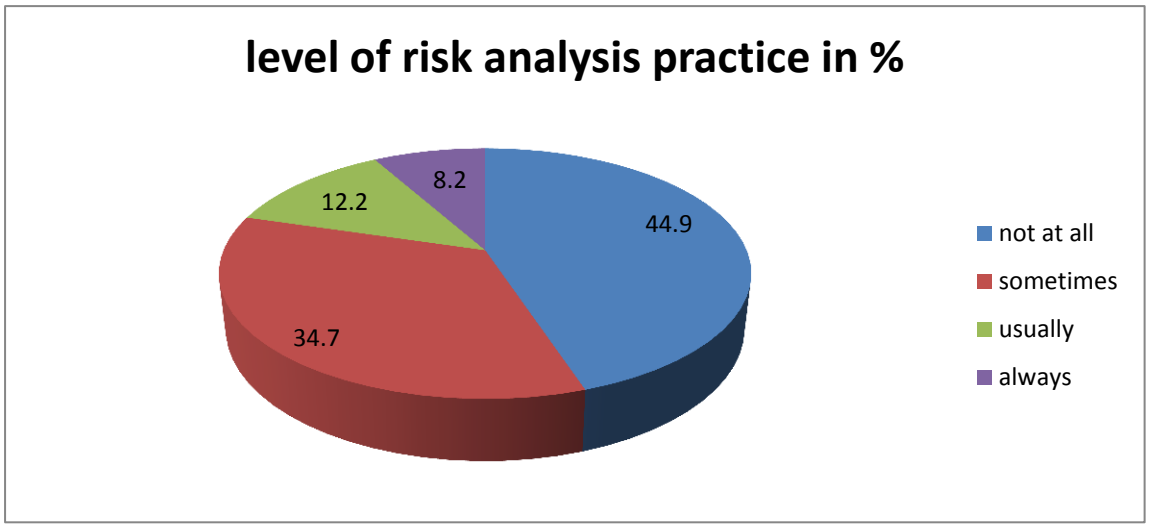
Table 4.2 Respondent's level of understanding about risk management

Description	Frequency	Percent
I have no idea	3	6.1
Little	9	18.4
Good	18	36.7
very good	19	38.8
Total	49	100.0

Source: survey data

As the above data shows 38.8% and 36.75 % of the sampled respondents have a very good and good understanding about risk management respectively. While the remaining 18.4% and 6.1% of the respondents have little understanding and very little understanding about risk management respectively. Similarly, some of the project staffs were interviews whether they are aware of risk management concepts or not, they replied as they have basic understanding about it regardless of the practice.

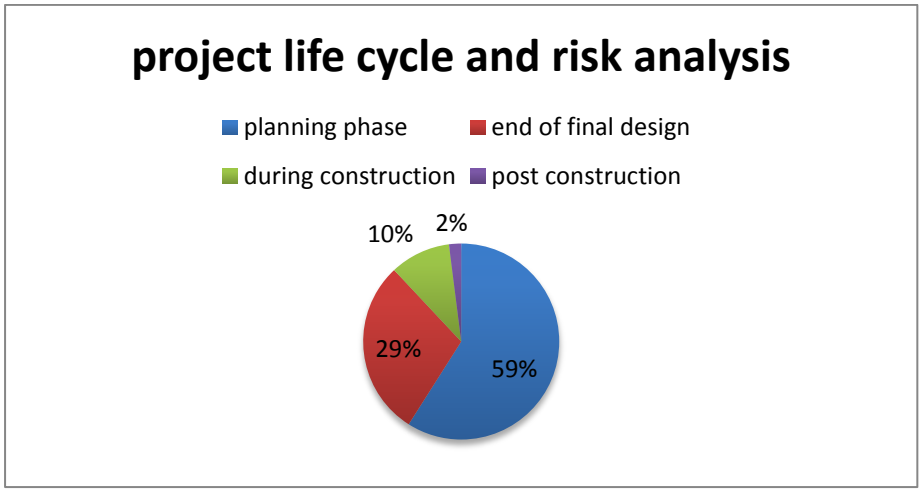
Figure 4:1 Risk management practice in the project they are engaged



Source: survey data

As the above figure illustrates nearly 45% of the respondents replied that there is no risk management practice in the road construction project they engaged while 34.7% and 12.2% of the sampled respondents said that there is sometimes and occasional practice of risk management respectively in the projects they are working. Some key informants from the Durame- Mazoria Road project suggested that absence of risk mitigation plan contributed for time and cost overrun of the project that could been tackled if it was preplanned.

Figure 4:2 Respondents response on project life-cycle they perform the risk analysis



Source: survey data

As the above figure showed, about 60% (36) of the respondents replied that risk analysis is made at the planning phase of the project life cycle while 29% (9) and 8.2% (4) of the participants of study believed that risk analysis and management is conducted during construction phase and at the end of design phase respectively.

In relation to this, most of the literature recommended that risk analysis and management has to be made in the planning phase of the project but this does not mean that there is no risk analysis and management at the other phases of the project life cycle.

4.5 Risk factors affecting road construction project

The potential risk factors that have an impact on road construction projects performance are identified from different literatures and experts opinion. The degree of occurrence, possibility of occurrence and criticality of the risk factors are determined from clients, consultants' and contractors' perspective using questionnaires. The results of the survey are analyzed in the following tables.

4.5.1 Risk factors on Omo- Tercha and Durame- Mazoria road project

The major risk factors identified were categorized in to client related, consultant related and contractor related risk factors and the extent to which these risk factors occurrence in Omo River -Tercha and Durame- Mazoria-Durgi**:**lot II: Durgi-Gibe river road construction projects were analyzed independently as follows:-

Client related factors

Table 4. 3: Respondents response on client related factors

Project engaged	Omo - Tercha			Durame – Mazoria - Durgi		
	N	Mean	Rank	N	Mean	Rank
Scope changes	24	3.54	3	25	3.88	3
Payment delays	24	3.46	5	25	4.20	1
Right of way problems	24	3.63	2	25	4.20	1
Schedule pressure	24	3.38	7	25	3.44	4
Inappropriate intervention	24	3.29	9	25	2.92	10
Design changes	24	3.83	1	25	3.36	6
Slow decision-making	24	3.13	10	25	3.08	9
Corruptive practices	24	3.38	7	25	3.20	8
Poor project management and supervision	24	3.42	6	25	3.24	7
Inadequate experience	24	3.51	3	25	3.44	4
Grand Mean		**3.45**			**3.49**	

Source: survey data

As it can be understood from the above table, ten major client related risk factors that could affect the road construction project are identified and respondents were requested to rate them the extent to which these risk factors affect Omo River – Tercha and Durame- Mazoria river Road projects. The analysis is made using descriptive statistics mainly weighted average or mean and rank. The result has shown that among the risk factors identified design changes (3.83), Right of way problems (3.62) and scope changes (3.54) are considered as having the higher degree of affecting Omo River – Tercha road construction project while slow decision making (3.12), inappropriate intervention (3.29) and schedule pressure (3.37) from the clients were identified as having a less degree of affecting the project performance.

In contrast to this, slow decision making (4.20), inappropriate intervention (4.20) and schedule pressure (3.88) from the clients side are regarded as having a higher degree of affecting Durame- Mazoria Road project but Poor project management and supervision

(2.92), scope changes (3.08) and inadequate experience (3.20) were regarded as risk factors with a relatively low degree of affecting this Road project. On the basis of the grand mean value, client related risk factors have a medium degree of affecting the construction of the two projects since the value is slightly greater than 3.0. From this analysis it is possible to infer that the risk factors don't have the same degree of effect across different road construction projects.

Consultant related factors

Table 4.4: Respondents response on Consultant related factors

Project engaged	Omo - Tercha			Durame – Mazoria - Durgi		
	N	Mean	Rank	N	Mean	Rank
Poor quality of design	24	3.88	6	25	3.60	6
Incomplete design	24	4.04	4	25	3.64	5
lack of experience	24	3.67	7	25	3.56	7
Inaccurate cost estimation	24	3.58	8	25	3.64	5
Design Change	24	4.38	2	25	4.28	1
Poor project planning & control	24	4.04	4	25	4.00	3
Delay in contractor's payment certification	24	4.46	1	25	4.20	2
Delay in design work	24	4.25	3	25	3.84	4
Grand Mean		**4.04**			**3.84**	

Source: survey data

The above table has shown that among the consultant related risk factors identified delay in contractor's payment certification (4.46), design change (4.38) and delay in design work (4.25) are regarded as having the higher degree of affecting Omo – Tercha road construction project while inaccurate cost estimation (3.58), lack of experience (3.67) and Poor quality of design (3.88) from the consultant's side are considered as having a lesser degree of affecting the project.

Similarly, incomplete design (4.28), design change (4.20) and delay in design work (4.00) are among those risk factors with a higher degree of affecting Durame- Mazoria

Road project but Poor quality of design (3.56), inaccurate cost estimation (3.60) and lack of experience (3.64) were regarded as risk factors with a relatively low degree of affecting this Road project. On the basis of the grand mean value, consultant related risk factors have a higher degree of affecting construction of the two projects since the value is around 4.0. From this analysis it is possible to infer that the consultant related risk factors have the same degree of effect on the two road construction projects.

Contractor related factors

Table 4:5 Respondents response on Contractor related factors

Projeect engaged	Omo – Tercha			Durame – Mazoria – Durgi		
	N	Mean	Rank	N	Mean	Rank
lack of experience	24	3.58	5	25	3.38	6
Poor labor productivity	24	2.63	9	25	2.40	9
poor management capacity	24	3.58	5	25	3.68	3
Shortage of materials, plant and equipment	24	3.54	7	25	3.20	8
Poor productivity of plant and equipment	24	3.67	4	25	3.40	7
Inflation and sudden changes in price	24	4.21	1	25	4.04	2
Insufficient cash flow	24	4.00	2	25	4.24	1
Exchange rate fluctuation	24	3.88	3	25	3.64	4
Force majeure	24	3.42	8	25	3.60	5
Grand mean		**3.61**			**3.51**	

Source: survey data

The above table has illustrated that among the contractor related risk factors, inflation and sudden changes in price (4.21), insufficient cash flow (4.00) and exchange rate fluctuation (3.88) are considered as having the higher degree of affecting Omo River – Tercha road construction project while poor labor productivity (2.63), force majeure

(3.42) and shortage of materials, plant and equipment (3.54) from the contractors side are regarded as having a lesser degree of affecting the project.

Similarly, insufficient cash flow (4.24), inflation and sudden changes in price (4.04), exchange rate fluctuation (3.68) are among those risk factors with a higher degree of affecting Durame- Mazoria Road project but Poor labor productivity (2.40), Shortage of materials, plant and equipment (3.2) and Poor productivity of plant and equipment (3.40) were regarded as risk factors with a relatively low degree of affecting this Road project. On the basis of the grand mean value, contractor related risk factors have a higher degree of affecting construction of the two projects since the value is closer to 4.0. From this analysis it is possible to understand that the consultant related risk factors have similar degree of effect across different Road construction projects.

4.5.2 Risk factors on Omo- Tercha and Durame Mazoria road project

As it is already mentioned risk factors were categorized in to client related, consultant related and contractor related risk factors and the probability of occurrence of these risk factors in relation to Omo River -Tercha and Durame- Mazoria road construction projects was analyzed and summarized in to three key stake holders using mean average and depicted as follows:-

Table 4.6 The mean average probability of occurrence of risk factors across the three C's

Company Name	Omo - Tercha		Durame – Mazoria – Durgi	
	N	Mean average	N	Mean average
Client	4	3.61	4	3.06
Consultant	8	4.03	8	2.92
Contractor	12	3.61	13	2.98

Source: survey data

ERA has better risk management score in its road construction projects which are managed by domestic contractors compared to projects handled by Chinese contractors. The project under Chinese construction management (Omo-Tercha) has mean scores of 3.61, 4.03, and 3.61 respectively for the client, consultant and contractor associated risks respectively. On the other hand, a project under domestic contractor (Durame – Mazoria) has mean scores of

3.06, 2.92, and 2.98 respectively for the client, consultant and contractor associated risks. The former are relatively risk taker compared to projects under local contractors (Table 4.6).

4.5.3 The criticality of risk factors on the performance of Omo - Tercha and Durame Mazoria construction projects

The major risk factors were identified but their criticality could differ from one project to the other and the following analysis is made with regard to the criticality of risk factors by category in to three categories:-

Client related factors

Table 4:7 Respondents response on client related factors

Project engaged	Omo - Tercha			Durame – Mazoria – Durgi		
	N	Mean	Rank	N	Mean	Rank
Scope changes	24	4.17	1	25	3.92	1
Payment delays	24	3.75	4	25	3.88	2
Right of way problems	24	3.63	6	25	3.44	5
Schedule pressure	24	3.83	3	25	3.84	3
Inappropriate intervention	24	3.54	8	25	3.12	6
Design changes	24	4.00	2	25	3.64	4
Slow decision-making	24	3.58	7	25	2.80	9
Corruptive practices	24	3.53	9	25	3.04	7
Poor project mg't & supervision	24	3.75	4	25	*3.03*	*7*
Lack of experience	24	3.21	10	24	*2.48*	*10*
Grand mean		**3.70**			***3.32***	

Source: survey data

As it can be understood from the above table, ten major client related risk factors that could affect the road construction project are identified and respondents were requested to rate them the extent to which these risk factors are critical on Omo River – Tercha and Durame-

Mazoria Road projects. The analysis is made using descriptive statistics mainly mean and rank. The result has shown that among the client related risk factors identified, scope changes (4.17), design changes (3.88) and schedule pressure from the clients side (3.84) are more critical than the other risk factors while lack of experience (3.21), corruptive practices (3.53) and inappropriate intervention from the clients side (3.54) were identified as relatively less critical in affecting Omo River –Tercha Road project.In the case of Durame-Mazoria Road project, among the identified risk factors scope changes (3.92), Payment delays (3.88) and schedule pressure from the clients side (3.84) are rated as more critical risk factors while lack of experience (2.40), Slow decision-making (2.80) and corruptive practices are regarded as less critical risk factors in affecting the project. On the basis of the grand mean value, client related risk factors are more critical in Omo-trecha road project than Durame- Mazoria- Road project.

Consultant related factors

Table 4:8 Respondents response on consultant related factors

Project engaged	Omo - Tercha			Durame – Mazoria - Durgi		
	N	Mean	Rank	N	Mean	Rank
Poor quality of design	24	3.08	2	25	3.16	2
Incomplete design	24	2.75	6	25	3.04	4
lack of experience	24	2.08	8	25	2.68	7
Inaccurate cost estimation	24	2.96	3	25	2.64	8
Design Change	24	2.88	4	25	3.08	3
Poor project planning & control	24	2.63	7	25	3.00	5
Delay in contractor's payment certification	24	3.15	1	25	3.44	1
Delay in design work	24	2.83	5	25	2.99	6
Grand mean		**2.79**			**3.00**	

Source: survey data

As it is illustrated from the above table, eight major consultant related risk factors that could affect the road construction project are identified and respondents were requested to rate them the extent to which these risk factors are critical on the performance of Omo River –

Tercha and Durame- Mazoria Road projects. The analysis is made using descriptive statstics mainly mean and rank. The result has shown that among the consultant related risk factors, delay in contractor's payment certification (3.44), poor quality of design (3.16) and Design Change (3.08) are rated as critical risk factors while lack of experience (2.08), poor project planning & control (2.63) and delay in design work (2.99) were considered as relatively less critical risk factors in affecting Omo – Tercha Road project.

In the case of Durame- Mazoria Road project, among the identified risk factors delay in contractor's payment certification (3.44), Poor quality of design (3.16) and Design Change (3.08) are considered as critical risk factors while inaccurate cost estimation (2.64), lack of experience (2.68) and corruptive practices are regarded as less critical risk factors in affecting the project. On the basis of the grand mean value, consultant related risk factors are less critical in Omo-trecha road project than Durame- Mazoria- Road project. In this analysis, it is possible to understand that there is some sort of difference in the degree of criticality of risk factors affecting the two road construction projects under study.

Contractor related risk factors

Table 4:9 Respondents response on Contractor related risk factors

Project engaged	Omo - Tercha			Durame – Mazoria - Durgi		
	N	Mean	Rank	N	Mean	Rank
lack of experience	24	2.54	9	25	2.60	9
Poor labor productivity	24	2.88	7	25	2.88	7
poor management capacity	24	3.21	5	25	3.04	5
Shortage of plant and equipment	24	2.96	6	25	2.84	8
Poor productivity of planned equipment	24	2.83	8	25	3.00	6
Inflation and sudden changes in price	24	3.92	2	25	3.32	3
Insufficient cash flow	24	3.50	3	25	3.20	4
Exchange rate fluctuation	24	4.29	1	25	3.60	2
Force majeure	24	3.29	4	25	3.68	1
Grand mean		**3.26**			**3.13**	

Source: survey data

As it can be understood from the above table, nine major contractor related risk factors that could affect the road construction project are identified and respondents were requested to rate them the extent to which these risk factors are critical on Omo River–Tercha and Durame- Mazoria Road construction projects. The analysis is made using descriptive statstics mainly mean and rank. The result has shown that among the client related risk factors identified Exchange rate fluctuation (4.29), Inflation and sudden changes in price (3.92) and Insufficient cash flow (3.50) are more critical than the other risk factors while lack of experience (2.54), Poor labor productivity (2.88) and Poor productivity of plant and equipment (2.83) were identified as relatively less crititcal in affecting Omo – Tercha Road project.

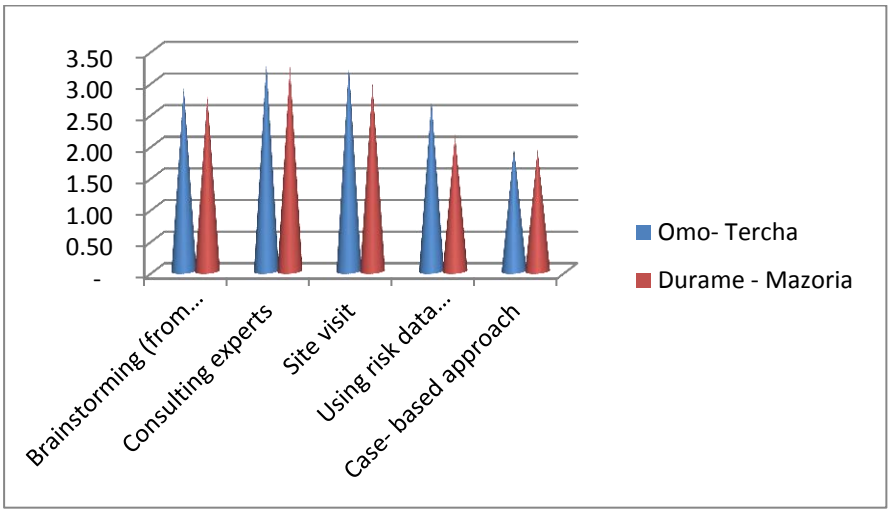
In the case of Durame- Mazoria Road, among the identified risk factors Force majeure (3.68), Exchange rate fluctuation (3.60), Inflation and sudden changes in price (3.32) are rated as more critical risk factors while lack of experience (2.60), Shortage of plant and equipment (2.84) and Poor labor productivity (2.88) are regarded as less critical risk factors in affecting the project. On the basis of the grand mean value, contractor related risk factors are critical in both road projects though there slight difference between the projects.

The researcher has interviewed some of sampled respondents from the three parties. From the contractor side they replied that sudden changes in price and inflation as well as exchange rate fluctuation are the most critical factors affecting the project they are executing while from the consultant side they confirmed that poor quality of design and design changes were identified as most critical risk factors that affect the performance of the road project particularly in Durame- Mazoria Road project.

4.6 Risk Identification Methods Used

Risk identification is the primary step in risk management process and there are different methods of risk identification depending on the nature of the projects. For this study, five commonly used risk identification methods were considered and respondents were requested to rate them how often they are using these methods in the projects they are constructing or supervising or administering. Their responses were analyzed using mean values independently of the two road projects and the result has shown the following.

Figure 4.3:- Respondents response on Risk Identification Methods used in terms of Mean values



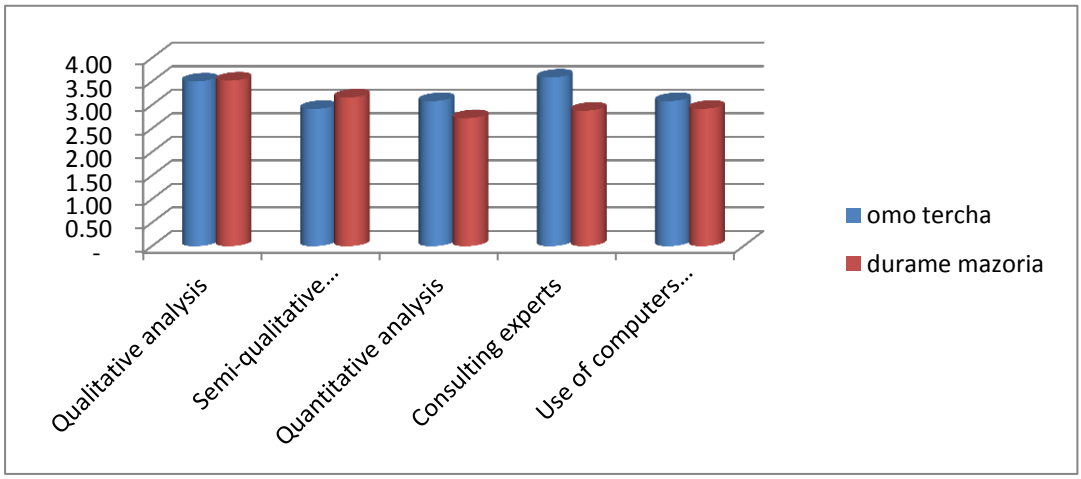
Source: survey data

It is understood from the above figure, relatively speaking among the five methods described consulting experts and site visit are the frequently employed methods for identifying risks for both road construction projects they are executing. Whereas Computer base approach and using risk data from past experience were considered as they as are occasionally used methods of risk identification in both Omo River -Tercha and Durame-Mazoria Road construction projects.

4.7 Risk analysis methods used

Risk analysis is the next step to risk identification in risk management process and there are different methods of risk analysis depending on the nature of the projects. For this study, six commonly used risk identification methods were considered and respondents were requested to rate them how often they are using these methods in the projects they are constructing or supervising or administering. Their responses were analyzed using mean values independently of the two road projects and the result has shown the following.

Figure 4.4 Respondents response on Risk analysis methods used in terms of Mean



Source: survey data

As it is illustrated from the above figure, five risk analysis methods were identified and respondents were requested to rate them how often they use these risk analysis methods in the projects they are involving i.e. Omo River – Tercha and Durame- Mazoria Road projects. The analysis is made using descriptive statistics mainly mean and rank. The result has shown that among the risk analysis methods identified, consulting experts and qualitative analysis are described as more frequently used method of risk analysis whereas semi-qualitative analysis and use of computer and other modeling tools were less frequently used in the case of Omo River - tercha Road construction project.

With regard to Durame- Mazoria project qualitative and semi- qualitative risk analysis methods are rated as they are frequently used but quantitative analysis and consulting experts were the less frequently used. Therefore, there is slight difference between the two road projects in the use of risk analysis methods.

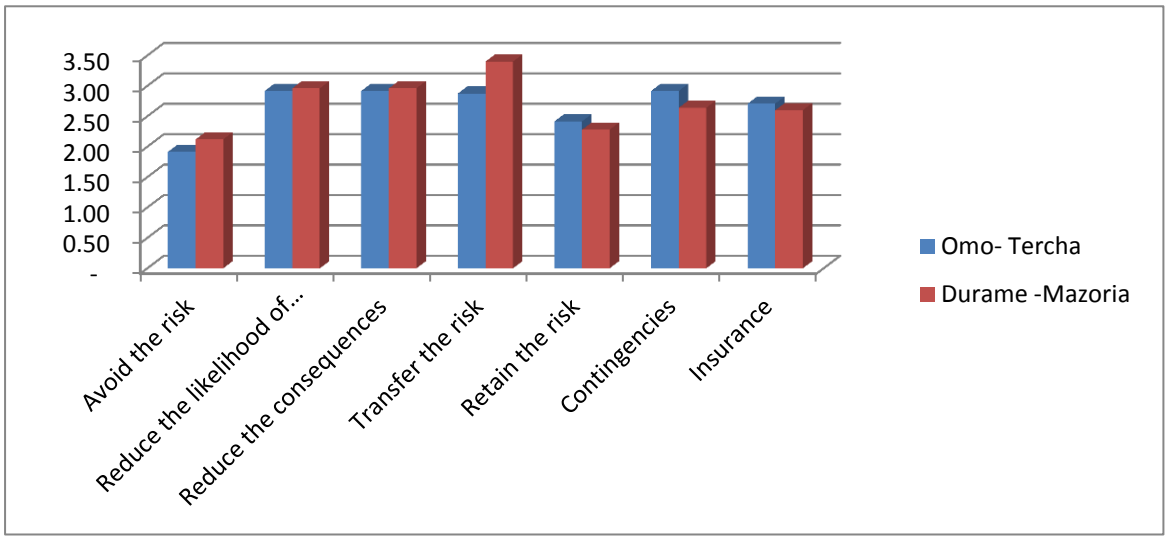
In relation to this, the information gathered through interview supported that there is some sort of qualitative analysis and consulting experts opinion for managing risks but the use of quantitative analysis, computer base and other modeling tools are very limited.

4.8 Risk Response methods

Risk Response as risk management process comes after risk analysis and there are different methods of risk analysis depending on the nature of the projects. For this study, the

conventionally used risk response methods were considered and respondents were requested to rate them how often they are using these methods in the projects they are involved. Their responses were analyzed using mean values independently of the two road projects and the result has shown the following.

Figure 4.5: Respondents response on Risk Response methods used



Source: survey data

As it is described from the above figure, the result has shown that among the risk response methods identified, reducing the likelihood of the occurrences, reduce the consequences of risk and keeping contingencies were identified as the methods that were occasionally used by the experts of the project whereas avoiding the risk and retaining the risk were less occasionally used methods in Omo River- Tercha road construction project.

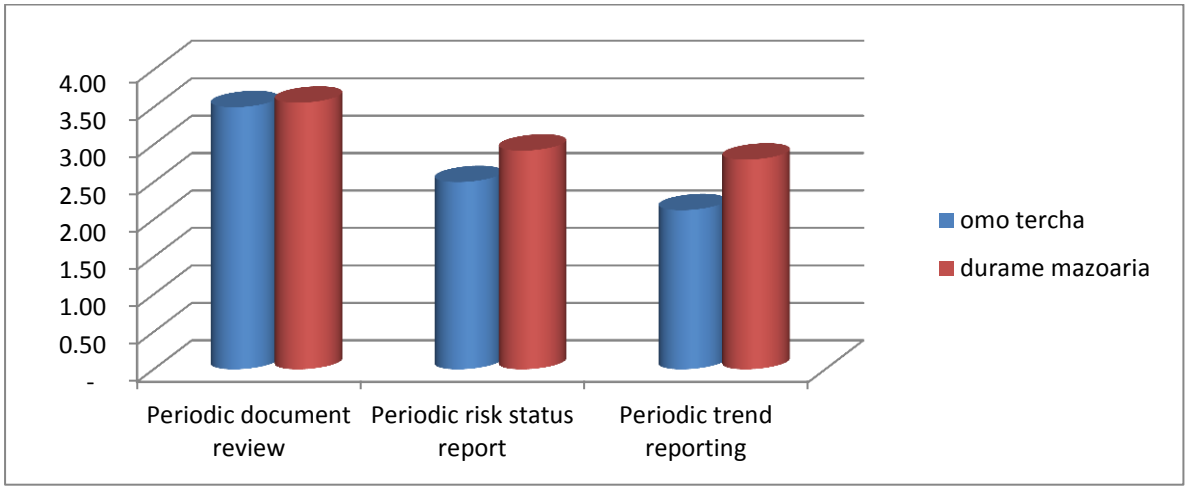
With regard to Durame- Mazoria Road project transfer the risk, reduce the likelihood of occurrences and the consequences of risks are the risk response methods that are frequently used while avoiding the risk and retaining the risk are the method which were occasionally employed by the clients, consultants and contractors. Therefore, there is some sort of similarity in the use of risk response methods in the two projects included in the study.

In relation to this, the information gathered through interview evidenced they are usually using risk transfer and reducing risk as a method of tackling risks related to the project under construction.

4.9 Risk monitoring methods

Risk monitoring is one of those essential risk management processes and three methods of risk monitoring were considered for this study. The use of these methods were assesses in relation to Omo River - Tercha and Durame – Mazoria projects.

Figure 4.6: Respondents response on risk monitoring methods used



Source: survey data

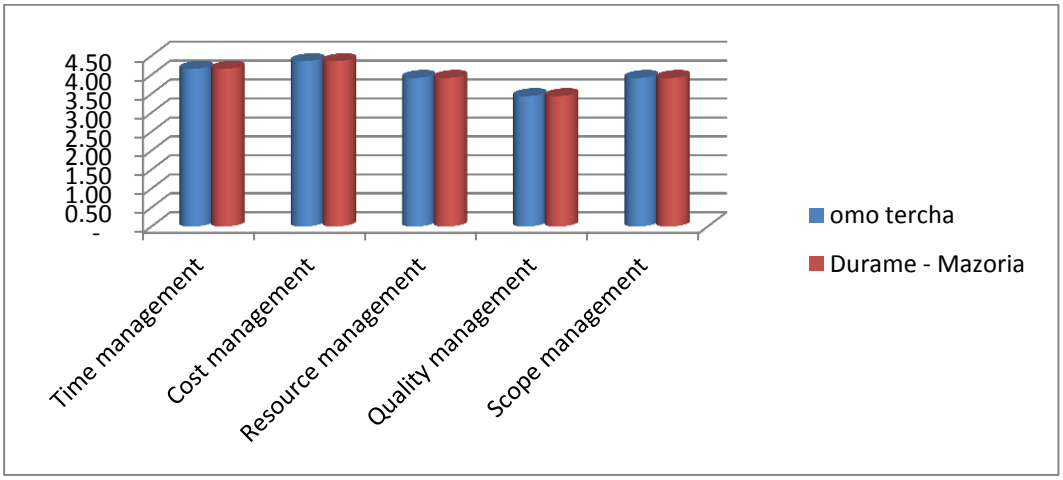
As it is inferred from the above figure, three Risk monitoring methods were identified and respondents were requested to describe how often they use these risk monitoring methods in the projects they are involved i.e. Omo River – Tercha and Durame- Mazoria Road projects. The result has shown that among the risk monitoring methods identified, periodic document review is the considered as the frequently used method in both road construction projects where as periodic trend reporting is occasionally used but with a different degree in the two projects. The information gathered through interview also supported that there is some sort of periodic document review and periodic trend reporting as method of risk monitoring in both projects. Even though they are practicing risk monitoring, the inputs of the risk monitoring were not transfer to risk response methods.

4.10 Risk management knowledge areas used

Within the construction industry, there is always the possibility of some factors that can hinder the progress of the project. These factors can affect the project negatively due to lack of knowledge and unrealistic attitude towards risk within the construction industry.

The best way to tackle this kind of situations, against factors that can harm the project is through risk management. Project management body of knowledge areas but for our survey we have used five of them i.e. time, cost, resource, quality and scope management. The result of the survey data has described by the following figure and narration.

Figure 4.7: Respondents response on risk management knowledge areas



Source: survey data

The above figure has shown that respondents of the study considered all the above body of knowledge areas as they are important to manage project risks in road construction projects but their level of importance differs. In both road projects, relatively speaking cost management and time management were considered as more important knowledge areas by the respondents to help management the project risks whereas quality management is identified as an important knowledge area to be considered in project risk management. In addition, scope and resource management take an intermediary position between more important and important category. Since the two projects are affected by time and cost overrun as well as scope changes due to various reasons, resources inflated. Therefore, stakeholders of the two projects need to be conscious about these five body of knowledge areas for the execution of the project.

The interviewed participants of the study from the three parties suggested that the knowledge areas considered above should be critically analyzed and incorporated during the preparation of Term of References on sides of the client. Besides, these knowledge areas need to implement with great emphasis not only in the two projects but also other projects.

CHAPTER FIVE
5. SUMMERY, CONCLUSION AND RECOMMENDATIONS

This chapter presents the summaries of the findings, conclusions derived from the analysis and the recommendations that are suggested will help to improve project risk management practice in road construction projects.

5.1 Summary of the findings

Based on the analysis of chapter four, the following findings were established and outlined here under:

- The analysis revealed that majority of the respondents have a good understanding about risk management but half of the respondents replied that there is no risk management practice and some others said that there is occasional practice of risk management in both Omo River-Tercha and Durame- Mazoria Road construction projects.
- The client, consultants and contractors have their individual preferences on the ranking of various risk factors in the road construction industry. The results of the study evidenced that among the risk factors identified design changes, Right of way problems and scope changes from the client side; delay in contractor's payment certification, design change and delay in design work from consultant side; inflation and sudden changes in price, insufficient cash flow and exchange rate fluctuation are considered as having the higher degree of affecting Omo River – Tercha road construction project. In the case of Durame- Mazoria Road project slow decision making, inappropriate intervention and schedule pressure from the clients side; incomplete design, design change and delay in design work from the consultant side; insufficient cash flow, inflation and sudden changes in price, exchange rate fluctuation are considered as having the higher degree of affecting the project mentioned. From this analysis it is possible to infer that the risk factors don't have the same degree of effect across different road construction projects.
- In relation to the probability of occurrence of risk factors, the analyzed data revealed that consultant related risk factors have a high probability of occurrence than client and contractor related risk factors in Omo–Tercha Road project**.** Whereas, all the

three categorized risk factors have medium probability of occurrence in Durame-Mazoria Road projects.

- With ragrd to the criticality of risk factors, the analyzed result has shown that among the risk factors identified, scope changes, design changes and schedule pressure from the clients side; delay in contractor's payment certification, poor quality of design and design Change from the consultants side; exchange rate fluctuation, Inflation and sudden changes in price and Insufficient cash flow are rated more critical than other risk factors in affecting Omo River -Tercha road project.
- In the case of Durame- Mazoria Road project scope changes, Payment delays and schedule pressure from the clients side; delay in contractor's payment certification, Poor quality of design and Design Change from the consultants side; Force majeure, Exchange rate fluctuation, Inflation and sudden changes in price are considered as more critical than the other risk factors. Thus, there is some sort of similarity in the criticality of risk factors in affecting the two road projects considered in the study.
- The results of the study has also shown that among the five methods of risk identification considered in the survey, consulting experts and site visit are the frequently employed methods in both road construction projects they are executing. Besides this, among the risk analysis methods identified, consulting experts and qualitative analysis in Omo River- Tercha road project while qualitative and semi-qualitative risk analysis in Durame- Mazoria Road project are rated as they are frequently used methods of risk analysis.
- With respect to risk response methods, the result has shown that among the risk response methods identified, reducing the likelihood of the occurrences and the consequences of risk as well as keeping contingencies were identified as the methods that were occasionally used in both road projects to mitigate risks.
- In relation to risk monitoring methods, the survey result evidenced that periodic document review is the considered as the frequently used method whereas periodic trend reporting is occasionally used in both projects.

5.2 Conclusion

Project risk management in construction project can enhance the performance of the project by managing the risk factors that have an impact on project performance. As the general objective of this study is to analyze the risk factors associated to Omo River -Tercha and Durame- Mazoria road construction projects and provide recommendations and the way forward to effectively and efficiently manage potential road project risk factors, the following conclusions are forwarded based on the findings listed above.

ERA has better risk management score in its road construction projects which are managed by domestic contractors compared to projects handled by Chinese contractors. The project under Chinese construction management (Omo-Tercha) has mean scores of 3.61, 4.03, and 3.61 respectively for the client, consultant and contractor associated risks respectively. On the other hand, a project under domestic contractor (Durame – Mazoria - Durgi) has mean scores of 3.06, 2.92, and 2.98 respectively for the client, consultant and contractor associated risks. The former are relatively risk taker compared to projects under local contractors.

Although the key stakeholders (client, consultant and contractor) of the two projects are well aware of risk management, the risk management is not well practiced and due consideration has be given in this regard. There are various risk factors that affect the road construction projects and from the results of the study it is possible to conclude that both projects are affected by client, consultant and contractor related risk factors that caused time and cost overrun on the project which resulted in to budget deficient to the project. Besides this, it is concluded that some of the risk factors such as design change, scope change, incomplete design, shortage of cash flow, inflation and sudden changes in price, delayed payment are very critical factors that could strongly hamper the execution of the project. Therefore, it is advisable for the three parties to take in to consideration these risk factors at all stages of the project cycle before damaging effect happened.

It is understood from the findings of the study that there are attempts by stakeholders of the project to identify, analyze, respond, monitor and manage risks in both projects the study considered but they are not consistently practiced and the result is not as such satisfactory. Thus, the client, consultant and contractor should strengthen their efforts in this respect for minimizing the adverse caused the project performance. Finally, it should also be important to be noted that there is a trend not to provide adequate emphasis towards risk identification.

The causes, challenges and repercussions of project risk goes beyond the project risk management body of knowledge. Therefore, appropriate application of the project management body of knowledge areas equally plays a vital role for mitigating risks in the road construction projects.

5.3 Recommendations

On the basis of the findings of the study and conclusions arrived at, the following possible recommendations are forwarded:-

- It is found that the advantage of analyzing risks in systemic way is not well understood by clients, contractors and consultants. The impact of project risk factors needs to be analyzed in a systemic way to effectively manage and understand the impacts of project risks on project performances.
- Right from the planning stage to the completion of a project, the client (ERA) is recommended to involve the various stakeholders (consultants, the contractors and the insurance companies) in discussing the risk management process. This may include identification of risk, allocation, control and mitigation of those risks as well as the drafting of applicable insurance policies before and during construction.
- Stakeholders of the projects need to consider risk management practice as an integral part of the project they are constructing, administering and supervising.
- The client, consultant and contractor should thoroughly analyze those risk factors which are critical on their side and design the means to tackle them beforehand so that they can minimize damaging effects on the project.
- It would better if capacity building programs arranged for the stakeholders of the project in the areas of risk identification, risk analysis, risk response and risk monitoring methods since it enables them to make a better effort in managing risks so that the project can met it‘s intended goal.
- Possible risks should be allocated contractually and clearly on each party (as client, consultant and contractor). That could be done by defining the potential risk factors and allocate them on the party which is in the best place to manage these risks.
- Exploring appropriate and state of the art risk identification and analysis tools has remained to be an interesting area of future study.

- Finally, the researcher recommends for further research to include other knowledge areas of project management. As this study only focused on one knowledge area which is project risk management.

REFERENCES

Abebe Dinku (Prof.Dr.ing.)(2000). *Insurance Requirements and Practices of Ethiopia's Construction Sector; Zede, 17.*

Acharyya, M. (2007) „Proposing a conceptual framework to measure the performance of enterprise risk management from an empirical study of four major European insurers‟,The 34th Seminar of the European group of risk and insurance economists. Cologne, 17-19 September

Adams, F.K. (2008) „Construction contract risk management: a study of practices in the United Kingdom‟, Cost Engineering, 50(1), pp. 22-33.

Ahmed S., Azhar S. and Ahmed I., 2001.*Evaluation of Florida General Contractors' Risk Management Practices*, Florida International University.

. Ahmad B Z., Hijab M (2012). *Risk Management Practices in the Nigerian Construction Industry:* A Case Study of Yola, Continental J Engineering Sciences c/o Wilolud Journals, 7(3), 1-6.

Ahmad, S. M., Ahmad, R., and Saram, D. D. (1999). *Risk management trends in the Hong Kong construction industry:* A Comparison of Contractors and Owners Perceptions.

Allensworth, W. R. (1996). *Risk Transfer in Construction Contracts*: The Architects' and Engineers' Perspective; Partnering: Beyond the Basics, 1-12.

APM (2000) *Project risk analysis and management,* UK: The Association for Project Management.

APM (2013) About APM. Available at: *http://www.apm.org.uk/AboutUs (Accessed: 6 Sep 2013)*

Asnake, N. (2010). *The Practice of Risk Management in Ethiopian Road Construction Projects;* Reading University Msc Thesis on Construction Project Management

Construction and Architectural Management, 6(3), pp. 225-234.

Baloi, D. and Price, A. D. (2003). *Modelling Global Risk Factors Affecting Construction Cost Performance.* International Journal of Project Management, 21, pp. 261-269

Baloi, D, and Price D. F (2003) *Modelling global risk factors affecting construction cost performance*. International Journal of Project Management 21.4: 261-269.

Belel, Z. A and Mahmood, H. (2012). *Risk management practices in the Nigerian construction industry–a case study of Yola*. Continental Journal of Engineering Sciences, 7(3).

Bradley, E. H., Curry, L. A., & Devers, K. J. (2007). *Qualitative data analysis for health services research:* developing taxonomy, themes, and theory. Health services research, 42(4), 1758-1772.

Chapman, C. and Ward, S. (2003). *Project Risk Management:* Techniques, and nsights. 2nd Ed, Wiley, New York, NY.

CIDB, C. I. (2004). *Managing Construction Procurement Risks; Pretoria:* First Edition of CIDB

Commercial Code of the Empire of Ethiopia Proclamation No. 166 Of 1960 ERA. (2013). *Assessment of 16 Years Road Sector Development Program*; Addis Ababa: Ethiopian Roads Authority

Cooper, D.R. and Schindler, P.S. (2008) *Business research methods. 10th ed.*

Boston, MA and Burr Ridge, IL: McGraw-Hill.

Cooper, Dale F., and Chris B. Chapman. (1987) *Risk analysis for large projects:* models, *methods and cases. New York: Wiley.*

COSO (2004) *Enterprise Risk Management–Integrated Framework*. Available at: http://www.coso.org/documents/coso_erm_executivesummary.pdf (Accessed: 3 October 2013)

ERA. Eschemuller, R. L. (2009). *Construction Project Management;* the McGraw-Hill Companies, Inc..

ERA-SMEC, S. E. (2008). Claims and Disputes Resolution Manual; Addis Ababa:

FHWA, F. H. (2006). *Guide to Risk Assessment and Allocation for Highway;* American Association of State Highway and Transportation Officials

Flanagan, R., and Norman, G. (1993). *Risk management and construction*, Blackwell, Oxford, UK.

FIDIC. (1986). *Construction insurance and law*; London, UK: FIDIC by Rhys Jones Consultants

Hill, Richard C., and Paul A. Bowen. "*Sustainable construction: principles and a framework for attainment."* Construction Management & Economics 15.3 (1997): 223-239.

IRM. (2002). *A Risk Management Standard;* the Institute of Risk Management.

Junying, L. (2006). Insurance and Construction Project Risks: A Review and Research Agenda; School of Management, Tianjin University

Keith, R. M. (2006). Risk Assessment and Allocation for Highway Construction anagement. Federal Highway Administration, American Association of State Highway and National Cooperative Highway.

Lockyer, K G, and Gordon, J. (2005) *Project management and project network techniques. earson Education Magretta, Joan.* Understanding Michael Porter: The essential guide to competition and strategy. Harvard Business Press, 2012.

Makui, A, S. Mohammad M, and S. Meysam Mousavi. (2010) *"Project risk identification and analysis based on group decision making methodology in a fuzzy environment."* International Journal of Management Science and Engineering Management 5.2 108-118.

Melese, M. (2006). *Role of Financial Institutions for the Ethiopia Construction Industry*; Addis Ababa: Addis Ababa University, AAIT.

Mustafa, M A and AI-Bahar, J F (1991) *'Project risk assessment using the analytic ierarchy process'* lEE Transactions of Engineering Management 38 (1991) 46-52

Nadeem, E. M. (2010). *Risk Management in construction industry;* IEEE, 6. (NCHRP), N. C. (2009). Research Report for Guidebook on Risk Analysis Tools and Management; *The University of Colorado Texas A&M University*.

Oluwakiyesi. T, (2011). Nigerian Construction Industry: A Haven of Opportunities. A *Report on Construction Industry*, *www.proshare.com*, pp. 2-31.

(OSPMI), O. (2007). *Project Risk Management Handbook*; California: *Office of Statewide Project Management Improvement (*OSPMI).

Oyewobi, L. O., Ganiyu, B. O., Oke, A. A., Ola-Awo, A. W. and Shittu, A. A. (2011). Determinants of Unethical Performance in Nigerian Construction industry. *Journal of Sustainable Development*, 4(4), pp. 175-182.

Perry J.H and Hayes R.W. (1985). *Risks and its management in construction projects.* In: Proc. *The institute of civil engineering; Part I*, 78, 499-521

PMI (Project Management Institute) (2008). *A guide to project management body of knowledge (PMBOK®Guide).* Newton Square, PA: *Project anagement Institute*

PMBOK. (2013). *Construction Extension to A Guide to the Project Management Body of Knowledge. Project Management Institute*.

Porter, Michael E. "*Towards a dynamic theory of strategy*." *Strategic management journal* 12.S2 (1991): 95-117

Premaraj, B. (2005). *Risk Identification and Allocation* – A Necessary Step.

Ritchie, B., & Brindley, C. (2007). *Supply chain risk management and performance*: a guiding framework for future development. International Journal of Operations & Production Management, 27(3), 303-322.

Ritchie, B and Marshall, D (1993) *Business Risk Management Chapman and Hall, UK Smith, Preston G.* (1999)"Managing risk as product development schedules shrink." Research-Technology Management 42.5 : 25-32.

Smith, N. J., Merna, T. and Jobling, P. (2006). *Managing risk in construction projects (2nd ed.).* Oxford, UK: Blackwell Publishing

Tang, W., Qiang, M., Duffield, C. F., Young, D. M., and Lu, Y. (2007). *Risk Management in Chinese Construction Industry*. Journal of Construction Engineering and anagement, 133(12), pp. 944-956

Thompson, P., & Perry, J. G. (Eds.). (1992). *Engineering construction risks*: A guide to project risk analysis and assessment implications for project clients and project managers. Thomas Telford

.Thomas, R. (1996). *Surveys. Research Methods*: Guidance for Postgraduates, Edward Arnold, London, pp. 115-124. document 1005.

Touran, A. (2006). *Owners Risk Reduction Techniques Using a CM;* Department of Civil & Environmental Engineering.

Turkey W. (2011). *Risk Factors Leading to Cost Overrun in Ethiopian Federal Road Construction Projects and Its Consequences;* Addis Ababa: Addis Ababa University; AAiT.

Zeleke, H. (2007). *Insurance in Ethiopia, Historical Development*, Present Status and Future

Zerfu Tessema. (2009). *Challenges in ERA Road Construction* Projects; Addis Ababa: Ethiopian Roads Authority

APPENDIX
Survey Questionnaire

Dear Respondent,

First of all thank you for your willingness to be part of the survey. This questionnaire is prepared by Mr. Wosen Fufa, Masters Degree student at St. Marry University to collect data to be analyzed for a masters thesis (study) which is a requirement for a student to accomplish the masters program. The title of the study is "**Risk analysis and Management practice in Road construction project with particular reference to Omo River -Tercha and Durame- Mazoria-Durgi**:**lot II: Durgi-Gibe river road projects."** The objective of the study is to analyze the risk factors, risk analysis and management practice associated to road construction projects. Your participation as respondent is entirely voluntary and the questionnaire is completely anonymous. Finally, I want to assure you that the information which you shared with me will be kept confidential and only used for the academic purpose. No individual's responses will be identified as such and the identity of persons responding will not be published or released to anyone.

Thank you in advance!

Section A:-GENERAL INFORMATION

1. In which project you are engaged: ☐ Omo-Tercha ☐ Durame- Mazoria- Durgi

2. Company type: Client ☐ Contractor Consultant

3. Working experience in your current organization

a) 1 - 5 years [ ] b) 6 - 10 years [ ] c) 11-15 years [ ] d) 16 and above [ ]

4. your position in the project:

Team leader	☐	construction Engineer	☐
Resident Engineer/ Project manager	☐	technical staff	☐
Counter part Engineer	☐	intermittent staff	☐

Section B:-Basic Information on Risk Management

1. Please indicate your level of understanding about risk management practices

Item	I have no idea	Little	good	very good
Level of Understanding				

2. Please indicate the extent to which risk analysis and management is practised in the road project you are engaged?

Item	Not at all	Some times	Usually	Always
Level of practice				

3. At what stage of project life-cycle do you perform the risk analysis?

At the planning phase [ ]

At the end of final design [ ]

During construction hase [ ]

After completion of the construction [ ]

Section C:-Risk factors affecting road construction project

Listed below are risk factors with potential effect on road construction projects. For each statement, please tick (✓) the number which best describes the extent to which each risk factor affects the road project you are engaged and its possibility of occurrence. Where,

5 = very high; 4 = high; 3= medium; 2 =low; 1 = very low

	RISK FACTORS	Degree to which it affects					Probability of occurence				
		1	**2**	**3**	**4**	**5**	1	2	3	4	5
I	**Client's related Risk factors**										
1.	Scope changes										
2.	Payment delays										
3.	Right of way problems										
4	Schedule pressure										
5.	Inappropriate intervention										
6.	Design changes										
7.	Slow decision-making										
8.	Corruptive practices										
9.	Poor project management and supervision										
10	Inadequate experience										
II	**Consultant's related Risk factors**										
1	Poor quality of design										
2.	Incomplete design										
3	lack of experience										
4.	Inaccurate cost estimation										
5.	Design Change										
6.	Poor project planning & control										
7.	Delay in contractor's payment										
8.	Delay in design work										
III	**Contractor related risk factors:**										
1.	lack of experience										
2.	Poor labor productivity										
3.	poor management capacity										
4.	Shortage of plant and equipment										
5	Poor productivity of plant and										
6	Inflation and sudden changes in price										
7	Insufficient cash flow										
8.	Exchange rate fluctuation										
9	Force majeure										

Section D:-Criticality of Risk factors

1. Please rate the following possible project risks factors based on your perception on their criticality in the construction project you are engaged on. (From 5 to 1 where, 5= Extremely critical, 4 = very critical, 3 = moderately critical, 2 = less critical and 1= not critical)

	RISK FACTORS	Degree of Criticality				
		1	2	3	4	5
I	**Client's related Risk factors**					
1.	Scope changes					
2.	Payment delays					
3.	Right of way problems					
4	Schedule pressure					
5.	Inappropriate intervention					
6.	Design changes					
7.	Slow decision-making					
8.	Corruptive practices					
9.	Poor project management and supervision					
10	Inadequate experience					
II	**Consultant's related Risk factors**					
1	Poor quality of design					
2.	Incomplete design					
3	lack of experience					
4.	Inaccurate cost estimation					
5.	Design Change					
6.	Poor project planning & control					
7.	Delay in contractor's payment certification					
8.	Delay in design work					
III	**Contractor's related risk factors**					
1.	lack of experience					
2.	Poor labor productivity					
3.	poor management capacity					
4.	Shortage of plant and equipment					
5	Poor productivity of plant and equipment					
6	Inflation and sudden changes in price					
7	Insufficient cash flow					
8	Exchange rate fluctuation					
9	Force majeure					

Section E:-Risk Identification techniques

1. To identify associated project risks, how often do you use the following techniques? (Please rate from 5 to 1 where, 5= Always , 4 = very frequently , 3 = frequently 2= occasionally and 1= Never)

S/n	Risk Identification techniques	5	4	3	2	1
1	Check list					
2	Brainstorming (from project participants/risk team)					
3	Consulting experts					
4	Site visit					
5	Using risk data compiled from previous experience					
6	Case- based approach					

Section F:-Risk analysis methods

1. In analyzing the effect of risk on a project, how often do you use the following methods? (Please rate from 5 to 1 where , 5= Always , 4 = very frequently , 3 = frequently, 2= occasionally and 1= Never)

S/n	Risk analysis methods	5	4	3	2	1
1	Qualitative analysis					
2	Semi-qualitative analysis					
3	Quantitative analysis					
4	Consulting experts					
5	Use of computers and other modeling tools					

Section G:-Risk Response methods

1. In handling or dealing with the risk in a project, how often do you use the following response methods and techniques? (Please rate from 5 to 1 where , 5= Always , 4 = very frequently ,3 = frequently, 2= occasionally and 1= Never)

S/n	Risk Response methods	5	4	3	2	1
1	Avoid the risk					
2	Reduce the likelihood of occurrence					
3	Reduce the consequences					
4	Transfer the risk					
5	Retain the risk					
6	Contingencies					
7	Insurance					

Section H:-Risk monitoring methods

1. In order to monitor and control the risk response method and risk preventive action taken, how often do you use the following monitoring methods? (Please rate from 5 to 1 where
   , 5= Always , 4 = very frequently , 3 = frequently, 2= occasionally and 1= Never)

S/n	Risk monitoring methods	5	4	3	2	1
1	Periodic document review					
2	Periodic risk status report					
3	Periodic trend reporting					
4	Other, Please specify:					

Section I:-Risk management

1. To what extent can the following knowledge areas or experience helps you to manage risks effectively? (Please give weights with 1-5 where 5= most important, 4= more important, 3= important, 2= less important and 1= not important)

S/n	Description	5	4	3	2	1
1	Time management					
2	Cost management					
3	Resource management					
4	Quality management					
5	Scope management					

Interview questions

1. How do you define a risk (risk, problem, threat)
2. Are you familiar with the concept of risk management and the risk management process? Would you please explain?
3. Does the project have risk management plan?
4. How do you identify risks in the project?
5. What influences are these identified risks have on the project objectives?
6. How do you handle the risks identified?
7. What methods of risk analysis and management do you use in the project you are working?