ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF PROJECT MANAGEMENT

FACTORS AFFECTING TIMELY DELIVERY OF GOVERNMENT CONSTRUCTION PROJECTS; CASE OF ETHIOPIA ELECTRIC POWER PROJECTS

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DECLARATION

This thesis has not been presented for any other university and is not concurrently submitted in candidature of any other degree, and that all sources of material used for the thesis have been duly acknowledged.

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ENDORSEMENT

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

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List of Abbreviation

Ethiopian Electric power	EEP
Project Management	PM
Project Management Body of Knowledge	PMBOK
Statistical Package for Social Science	SPSS
Relative importance index	RII
Contractor	C
Materials	MT
Equipment	EQ
Manpower	MP
Project Management	PM
Consultant	CNS
Owner	OWN
Early Planning and Design	EP&D
External Factors	EF

ABSTRACT

Construction delays are one of the biggest issues facing the construction industry and affecting delivery in terms of time, budget and the required quality. The characteristics of delay factors and their level of impact vary from project to project, ranging from a few days to years. They have significant financial, environmental and social impacts in construction projects; therefore, it is vital to investigate the causes of delay and analyses their impact. In this context, the research study was initiated to develop a new methodology for analyzing and quantifying the impacts of delay factors on construction projects.

A comprehensive literature survey was conducted to build up general background Knowledge of delay factors in construction projects and particular attention was paid to identifying the delay factors in EEP, A construction industry survey was conducted through a semi-structured questionnaire amongst contractors, consultants and owners. A total of 41 out of 50 responses (82%) were received data were analyzed using Statistic Package for Social Science (SPSS) and MS Excelfor ranking the factors overall using a by use of Relative Importance Index (RII), were executed to analyses the responses and present the findings from the survey.

The study indicate that the top major causes of delay were Delay in progress payments by the owner, Right of way problem ,Poor communication and coordination by contractor with other parties, Poor site management , Long waiting time for approval of tests and inspection, Shortage of construction material and Improper project feasibility study In addition, the top major effects of delay were; time overrun, cost overrun, dispute, arbitration, litigation and abandonment.

CHAPTER ONE

INTRODUCTION

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

It is widely accepted that a project is successful when it is finished on time but unfortunately, due to many reasons, in Ethiopia electric power large number of construction projects fail to meet their original contact time. Construction delays are critical problems that which send bad signals to foreign investors thereby slowing down the national development.

The construction industry has unique characteristics in comparison to other industries. This means that every project is different, a situation which emanates from the project's own characteristics. For example, the project type, size, geographic location, and personnel involved emanate from the other subsystems within the industry, and also from those of the super-system. Hence, project execution is inherently risky and the lack of an appropriate approach to address these risks has led to a lot of undesirable results in project execution, particularly in the construction industry (Wells, 1986).

The cost of a construction project is one of the most important factors in the construction industry. Due to many reasons, the total cost of a project can significantly vary from the initial estimated cost. The reasons could be changes in scope of work, specifications, or any other contract documents. In the construction industry, variation orders are created when changes occur. It is an official document that states the changes made into the original agreement between the client and the contractor. When a variation order is created, it brings several negative effects to both the client and the contractor.

Construction delay is a significant problem facing the construction industry in nearly every countries in the world. Delays occur in almost every construction project, and their magnitudes vary considerably from project to project, ranging from a few days to years. It is generally understood that construction delay is the most critical factor affecting the delivery of construction projects in terms of time, budget, and the required quality (Hancher and Rowings, 1981). However, it is very important to identify the exact causes and their significance to minimize and avoid delays in construction projects. Mansfield et al. (1994) found that construction projects completed on time were a signal of project efficiency;

however, construction processes depend on a number of unpredictable factors that occur from various sources.

These sources include the performance of construction stakeholders, availability of resources, site conditions, contract types, weather conditions and the contractual relations between stakeholders. However, it rarely happens that a project is completed within the specified time and budget especially in Ethiopia.

In this context, this research study focuses on developing a methodology for analyzing and quantifying the impact of delay factors in the Ethiopia Electric Powers construction industry. The study also presents comparative results about the impact of delay factors in the Ethiopia Electric Powers construction industries by conducting an Industry survey and evaluating case studies of projects.

1.2 Statement of the Problem

According to Moavenenzadeh (1987), the construction industry can play a significant role in economic growth and development processes if it is well understood. Thus, to enable the construction industry in Ethiopia to fulfill its significant roles, it should be managed efficiently. This requires a better understanding of the Ethiopian construction industry and its associated characteristics, processes and delays factors.

In Ethiopian construction practice, it is very rare that construction projects are completed on the time specified or agreed upon. Ismeal (1996) reported that delays are endemic to construction projects in Ethiopian. His study indicates, most of the projects experience delay from 100% to 460% of the original contract time. The study shows how important it is to investigate and study on delay causing factors in construction projects of Ethiopia and find solutions to reduce the effect.

The Ethiopian construction industry and its associated processes and operations appear to be restricted by many obstacles. Its current capacity and capability are unable to meet national construction demand. Consequently, hundreds of construction projects are suspended, delayed or stopped. Furthermore, high demand for construction projects is expected in future years. In addition, the Ethiopian construction industry has a poor image in the construction market due to its low performance over the past few decades (GPC,2007).

Therefore, to improve the operations of the Ethiopian Electrical power, it is necessary to understand what the key factors are affecting timely delivery of construction projects and its associated operations; how the construction industry is organized; how construction activities are conducted; and what the major delay factors are in the Ethiopian Electrical power. Thus, this study attempts to answer these questions.

1.3 Research Objective

1.3.1 General Objectives

Broadly, this study examined the causes of delay in construction project in Ethiopia. And, hence, draw a significant and feasible suggestion based on the findings.

1.3.2 Specific Objectives

The following objectives are developed to achieve the aim of the research

1. Describe the existing schedule performance of the company.
2. To identify delay factors that currently exist in EEP projects.
3. To identify the main reasons of construction delay in EEP construction project

1.3.3 Research questions

Basis on the above stated facts, the following would be the research questions.

In this study, the process of developing the research questions was based on a review of the literature related to the impact of delay in the construction industry during the course of this study. In addition, the questions were improved through discussion with construction industry specialists, and finally revised throughout all phases of the research process in order to meet the purposes of the study. At the end of this process, the study attempts to answer the following key questions:

1. What are the real causes of project delays in the EEP projects?
2. To what extent is the company forced to allocated additional resources to complete the delayed projects

3. What is the frequency and severity of the delay factors?
4. How can the influence of delay factors on EEP projects be reduced?

1.4 Scope and limitation of the Study

The scope of this study will be focused on the following matter:

- These studies is focused on analyzing the delay causes & rate the extent of time overrun on the electric power construction projects in Ethiopia. The research identified and ranked the delay variables in their order of importance and also investigate the delay causes on recently completed electric power construction projects administered by Ethiopian Electric Power (EEP). Once the most important delay causing factors are identified, the parties to the projects shall then be able to channel their energies and resources to the specific factors thereby reducing delays to the projects.
- The group of respondents for this research involves client, consultant and contractor companies engaged in electric power construction projects.

1.5 Significance of the study

This research is significant in various dimensions it can:

- Helps to understand the most delay factors in the electric power construction projects in Ethiopia.
- Provides desperately needed evidence and advice to significantly advance value for money in the delivery of power projects and, in turn, contribute to national economic growth
- Helps to know the extent of time overruns in the electric power construction projects in Ethiopia.
- Helps the management of the EEP & responsible parties to take corrective actions to foster project management success in terms of time requirement.

1.6 **Organization of the paper**

This research proposal paper is composed of three chapters. The first chapter is an introductory

chapter. It includes a background of the study, which gives insight onto the delay of projects. Statement of the problem answers why this research was conducted. The study's general and specific objectives are also included in this chapter based on the research questions given in the statement of the problem. The significance of the study, which is about who will be benefited from this research, is also part of this chapter. Scope and limitations of the study tell about areas to be included and areas not to be included, and the reason for not having comprehensive research in the whole areas of project management the second chapter is all about the review of related literature. It contains conceptual, theoretical, and empirical parts used as framework and supportive information for the study. It explains project time delay and other related issues. . Research methodology, which is the third chapter, emphasizes: which data sources are used, what techniques of sampling are the most appropriate, and how the gathered data are presented and analyzed.

CHAPTER TWO

REVIERW OF RELATED LITERATURE

CHAPTER TWO: REVIERW OF RELATED LITERATURE

2.1 Introduction

This chapter presents the review of the literature related to the identification and analysis of the impact of delay factors from the contractors, owners and consultants' aspects in construction projects. The literature review includes the identification of state-of-the art methodologies regarding the identification and ranking of the critical delay factors in the construction industry. This chapter discusses the different types of delay factors which are responsible for delays in the delivery of a construction project.

2.2 Previous research studies in construction delay

Wael et al (2007) identified the major causes of delay in construction projects in Malaysia and the perceptions of the different parties regarding the causes and types of those delays. Their study decided on the causes and effects of delay in construction projects and found that delays are considered to be a serious problem in the construction industry for both owners and contractors. Wael et al's study included all factors causing delay in construction projects, considering three major categories: contractor, consultant, and owner. They concluded that the most important external factors causing the delay in construction projects were the lack of materials, and the unavailability of equipment and tools in the market. The next most important factors were poor weather conditions and delays in materials transportation.

Aibinu and Jagboro (2002) studied the effects of delays in project delivery in the Nigerian construction industry and investigated how the effects of delays on project delivery and the total construction cost of building projects can be minimised. A questionnaire survey for construction practitioners was used to investigate the effects of construction delays on project execution, and to minimise the effect of those delays.

Chan and Kumaraswamy (1994) identified the major causes of time overrun in Hong

Kong construction projects. First they identified the principal causes of delays in both building and civil engineering projects in Hong Kong, and then investigated the relative importance weight of these causes. Secondly, they studied the differences in the perceptions of the three major industry participants – clients, consultants and contractors – to analyses the factors causing project delays. Finally, they tested the delay factor categories between two groups of respondents and compared the results with researchers' results in other countries. Saudi Arabia and Nigeria were chosen for this research, in view of the similarity of the format of observations. They focused on identifying and ranking the order of importance weight. The main factors causing project delays were found to be 'poor site management and supervision', 'unforeseen ground conditions', and 'low speed of decision-making involving all project teams'.

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Odeh and Battaineh (2002) identified the major causes of delay in the Jordanian residential construction sector and assessed the relative importance of these causes from the points of view of consultant engineers, contractors and owners in residential projects. Delays in construction projects are common in the Jordanian construction industry, but can be avoided or reduced if the major causes of such delays can be identified and dealt with in a timely fashion.

The results of Odeh and Battaineh's study indicated that financial difficulties faced by contractors, change orders from the owner, and poor planning and scheduling of the project by the contractor were the major sources of delays in Jordan. It can be clearly argued that major delay causes are related to the internal environment of the system, especially that of the contractors, and to input factors relating to labour, while the external factors have very little effect on project delay.

From literature review, it was found that several studies conducted in different countries to identify the delay factors. The Table 2.1 presents the similarity and differences of delay factors identified by difference authors.

Table 2.1: Summary of delay factors in construction projects found by past studies in differences countries

Malaysia Wael et al (2007),	**Nigeria** Aibinu and Jagboro (2002)	**Hong Kong** Chan and Kumaraswamy (1994)	**Jordanian** Odeh and Battaineh (2002)
1. Lack of materials 2. Unavailability of equipment and tools in the 3. Poor weather conditions 4. Delays in materials transportation. 5. Design complexity 6. Plant procurement 7. Statutory undertakers	1. Contractors' difficulties in receiving interim payments from public agencies 2. Contractors' financial difficulties 3. Inadequate public agencies' budgets 4. Deficiencies in contractors' organizations 5. Deficiencies in planning and scheduling 6. Frequent variation/changed orders 7. Difficulties in obtaining construction materials 8. Deficiencies in public agencies' organizations 9. Contractors' unrealistic tenders	1. Poor site management 2. Unforeseen ground conditions 3. Delays in design information 4. Lack of communication between consultant and contractor 5. Inadequate contractor experience 6. Low speed of decision making involving all project teams 7. Client-oriented variations 8. Necessary variations of works 9. Delays in subcontractors' Work	1. Financial difficulties faced by contractors 2. Change orders from the owner 3. Poor planning and scheduling of the project by the contractor. 4. External factors

		10. Improper control over site resource allocation	

Before any discussion of delay analysis can begin, a clear understanding of the general types of delays is necessary. There are four basic ways to categorize delays:

2.3 TYPES OF DELAYS:

Delays in construction projects have been put in various classifications by several authors, but most of these classifications have a lot in common in terms of their fundamentals. Although multiple types of delays have been put in several studies, they are somewhat linked. These classifications have been elaborated in the arguments below.

Most importantly, delays can be seen in these four major categories as explained by Theodore J. Trauner Jr (2009);

1. Critical or Non Critical.
2. Excusable or Non Excusable,
3. Compensable or Non Compensable
4. Concurrent or Non Concurrent.

2.3.1 Critical Delays and Non Critical Delays:

As indicated earlier in the above classification of delays as portrayed by Bolton J. this set of delay classification has some connection with previous ones. Critical delays are delays which prevent the contractor from finishing the work on the scheduled completion date as agreed upon in the contract. This concept has roots entrenched in the Critical Path Method (CPM) schedule which helps identify the critical activities in a construction project. All projects have critical activities embedded in their execution irrespective of the kind of schedule being run. These critical activities are sometimes referred to as the controlling item of work. CPM seeks to accomplish three main objectives:

- To calculate the project's completion date
- To identify the extent to which each activity in the schedule could slip without delaying the project.

- To identify which activities in the schedule would have the highest risk of affecting the project completion date if they slipped.

How is the CPM used to estimate the project's finish date? There are basically two methods of estimating the project's date using the CPM, the Forward Pass Calculation and the Backward Pass Calculation. The Forward Pass computes the early start and the early finish dates of the project whiles the Backward Pass estimates the late start and the late finish dates. That notwithstanding, identifying which activities truly impact the completion date of the project also depends on the following factors as given by Trauner (2009):

- The project itself
- The contractors plan and schedule (particularly the critical path)
- The requirements of the contract for sequence and phasing
- The physical constraints of the project – how to build the job from a practical perspective.

It is important to note that irrespective of how one chooses to analyze a construction project schedule to identify delays; there will always be an overriding factor which will need much attention. This is known as the contemporaneous information which refers to the daily reports, the schedules in effect and any other job data available to reflect the existing situation at the time of the delay (Trauner, 2009). From the above explanation, noncritical delays can be seen as those delays that do not impact the project's completion date but, in a way, affect the progress of the work. It can therefore be said that both excusable and nonexcusable delays are critical delays. This leaves noncritical delays as a standalone delay classification..

2.3.2. Excusable Delays& Non Excusable Delays:

2.3.2.1. Excusable Delays:

Excusable Delays is a delayed due to an unforeseeable event beyond the contractor's or the subcontractor's control, typically based on standard general provisions in public agency specifications, delay resulting from the following events would be considered excusable:

- General labor strikes.
- Fires.

- Floods.
- Acts of God.
- Owner- directed changes.
- Errors & omissions in the plans and specifications.
- Differing site conditions or concealed conditions.
- Usually sever weathers.
- Intervention by outside agencies.
- Lack of action by government bodies, such as building inspection.

Before the analyst concludes that a delay is excusable based solely on the preceding definition , he or she must refer to the construction contract documents . Decision concerning delays must be made within the context of the specific contract. the contract should clearly define the factors that are considered valid delays to the project that justify time extensions to the contract completion date , for example some contracts may not allow for any time extension caused by weather conditions, regardless of how unusual , unexpected ,or sever.

2.3.2.2 Non Excusable Delays

Non excusable delays are events that are within the contractor's control or that are foreseeable. These are some example of non-excusable delays:

- Late performance of subcontractors.
- Untimely performance by suppliers.
- Faulty workmanship by the contractor and subcontractors.
- A project specific labor strike caused by either the contractor's unwillingness to meet with labor representatives or by unfair labor practices.

2.3.3 Compensable or Non Compensable:

A compensable delay is a delay in which the Contractor is entitled to a time extension and additional compensation. . On the issue of the excusable and non-excusable delays, only excusable delays can be compensable. A non-compensable delay means that although an excusable delay may have occurred, the contractor is not entitled to any added compensation resulting from the excusable delay. Thus, the question of wheatear a delay is compensable must

be answered. Additionally, anon-excusable delay warrants neither additional compensation nor a time extension.

Whether or not a delay is compensable depends primarily on the terms of the contract. In most cases, a Contract specifically notes the kinds of delays that are non-compensable, for which the contractor does not receive any additional money but may be allowed a time extension.

2.3.4 Concurrent or Non Concurrent:

Concurrent delays like most other delays have several definitions as put forth by practitioners in the industry. A few definitions as prescribed by the Association for the Advancement of Cost Engineering (AACE) (Recommended Practice 10S-90) have been considered below;

- Two or more delays that occur or overlap within the same period, either of which occurring alone would have affected the ultimate completion date.
- Where two or more independent causes of delay occur during the same time period. The same time period being referred to is not always literally within the exact period of time but can be related by circumstance, even though the circumstance may not have occurred during the exact same period.
- True concurrent delay is the occurrence of two or more delay events at the same time, one an employer risk event, the other a contractor risk event and the effects of which are felt at the same time.

Concurrent delay mostly refers to the situation where two or more delay activities occur at different times but the impact is felt (in whole or in part) at the same time. It occurs when both parties to the construction contract (owner and contractor) delay the project during an excusable but non compensable delay (such as severe weather conditions). Such delays do not necessarily have to occur simultaneously but can be on two parallel critical path chains. Concurrent delays may also be an excusable delay with compensation which may grant some reliefs to the contractor in the form of extension of time, remission of liquidated damages and sometimes potential delay of damages subject to the given circumstance and the contractual agreement. In the same vein, a concurrent delay may also be inexcusable where the delay of the contractor, though concurrent with that of the owner, had a more severe impact on the finishing date. For instance, the owner's delay occurred from the 5th to the 8th month of the project period while the contractors delay was from 4^{th} to the 10th of the project period. Though these two delays

happened around the same time, the contractor's delay would impact the completion date rather than the owner's.

Concurrent delays could be caused by the delaying effects of events that were either excusable (i.e. the events for which the employer takes the risk of time and for which extensions of time should be granted to the contractor) or culpable (i.e. events for which the contractor takes the risk of time) (Rawlings, 2003). However, the effects of two delaying events by both parties to the contract, which impacted upon progress of the contract at mutually exclusive time frames, could not be said to be concurrent.

2.4 Identification of delay factors

The literature review was conducted through published books, conference proceedings, articles related to the research area and e- resources. In the next step, all the delay factors that may be encountered in a construction project were listed through a detailed review of the literature, and the possible delay factors recognized in practice were identified. These delay factors were grouped into four major categories as follows:

1. Contractor-related factors
2. Consultant-related factors
3. Owner-related factors
4. Others.

2.4.1 Delay factors related to contractor

A contractor has the significant responsibility to carry out most of the project activities among all the construction parties.. Similarly, if the project is not finished on time and within the allocated budget, the contractors are blamed. In reality, the contracting business is a challenging and demanding profession that contains many complex activities, and, to avoid project delays, the main contractor often holds full responsibility for the work of sub-contractors as well as his own. Basically, how the contractor deals with particular situations depends on the nature of the work and the type of contract Shi and Arditi, (2001).

The capability of the contractor to finish the project according to the planned schedule mainly depends on two things: availability of resources (incorporating money, manpower, materials, and equipment and machinery) and managerial competence. There

are two types of sources from which the contractor hires manpower: sub-contract and direct hire. If the sub-contractor causes delay to the construction project then both the owner and the main contractor have the responsibility to look for a solution to the problem. Therefore, it is essential for the contractor to constantly supervise the work performance of sub-contractors in order to maintain a balance between construction activities Abdul-kadir and Price,(1995).

There are a lot of factor that were get from previous study about the factor cause the delay in construction project. Most of the researchers agree that are the factor that always happen relate to the contractor:

Table 2.2 : Factors of delay related to contractor

	Factors
Contractor-related delays	1. Inadequate contractor experience 2. Inappropriate construction methods 3. Inaccurate time estimates 4. Inaccurate cost estimates 5. Poor site management and supervision 6. Improper project planning and scheduling

2.4.2 Consultant-related delay factors

The client may consult with other professionals who can assist him in organizing the entire construction project. These professionals are called consultants. The main duties and responsibilities of a consultant may be to design the infrastructure of the project, which includes architectural, mechanical, structural, and electrical designs. Some other responsibilities may include the preparation of project related documents such as bills, drawings, specifications, and tender documents Long et al, (2004). Furthermore, in some cases, consultants also conduct project planning, cost control and estimation, and quality control.

In normal circumstances, consultant-related delays occur during preparation of drawings, during the adoption of design drawings, while taking design approvals from contractors and client, and when performing inspection procedures. There are many possible reasons behind these types of delays; prominent factors include inexperienced consultancy staff, poor qualifications, inadequate communication and coordination skills, and improper planning (Gunlana and Krit, 1996). Odeh and Battaineh (2002) believe that during the construction

processes, the enquiries and inspections of the consultant may slow down the progress of the work. In response, the contractor may come up with solutions to the problems; however, these solutions may not satisfy the consultant, and could result in the work having to be redone. Effective control and command over production on the construction site is a major element that contributes implementing the project; conversely, hindrances in performing these activities can have severe impacts on a construction project.

Table 2.3: Factors of delay related to consultant

	Factors
Consultant- related delays	1. Poor qualification of consultant engineer's staff assigned to the project 2. Delay in the preparation of drawings 3. Delay in the approval of contractor submissions by the consultant 4. Poor communication between the consultant engineer and other parties involved 5. Poor planning and coordination by the consultant engineer with other parties involved 6. Delays in performing inspection and testing by the consultant engineer 7. Slow response from the consultant engineer to contractor inquiries 8. Inadequate design specifications 9. Poor contract management

2.4.3 Owner-related delay factors

The owner or client is the crucial participant during the entire construction process. Kwakye (1998) mentioned that the owner's duties and responsibilities are onerous and that he or she needs other knowledgeable parties to manage or organize the construction project. In a few cases, owners have in-house project management teams that participate in the construction process, but most of the time, owners hire a project manager and external parties to handle the project Odeh and Battaineh,(2002).One of the most crucial decisions that owners need to take at the beginning of the project is to determine the duration of the contract. Many owners prefer fast completion of work but thorough investigations should be conducted to

decide the contract duration. Another major factor that delays the initialization of the project is the owner's failure to hand over the site to the contractor. Therefore, the personal involvement and quick question decision-making on various matters by the owner in the initial phases of the project may accelerate the project's progress. Kimmons and Loweree (1989) observed that "*the working relationship between an owner and a contractor is one of the most crucial determinants of project success and this relationship also develops trust between the two parties"*. The owner must participate in the construction project horizontally and vertically, but without interrupting the contractor's project plan.
In addition, financial matters should also be taken into account, and the owner must ensure the on-time availability of funds; lack of financial stability may cause many problems, such as extensive delays due to labour strikes or material mismanagement Chan and Kumaraswamy, (1997).
Based on the literature review of owner-related delay factors, nine factors have been identified, and are shown in Table 2.4.

Table 2.4: Factors of delays related to owner

	Factors
Delays related to owner	1. Delay in furnishing and delivering the site to the contractor 2. Unrealistic contract duration 3. Delay in the settlement of contractor claims by the owner 4. Suspension of work by the owner's organization 5. Delay in issuing of change orders by the owner 6. Slow decision-making by the owner's organization 7. Interference by the owner in the construction operations 8. Delay in progress payments by the owner 9. Owner's poor communication with the construction parties and government authorities

2.4.4 Other factors

There are two other critical factors which can cause delay to a construction project: early planning and design, and external factors.

2.4.4.1 Early planning and design

The early planning and design stage may positively or adversely affect the life cycle of the entire project. Accurate, precise, and adequate planning can smooth progress of construction activities and ultimately accomplish the work on time, but it requires a great deal of attention, and extensive information about the project and interrelated matters. As Carnell (2000) wrote, "the purpose of the provision of information and the use of the various planning tools is to enable the parties to put their respective contract obligation into effect. It can be reduced to a single question: how are to going to deliver this project on time and within budget?" He further opined that incomplete and unclear documents, design, and specifications may create an unpleasant environment on site that can create problems for the owner and other construction participants. It is important to recognise the crucial role of drawings in the early design phases, and, for this purpose, a proper communication or coordination plan has great significance. Odeh and Battaineh (2002) highlight the information which is necessary for the drawings, including the size, location, shape, infrastructure, and materials related to the design of the project.

2.4.4.2 External factors

Some factors are outside the control of construction participants. For instance, the weather conditions in of some Ethiopia area in the summer are very hot, and the temperature exceeds typically40 degrees Celsius.

The construction may face many difficulties that normally result in either slowdown of the construction process or, sometimes, a complete stoppage of works. These difficulties may include disruption to utility lines such as gas, electricity or water. Ogunlana and Krit (1996) mentioned that social and cultural festivals and celebrations may also affect the time it takes labour to reach the job site, negatively affecting the productivity of the construction project and potentially resulting in minor delays.

As discussed earlier, increases in the prices of raw materials can also have a significant impact on a construction project, yet is a factor also beyond the control of the owner and contractor. This is evidenced by the recent case in Ethiopia, when many projects were stopped due to the prices of steel doubling in 2011. These external factors may also create clashes or disputes between the construction participants, which will further increase the product cost and duration (Odeh and Battaineh, 2002). Eight external- related factors are included in Table 2.5.

Table 2.5 : Factors of delays related to external factors

	Factors
External- related delays	1. Unforeseen ground conditions 2. Unexpected geological conditions 3. Problems with neighbours 4. Unusually severe weather 5. Conflict, war, and public enemy 6. Poor weather conditions on the job site 7. Traffic control and restrictions on the job site 8. Rises in the price of materials

2.5 Conceptual framework of the study

There are several of definitions for the delay: Delay is a major problem in construction industry. Trauner et al. (2009) define that construction delays make something happen later than expected, cause something to be performed later than planned, or act timely..

Delay can affect any activity of work in a schedule and results in many problems between parties. According to Al-Khalil and Al- Ghafly (1999), delays can adversely impact project stakeholders, such as clients, contractors, and designers. To the client, delay perceives the loss of revenue due to lack of rentable space or lack of production facilities. On the other hand, delay can be meant to the Contractor as higher overhead costs, higher material and labour costs because the project takes longer than planned.

Having finished the projects on time Assaf and Al-Hejji, (2006) can be marked as an indicator of efficiency, but the construction activities involve many unpredictable factors and variables from various sources. These resources may include environmental circumstances, availability of resources, stakeholders' performance, and contractual relations. Nevertheless, Trauner et al. (2009) states that it is hardly ever occur that a construction project is finished within the planned time.To make something happen later than expected, to cause something to be performed later than planned, or not to act timely. Each of these definitions can describe a delay to an activity of work in a schedule. On construction projects and other projects where a schedule is being used to plan work, it is not uncommon for delays to occur. Ethiopian Electrical Power industry. It is engaged

in the development, investment, construction, operation, and management of power Plants, power generation and power transmission. The company is a key in the Ethiopian energy sector.

Ethiopian Electric Power owns and operates the Ethiopian national power grid with all high voltage power transmission lines above 66 Kv, including all attached electrical substations and almost all power plants within the national power grid (with the exception of some co-generation power plants belonging to the state-owned Ethiopian Sugar Corporation). Ethiopian Electric power is almost the state monopoly in generating electric power for the national power grid, although Ethiopia also allows Independent Power Producers to construct and operate power plants to deliver power to the national grid since 2017..

Electric power distribution and the operation of power transmission lines of ≤66 kV within the national power grid is not part of the activities of Ethiopian Electric Power, which is done by the also state-owned sister company Ethiopian Electric Utility.

The relationship between construction delay and delay causing factors can be conceptualized at a fairly general level, depicted in Figure 1, as two stage relationships where a set of casual factors are categorized based by the responsible body which in turn determine the outcome in terms of effects of delay in construction. The framework is developed from works of two different authors. Abdella *et al*(2002) who categorised delay causing factors in eight groups and Sambasivam *et al* (2007) who identified six effects of delay.

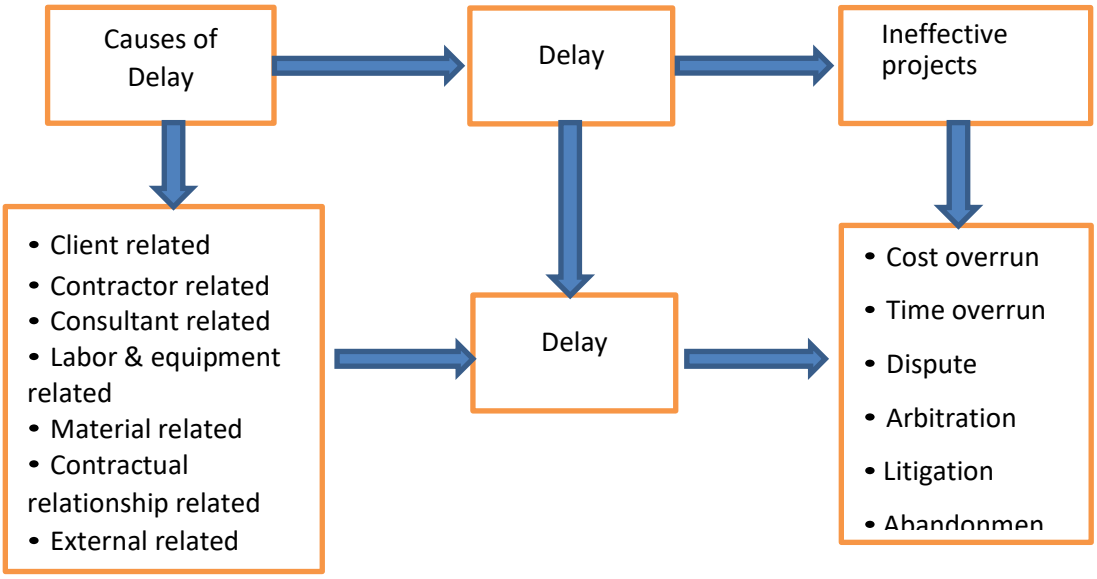

Figure 1 Analytical framework for linking causes of delay to effects of delay

CHAPTER THREE

RESEAECH METHODOLOGY

CHAPTER THREE: RESEAECH METHODOLOGY

3.1 Research Approach and Design

The main interest of the study is to identify and analyze factors that affecting timely delivery of government constriction projects, case of Ethiopian Electric Powers Projects.

This chapter discusses the methodological choice and the research design of the research, sources of data, data collection technique, population of the study, sampling technique, sample size, design process of the research, and ethical considerations.

Research design refers to the plan or organization of scientific investigation, designing of a research study involves the development of a plan or strategy that will guide the collection and analyses of data (Poilt and Hungler, 1985).

From the literature review, it was found that there are two basic research approaches: quantitative and qualitative. The quantitative approach includes the generation of data in quantitative form using quantitative analysis in a suitable way, whereas the qualitative approach depends on subjective decisions, which are based on attitudes, opinions and behaviour (Kothari, 2008). According to Patto (1993) both qualitative and quantitative approaches have advantages and disadvantages. Quantitative approaches lack flexibility and doesn't enable one to get in-depth information as the data is mostly collected through close ended questionnaire. In addition, it doesn't consider the respondents' natural context during data collection process. On the other hand qualitative approach provides little base for scientific generalization since randomly selected sample is not used. Thus, in order to substantiate their limitations and capture the strength of the two approaches the researcher used both of them together. Moreover, because of descriptive type of research design helps to depict accurately the characteristics of a particular individual, situation and a group (Zikmund, 2003); the research design adopted for this study is descriptive.

3.2 Data Sources and data collection Methods

The researcher used both primary and secondary data sources. The questionnaire, interview, and observation will be used as a primary source of data collection tools. Questionnaires will be distributed to Employees, Managers, Project managers, Project Members, Project Coordinators,

Support Staffs of the Projects and others Technical Experts. The interview was conducted with team leaders and with the head of each department who serve as managers. The secondary data were collected from relevant documents, newspapers and magazines of the enterprise that were related to the study. The organization project management manuals and policy documents, newsletters, website and annual reports were used to obtain reliable information that help for the study. For this research, structured questionnaire was designed, distributed and filled by the sampled respondents to collect primary data. Because, the questionnaire survey method is usually easy to administer to a large number of respondents, and normally gets more consistent and reliable results. The structured questionnaire was employed with five ranking scale. Interviews were conducted with concerned management bodies of the employer and contractors in order to gather the relevant primary data.

The data were collected via hard copy questionnaires this data was analyzed using SPSS and MS Excel for ranking the factors overall using a relative importance index.

The questionnaire developed in the study was divided into two parts:

- Part one was related to general information of the respondent's experience and associated company. Contractors, owners and consultants were requested to answer the questions pertaining to their experience in the construction industry and to give their opinions about the percentage average time delay in projects that they experienced.
- Part two related to respondents' experience of project performance.

To obtain a high level of response, the following points were considered during the design of the questionnaire:

- A covering letter was attached with questionnaires;
- The purpose and the benefits of the study were highlighted in the cover letter;
- The participants were informed that their name, department or company name would be kept confidential in the research;

The questionnaire was presented in a smart and attractive design; The questionnaire was designed to be as short as possible, so that it could be completed within 20 to 25 minutes. Target population is said to be a specified group of people or object for which questions can be asked or observed made to develop required data structures and information.

The target population includes:-

- Employees who have been working in the project from day one,
- Project managers,
- Team leaders,
- Managers of each department in the EEP,
- Contractors,
- Consultants,
- Technicians, Engineers, and others technical experts that are related to government projects.

3.3 Population and Sampling

Social scientists use many different sampling strategies to find a representative sample, and there are different types of sampling techniques. In general, the determination of a sampling technique depends on two factors: the degree of accuracy required in the study, and the cost (Smith, 1991). In this study, the selection of a sampling method was based on the need to avoid a biased sample, the time available, and the circumstances of the study. The random sampling method was adopted in the industry survey since this method ensures that each sample has equal chance of being selected for questioning, considering different locations. It is practically difficult to get data from all the professionals in the Ethiopian construction industries. Normally, work with a carefully selected sample is called experimental units, with the sample having characteristics that are different from the overall population. The best way to get an equal representative sample is to choose a proportion of the population at random without bias, with every possible experimental unit having an equal chance of being selected. A random sampling method was adopted for the distribution of the semi-structured questionnaires, with questionnaires distributed to randomly selected construction professionals in the Ethiopian electric power

3.4. Data Analysis Methods

Then quantitative data were analyzed using Statistic Package for Social Science (SPSS) and MS Excelfor ranking the factors overall using a by use of Relative Importance Index (RII). The contributions of each element to overall delays were examined, and ranking of attributes in terms of their criticality as perceived by respondents was then made using the Relative Importance Index (RII), which was computed using the following equation..

$$RII = \frac{\sum W}{A*N} \qquad (0 \le RII \le 1)$$

$$RII = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{A * N}$$

W – Is the weight given to each factor by the respondents and ranges from 1 to 5, (W – Is the weight given to each factor by the respondents and ranges from 1 to 5, (where "1" is "No Impact" and "5" is "Major impact")

A –Is the highest weight (i.e. 5 in this case) and;

N–N–Is the total number of respondents..

The collected data will be analyzed in their form of contents.

The questionnaire will be developed in five scales ranging from five to one; where:-

- 5- represents Major impact,
- 4- represents agree, Moderate impact,
- 3- represents neutral, Marginal impact
- 2- represents Negligible impact, and
- 1-represents No Impact.

3.5. Reliability and validity

Are concepts used to evaluate the quality of research? They indicate how well a method, technique or test measures something. Reliability is about the consistency of a measure, and validity is about the accuracy of a measure. A group of participants complete a questionnaire designed to measure personality traits. If they repeat the questionnaire days, weeks or months apart and give the same answers, this indicates high test-retest reliability.

For a questionnaire to be regarded as acceptable, it must possess two very important qualities which are reliability and validity. The former measures the consistency of the questionnaire while the latter measures the degree to which the results from the questionnaire agrees with the real world.

3.6. Ethical Considerations

In this research we will consider the six broad ethical areas that need to be considered in the research. We will discuss voluntary participation, informed consent, confidentiality and anonymity, the potential for harm, communicating the results, and more specific ethical issues.

CHAPTER FOUR

RESULTS AND DISCUSSION

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

The results and discussion below is devised in three parts corresponding to the research questions and also the sections of the questionnaire. These divisions can help tackle one question at a time. The first part of the results and discussion contains the findings of the questions directed towards identifying the importance of delay causes and raking in the level of their severity.

A total of 50 questionnaires were distributed randomly amongst the selected companies for the industry survey: 20 distributed for contractors; and 5 distributed for consultants and 25 distributed for owners. A total (41) 82% responses were received from the participating companies/professionals, (see Table 4.1).

Table 4. 1: Numbers of questionnaires distributed and responded.

Questionnaires	Contractors	Consultants	owners	Total
Distributed	20	5	25	50
Respondents	17	4	20	41
Percentage of Responses	85%	80%	80%	82%

4.2 Profile of respondents

4.2.0. Respondents' experience

4.2.1. Type of business

This section presents general information about the respondents who completed the survey. This section aims to provide background regarding the respondents' experience and, therefore, indicate the degree of reliability of the data provided by them.

Table 4. 2: Respondents by type of business in the construction industry

Type of business	Total	Percent

Contractor	20	40%
Consultant	5	10%
Owner	25	50%
Total	50	100.0
Percent	100%	

Table 4.2 indicates the number of respondents who participated in this survey. Each respondent was asked to select his/her business in the construction industry. As noted before, the total number of respondents participating in the survey was 50. Of these, owners were the highest number, with 25 participants (50%). contractors came in the second position, with 20 participants (40%). Finally, Consultants the smallest numbers of respondents were, with 5 participants (10%).

4.2.2. Years of experience

Fortunately, of the largest proportion of professionals who participated in the survey have more than 10 years of experience in the construction industry, which reflects well on the reliability of the data collected.

Table 4. 3: Number of years' experience

Country	Years of experience				Total
	<5 years	6- 10 years	11-15 years	>16 years	
Frequent	3	17	13	8	41
Percent	7.3%	41.4%	31.7%	19.5%	100%

Table 4.3 show the years of experience of the respondents. It shows that 41.4% of the participants (17 respondents) had experience of between 6 to 10 years, 31.7% (13 respondents) between 11 to 15 years and Of those remaining 19.5% (8 respondents) over 16 years. whereas 3(7.3%) had less than 5 years of experience.

4.2.3. Project sizes

Table 4.4 illustrate respondents' experiences with regard to projects of different sizes.

It shows that the highest number dealt with small- and medium-size construction projects (28), followed by those who dealt with both small and large projects (17). No respondents said that they participated in all sizes of construction projects (i.e. small, medium, large and very large).

Table 4. 4: Experience different project sizes they have participated

Size of construction projects	Total	%
Very large (Over £30 million)	26	63.4
Large (£16 – 30 million)	12	29.2
Medium (£5 – 15 million)	1	2.4
Small (Under £5 million)	2	4.9
Total	41	100%

From the survey, it was found that 63.4% out of 41 respondents were working in Very large (Over £30 million) size construction projects, while the proportions working in medium, large and small construction projects were %,29.2 , 2.4 and 4.9 respectively. This revealed that the size of a project has a direct relationship to the level of impact due to delay factors, since smaller-size projects have less impact compared to bigger-size projects. Since the survey included all types of project and was dominated by very large- and large-sized projects, the results of delay impact have an effect in analyzing the delay factors by minimizing the bias of the project sizes. However, the medium and small projects have less influence in terms of analyzing the delay impact.

4.3 Time schedule, performance, experience of EEP construction project

This section focuses on identifying and understanding the existing procurement methods and tendering arrangements in the construction industry so that the impact on project delays due to

procurement systems can be analyzed. The survey data associated with the procurement system of construction projects was collected through the questionnaire. The findings are discussed by analyzing the survey data using suitable statistical tests, as follows.

4.3.1 Procurement methods

Various types of procurement methods are commonly used in construction projects. The questions related to contractual arrangement were distributed to owners and consultants, and the possible methods were grouped into four major categories, since the type and nature of delay factors are different according to the methods of procurements used in building projects. Therefore, all procurement methods were included in the questionnaire to reduce the risk of bias from any one method of procurement that has a high impact in a project when analyzing the delay factors. Respondents were asked to select the methods that they had experienced. Table 4.5 show that the type of procurement method most commonly used by respondents was the traditional method, used by 19 participants (46.3%). In contrast, the least-used method was design & build procurement, used by 5 participants (12.9%). Management contracting and construction management procurement methods were used by 9 participants (21.9%), while 8 (19.5%) were involved in projects using the construction management procurement method.

Table 4. 5: Procurement methods used by owners and consultants

Procurement methods	Total	%
Traditional	19	29.11%
Management contracting	9	22.79%
Design & build	5	20.25%
Construction management	8	27.85%
Total	41	100%

The survey results revealed that delay factors were mainly influenced by traditional methods of procurement followed by construction management, management contracting, and the design and

build method of procurement. The design and build method of procurement has less influence when analyzing the delay impact, because delays due to design error and approval can be reduced in this method, which is its main advantage compared to the traditional method.

4.3.2 Tendering arrangements

Table 4.6 presents the survey data related to different types of tendering arrangements. From the survey, it was found that respondents participated in several different types of tendering arrangement. Selective tendering arrangements were selected by 16 respondents (39.02%), while negotiation tendering and continued tendering were each experienced by 9 (21.95%) A further 7 respondents (17.07%) had been involved in projects arranged by open free tender. The details of the different tendering arrangements in which respondents participated are presented in Table 4.6:

Table 4. 6: Frequency of participation in different tendering arrangements (from owner and consultant)

Tendering arrangement	Total	%
Negotiation	9	21.95%
Open tender	7	17.07%
Selective tendering	16	39.02%
Continued tendering	9	21.95%
Total	41	100%

Since the tendering arrangement is also a key factor that influences delays in a construction project, respondents from different types of tendering arrangements were selected for the study in order to reduce the bias of any one type of tender arrangement.

The majority of respondents were from selective tendering followed by the open tendering arrangement.

4.3.3 Delays experienced

Table 4.11 and Figure 4.13 indicate that the vast majority of contractor and consultant respondents had experienced delays in a construction project. 37 out of 41 participants – or nearly (90.24%) – had been involved in projects that were not completed as planned or as stated in the contract, whereas just 4 (9.75%) participants had no experience of delay.

Table 4. 7: Experience of construction project delays among contractors and consultants

Description	Yes	No	Total
Experienced delay	37	4	41

4.3.4 Percentage of delayed time of the delayed projects

The percentage of delayed time was classified into five categories, and respondents were asked to select more than one of these categories to indicate the percentage delayed time of the delayed projects that they had participated in. Table 4.8 shows that the percentage delayed time of delayed projects for nearly two-fifths of respondents (14; 34.14%) was from 31% to 50% of the project plan. Projects that had been delayed by 10% to 30 % of the project plan time were second, cited by 11 respondents (26.8%). The percentage of respondents who had experienced a percentage delay less than 10% was 24.3% (10), while 5 respondents (12.19%) had experienced from 51% to 100% delay time. The lowest frequency was for a percentage delay of over 100% of the project schedule, which only one respondent (2.43%) had been involved in.

Table 4. 8: Percentage delayed time of construction projects

Percentage of delayed time	Total	Percent
< 10 %	10	24.3%
10 – 30 %	11	26.8%
31 – 50 %	14	34.14%
51 – 100%	5	12.19%
> 100%	1	2.43%

Total	41	

4.3.5 Responsible party for delays

Table 4. 9: Responsible party for delays based on all respondents' opinions

Responsible for delays	Total	%
Contractor	14	34.14%
Consultant	17	41.46%
Owner	10	24.39%
Total	41	100%

The respondents, including contractors, consultants and owners identified that the consultant was the most responsible party for construction projects' delays (Table 4.9).

Respondents considered that consultants were the category most responsible for delays with 17 respondents (41.46%) citing this group. Contractors (34.14%) were most commonly named as being the party most responsible for delays. owners emerged as the least responsible party being named by 10 respondents (24.39%). However, it should be remembered that these are the results of all the respondents, and more subtle points can be discovered in the next part of the chapter as it breaks down the results according to group opinions.

4.4 Delay factors analysis

A total fifty-seven well-recognized delay factors were identified through quaternary. With the aim of ranking them, the identified delay factors were included in the questionnaire. The main objective of this survey was to determine the importance level of all delay factors in construction projects, given that each delay factor has a different level of impact on project

delays according to its nature and complexity. Therefore, the Relative Importance Index (RII).) of each critical delay factor has been considered as a main input in the simulation model of the delay analysis system, introduced in this study.

4.4.1 Survey Data Analysis

The results of the industry survey in the ranking scale of Relative Importance Index (RII) is presented in Appendix C which shows in appendix B there coding of the questionnaires.

Appendix C provides the delay factors ranked by the RII and arranged according to their ranking delay factor are also presented in Table 4.10, as shown below

Table 4. 10: top seven ranking of causes of delay

Causes of Delay	RII	Ranked
Delay in progress payments by the owner	0.795122	1
Right of way (RoW) problems	0.770732	2
Poor communication and coordination by contractor with other parties	0.746341	3
Delay in the preparation of drawings	0.736585	4
Poor project feasibility study	0.678049	5
Poor site management and supervision by contractor	0.673171	6
Financial problems (delayed payments, financial difficulties, and economic problems)	0.668293	7

Project delay is defined as the additional time involved in completing a project beyond its contractual duration. A delay is a situation in which a contractor, consultant, or client/owner jointly or independently contribute to the delay of a project's completion time. The seven major causes of delay in project considered by each project party are presented in Table below, The groups and associated delay factors are discussed below in the light of the existing studies and the expert opinions collected during the preliminary survey under Appendix A of the preliminary questionnaire.

Table 4. 11: The seven major causes of delay in project

Causes of Delay	RII	Ranked
Delay in progress payments by the owner	0.795122	1
Right of way (RoW) problems	0.770732	2
Poor communication and coordination by contractor with other parties	0.746341	3
Delay in the preparation of drawings	0.736585	4
Poor project feasibility study	0.678049	5
Poor site management and supervision by contractor	0.673171	6
Financial problems (delayed payments, financial difficulties, and economic problems)	0.668293	7

As Table 4.11 shows, the 'Delay in payments' problems of the construction projects (ORF12), at RII = 0.795122) is ranked as the most critical factor contributing to constriction projects delay in the view of the project parties.

It indicates that the importance of the funding capabilities and payment procedures of all the project parties because of being a chain between the two main project parties this also emphasizes the liquidity of the project stakeholders and the need to pay special attention to smooth disbursements to reduce delay. It is often not the funding, but the lengthy bureaucratic procedures that delay the owner's payments and thus impede physical progress by making it difficult for the contractor to achieve planned progress.

Second overall in group, and quite close to Delay in payments, is 'Right of way (RoW) problems (EXF3) at RII = 0.770732 the 'right of way (RoW) problems constriction projects is ranked the seconnd critical factor contributing project delay. This is because RoW problems are very unpredictable and common in rojects, and also known to all the project parties.

RoW problems have many unknown dimensions, from regulatory issues to changes in land demographics, educational institutions, religious establishments, graveyards, forests, market places, and households.. There is also no compensation for the RoW in most countries, which is one of the critical issues prolonging delays, as many landowners try to hinder construction as it

often leaves their land unusable for future development. Moreover, due to the lack of any incentives, landowners sometimes intentionally build settlements in the RoW just before the construction starts on site, which can substantially affect the completion time because of the lengthy legal procedures involved which can be found in linear construction projects .

Poor communication and coordination between the project parties (PMRF15) is very apparent across all kinds of projects. Table 4.11 indicates that the 3rd most critical overall at RII = 0.746341. Poor communications compromise the effective coordination of project stakeholders, which leads to increased rework and hence delay. This generally occurs due to the insufficient flow of information. Of all the stakeholders involved, project managers are the key point of contact, and hence their negotiation skills significantly affect coordination and thus project progress.

Corresponding with existing findings, Delay in the preparation of drawings (CRF2), ranked 4th overall at RII = 0.736585, In a turnkey contract environment, consultants play a vital role in drawing design-related issues, and their skills determine the quality of their work. Unclear owner specifications and erroneous contractor designs complicate the situation and hamper expected progress, as final victims to the project.

The respondents also revealed that the feasibility study of the projects if it is not done properly and it became sources to the delay of the projects. In projects were constructed with the interest of the government and the manager of EEP when they get fund by ignoring whether the projects are feasible or not. One the construction is begun, it took years and the community never got power because the projects faced problems due to the feasibility study problems and it ranks 5th out of the factors.

Improper site management and supervision' ranked as 6^{th} with (RII = 0.673171) Successful delivery of construction of projects within the measurable tenets is driven by effective site management and site supervision. Unfortunately, a consistent finding is that most construction works are not delivered on time and consequently, the construction setting in Ethiopia. The dangerous and hazardous nature of construction activities even makes site supervision more challenging is the contractor fraud.

Financial problems (delayed payments, financial difficulties, and economic problems) is the critical delay factor with an overall 7th rank (RII = 3.045) poor cash flow management,

insufficient financial resources and financial market instability makes the project to delay this specially with the contractor b/c they will not want their money to invest in the project they want to contract with the client money.

4.5 Discussion of the Results

The outcome of analysis from this study can be said to be of great relevance to the construction project in Ethiopian electric power industry. Just like any other construction industries, the EEP is also prone and liable to delay. The factors that cause delay in construction project varies across different countries based on the political and socio economic condition of a particular country. In addition, the environment condition of a country significantly influences the extent to which construction projects are delayed and the effects are pronounced. There are many factors that induce delay on construction projects; however in this study the factors are limited to 57 factors. These delays causing factors are grouped in seven categories and they were ranked according to the Relative Importance Index.

The factors: Delay in progress payments by the owner, improper project feasibility study long waiting for approval of test and inspection, shortage of construction materials, labor supply and productivity, frequent change order inappropriate organizational structure linking all parties involved and problems with neighbors are found to be the most important from each category. The result of the previous finding made by Wael et al (2007), indicates that Lack of materials on the site, Unavailability of Equipment and tools in the market, Poor weather conditions, Delays in materials transportation, Design Complexity, Plant procurement and Statutory undertakers top seven effective for overall ranked by contractors and consultants and also the finding of Aibinu and Jagboro (2002) , the most delays factors includes: Contractors' difficulties in receiving interim payments from public agencies, Contractors' financial difficulties, Inadequate public agencies' budgets, Deficiencies in contractors' organizations Deficiencies in planning and scheduling, Frequent variation/changed orders, Difficulties in obtaining construction materials and Deficiencies in public agencies causing factor. Thus, showing importance level of delay causing factors may vary from based on the construction nature and country.

Analysis was also carried out on the effect of delay on the project work. Time overrun, cost overrun and dispute among parties involved were ranked highest. Time is factor that is very essential in all activities that has to be carried out, in the contract document. A specific time

phase is given for delivery of project and if the time is being exceeded more money is often spent which could lead to increase in final cost of project leading to cost overrun and finally to dispute.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION

5 Introduction

In the Previous chapters we discussed the research methodology, literature review, construction industry survey, design of the conceptual framework of the delay. This chapter presents the main conclusions drawn from the different chapters presented in this dissertation, and suggests recommendations for both further development and future study.

5.1 Summary of Findings

The research has been undertaken by reviewing literature, which was used to identify the possible variables causing delays Ethiopian electric power EEP construction projects. It basically aims to acquire data degree of impact and frequency of occurrence of the identified factors; and effects from their personal comments. After distributing the questionnaire for contractors, managers, and employees who have experience construction projects in EEP, sufficient responses are collected 41 with a response rate of more than 82% which is well and above the minimum required for conducting the analysis.

Based on the respective importance indices, the factors are ranked separately for delays and the rankings is checked using relative importance index, which result in high values of the coefficient confirming strong agreement among the rankings. With regard to delay factors, the most important causes identified, ranked and compared. The reply from respondents and the desk assessment shows the sector is severely suffering from over extended project delays.

5.2 Conclusions

This chapter includes the conclusions and recommendations that would help in solving the occurrence of delay and the way forward of the construction projects EEP. The general objective of this study was to rank the factors of delay of the projects and forward suggestions on how to minimize the project delay.

The conclusions drawn from the research study are summarized under different sections as follows: finding of the researcher; literature review; construction industry survey; of the project in EEP.
The survey results showed that different responsible party for the delays in construction projects.

The survey results also found that the rank level of delay factors was different in relation to the three parties (contractor, consultant and owner).

Considering the contractor's point of view, the survey result showed that there were five most critical delay factors among the all identified factors in the Ethiopian construction industry. These critical delay factors were Poor communication and coordination by contractor with other parties, Poor site management and supervision by contractor changes in materials prices, delays in materials delivery, shortages of required equipment, low-skilled manpower, and changes in the scope of the project were the most critical delay factors.

Considering the owner's point of view, the survey results found that Delay in progress payments by the owner, Improper project feasibility study ,financial problems (delayed payments, financial difficulties and economic problems), slow decision-making by the owner's organization, changes in materials prices, delays in issuing change orders, delays in furnishing and delivering the site to the contractor, and modifications (i.e. the addition of new work to the project and changes in specifications), unrealistic contract duration, and interference by the owner in the construction operations most critical delay factors found in EEP construction projects.

From the consultant's point of view, the survey results identified that, Delay in the preparation of drawings, slow supervision and delays in making decisions, delay in the approval of contractor submissions by the consultant, slowness in giving instruction, and poor qualifications of consultant engineers' staff assigned to the project were the five most critical delay factors in the construction industry.

Identifying the responsible party will be expected to assist owners/clients in their decision-making process during the procurement of a public and private construction project.

The RII of delay factors identified from all parties was used as a key input into the delay analysis system for analyzing and quantifying the impact of delay factors associated with construction projects in EEP.In this study, the first objective was set to identify the list of possible delay factors associated with construction projects, and to explore existing techniques being used to analyze those delay factors. In order to achieve the first objective, a comprehensive literature review was carried out, including research publications in journals, conference proceedings and related books. The following are the conclusions drawn from the literature review:

The second objective of the study was assigned to conducting a construction industry survey that aimed to identify the RII of each delay factor associated with construction projects, while the third objective was to rank the response of the questionnaire. In order to achieve the second objectives, a construction industry survey was conducted by using questionnaires, with responses collected from consultants, contractors and owners in order to analyses the views of the parties involved. Relative importance index (R1I) was calculated using Relative importance index (R1I) methods to rank the listed delay factors associated with construction projects, which helps to achieve the second objective of the study. The conclusions from the industry survey are as follows:

The survey results showed that contractors, consultants and owners, were the most responsible party for the delays in construction projects, whereas owners were the party most responsible for construction project;

The identification of the responsible party will assist owners and clients in the decision-making process during the procurement of a public and private construction project;

The survey results also found that the rank level of delay factors were different from the views of the three parties (contractors, consultants and owner). The list of delay factors which were ranked considering R11 is shown in Appendix c;

The survey results showed that the five main delay factors in the construction industry were delays in materials delivery, a shortage of required equipment, the low skills of the manpower, financial problems, severe weather conditions, waiting times for the approval of drawings and test materials, delays in issuing change orders by the owner, and poor qualifications of the consultant engineer’s staff. In contrast, changes in materials prices, changes in the scope of the project, and poor communication between the consultant engineer and the parties. involved in the project were the most critical delay factors in the Ethiopian electric power construction industry.

5.3 Recommendations

Delays are common for all types of projects, and these are widely recognized as costly, complex, and challenging problems. Since delays are costly to all project parties, including extended timelines that threaten development, their minimization is vital for all concerned. However, delays can be minimized when their causes are identified. Building on the outcomes of this study, it is suggested that the project parties can significantly reduce delays by adopting the measures below:

This section discusses the recommendations for identifying, analyzing, and responding to the delay factors associated with construction projects. Taking into account the findings from the literature review and survey. The following recommendations are suggested to manage the delay risks related to construction projects.. The recommendations and solutions suggested by construction professionals during the review of the case studies were also taken into account in developing the following recommendations. These recommendations are presented in four categories: owners, contractors, consultants, and external factors.

Owners should consider the following recommendations:

- First precise site location from compensation issues before the construction starts to avoided stoppage of the construction, paying particular attention to legal matters and demographic information of the RoW in terms of community consultation, floods, and soil properties;
- Trust and supervise the site with contractor to avoid fraud
- Pay progress payments regularly to contractors so that delays can be avoided, and the contractor's ability to deliver the project on time and within quality improved;
- Establishing an effective communication protocol between the project parties, engaging an efficient project manager to identify priority areas to keep pace with the updated planned schedule;
- Minimize change orders throughout construction to avoid delays to the project;
- Review and approve the design documents within the agreed schedule;
- Verify the resources and capabilities of the lowest bidding contractors before awarding the contract.

Contractors should consider the following recommendations:

- The required amount of manpower should be allocated to the construction site, and site productivity should be improved by mobilizing all resources;
- The contractor should manage financial resources and plan cash flow by utilizing progress payments and managing the contingency budget to cover expenses resulting from climate factors and high market prices;
- Establishing an efficient communication and coordination framework, ensuring timely interactions between the subcontractors, owners, and other project stakeholders;
- To avoid cost overrun and disputes, contractors need to focus on planning and scheduling tasks during the construction process by matching the available resources and time;
- Site administrative and technical staff should be assigned as soon as the project is awarded, so that the project can be delivered within the specified time, to the required quality, and to the estimated cost;
- To improve contractors' managerial skills, there is a need for continuous work- training programmers for personnel in the industry, so that they can update their knowledge and become familiar with project management skills;
- Motivate to improve workers' skills by awarding pay rises;
- Avoid reworks at site, since they reduce the morale of foremen and workers, causing further delays;
- Contractors should plan effectively for the delivery of materials and equipment

in time to avoid expected delays from late delivery during construction.

- Updating the planning and scheduling of the project's progress, ensuring resource

Availability and taking into account natural calamities and political interventions; and

- Appointing locally experienced and technically sound staff, especially the project manager, providing quick solutions to problems that arise during the project life cycle.

Consultants should focus on the following points:

- Reviewing and approving design documents: any delay caused by the consultant engineer in checking, reviewing and approving the design submittals prior to the construction phase could delay the progress of the project work;

- Inflexibility: Consultants should be flexible in evaluating contractor works without compromising the quality of works;
- Approve design documents: Working drawings and construction schedules need to be approved in time to avoid work suffering from delays or quality issues;
- Inspection of mistakes and discrepancies in design documents: These are common reasons for redoing designs and drawings, and it may take a long time to make necessary corrections;
- Communication and coordination: Consultants need to make sure that there is proper communication and coordination among project stakeholders to avoid delays due to a lack of proper communications at the construction site;
- Testing materials: Facilitating the laboratory testing of construction materials and products is crucial to avoid construction project delays and reworks.

5.3.1 The following recommendations are suggested to manage external factors:

- To avoid time extensions due to adverse weather, it is recommended to improve site productivity by working overtime hours or to work night shifts when weather allows;
- To overcome delays due to unexpected variations in site conditions, there is need for more resources, a number of different sets of equipment, and the availability of skilled manpower;

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APPENDICES

Appendices-A: Questionnaire sample with consent letter

Appendices-B: Delay Factors with their Groups and Coding

Appendices-C: Questionnaires Ranking