ADDIS ABABA UNIVERSITY
SCHOOL OF COMMERCE

DEPARTMENT OF PROJECT MANAGEMENT

Assessment on Causes of Substation Construction Delay: Case of Electricity Transmission system Improvement program 2 lot I project (Etisp 2 lot I)

A Project work Submitted to School of Commerce in Partial Fulfillment of the Requirements for the Master of Art in Project Management

BY: ASTER MULUNEH

ADVISOR: Dr.WUBSHET BEKALU

August 2018

ADDIS ABABA UNIVERSITY

SCHOOL OF COMMERCE

Assessment on Causes of Substation Construction Delays:
(The case of EEP-Etsip2 lot I project)

Submitted to School of Commerce in Partial Fulfillment of MA Degree in Project Management

By:

Aster Muluneh; GSW/0014/08

Advisor:

Dr.WUBSHET BEKALU

August 2018

DECLARATION

I, hereby, declare that this research report entitled **Assessment on Causes of Substation Construction Delay: (The case of EEP-Etsip 2 Lot I project) is** my original work and has not been submitted earlier either to this university or elsewhere for an award of any other degree.

SIGN: _____

DATE _____

By: ASTER MULUNEH
ID: GSW/0014/08

Dr.WUBSHET BEKALU

SIGN_____

DATE _____

ADDIS ABABA UNIVERSITY
SCHOOL OF COMMERCE

Assessment On Causes of Substation Construction Delay: (The case of EEP-Etsip 2 lot I Project)

BY: ASTER MULUNEH

APPROVED BY:

Dr.WUBSHET BEKALU
DATE SIGNATURE
(ADVISOR)

---------- ---------- ----------

Dr. TEKLEGIORGIS ASSEFA (ASST.PROF.) DATE SIGNATURE
INTERNAL EXAMINER

---------- ---------- ----------

Dr. MARU DATE SIGNATURE
EXTERNAL EXAMINER

---------- ---------- ----------

ACKNOWLEDGMENT

First of all I am so thankful to the Almighty God who has blessed me in my entire life and made me to arrive at this final stage with all the difficulties and challenges.

I am so grateful to all staffs of school of commerce for the exciting and fruitful time I have had in the whole Masters program.

I thank my advisor Wubshet Bekalu (PhD) for his guidance, and encouragement to complete this paper work in this manner.

My special thanks go out to my husband Engineer Abiot Diada who has been encouraging me and taking care of our kids in my absence throughout the whole course and my friend Dadi Weyifen and my sisters as well who supported me while carrying out my study. I also thank the project team of EEP and Cymi for collaborating in replying the questionnaire on time and providing all other information through the unstructured interview.

DEDICATION

I dedicate this work to my beloved son Nathnael Abiot and my beloved daughter Afomiya Abiot who came to my life along the way of this masters program.

Contents

List of Acronyms:

ADB	African Development Bank
EEA	Ethiopian Economic association
EELPA	Ethiopian Light and Power Authority
EEP	Ethiopian Electric Power
EEU	Ethiopian Electric Utility
EEPCo	Ethiopian Electric Power Corporation
EPC	Engineering, Procurement, Construction
ETSIP	Electricity Transmission System Improvement project
GERD	Great Electric Renaissance Dam
GDP	Gross domestic product
GTP	Growth and Transformation Plan
MW	Mega Watt

List of Figures:

List of Tables:

ABSTRACT

Construction delays can be defined as the late completion of work compared to the planned schedule or contract schedule. Construction delays can be minimized only when their cause are identified. The objective of this study was to identify the major causes of substation construction delays; This study was carried out based on literature review and a questionnaire survey and unstructured interview and owns observation. A total of forty six delay factors, categorized in four groups, were identified as cause of substation construction delays. The literature review has included effects of construction delays in order to emphasize how important is to identify the causes of delay to minimize consequences of delay .The questionnaire survey was distributed to the target respondents of client and contractor groups, twenty one (21) respondents of project managers ,site managers ,site supervisor and office engineers were participated. The objectives of the study were successfully achieved. The top ten main causes substation construction delay identified using RII from the respondent selection,(1) Poor and unorganized procurement ,(2)Delays in sub-contractors work ,(3)Incompetent consultant staff, (4)Difficulty to run the project due to poor cash flow of the contractor ,(5) Inadequate experience of consultant (6)Poor management of the project by the contractor (7)Poor planning and scheduling of project, (8) Lack of appropriate machineries and tools in work place, (9)Late procurement of electromechanical equipments ,(10)Design error that lead to wrong construction & rework.

From the group cause analysis Contractor-related delays was ranked the most significant category that cause delays followed by consultant related and client related delays. The paper includes recommendation for contractor and client for betterment of future performance.

Key words: construction projects, cause of delay, Relative importance index (RII), Ethiopia.

Chapter One: Introduction

1.1 Background of the study

Projects are centerpieces of development plans. Objectives of a plan get reflected in projects, so achievement of planned targets rest heavily on successful and timely completion of projects.

Implementation of a project is the step where all the proper planned activities are put into action. Usually project implementation process involves preparing, deployment, maintaining and use of the final product of the project. Project managers and sometimes project team members are committed to controlling and monitoring project implementation process, (Abebit 2013).

Project implementation delay can be defined as the late completion of work compared to the planned schedule. Project implementation delay can be minimized only when their cause are identified.

Project delays frustrate the process of development. Delays in schedule are always followed by an increase in cost which leads to cost overrun. Delays have costs, risks and undesirable consequences on project success in terms of time, cost, quality and safety (Sunjka and Jacob, 2013). The effect of delay not only confined to the construction project but it influences the overall economy of a country (Divya and Ramya, 2015) and thus it has received much attention in economic development endeavor of a country.

Construction projects are series of projects related to the construction field who have limited time dimension with specific allocation of resources, in order to realize an idea and a particular purpose, after the idea is feasible, (Muliyani, 2006).

Looking into the construction industry in general, it is dynamic in nature due to the increasing uncertainties in technology, budgets, and development processes. Currently, construction projects are becoming much more complex and difficult. This is due to modern construction projects are characterized by new standards, advanced technologies, multiparty participation, and frequent owner-desired changes. In addition the construction process becomes complex and sophisticated due to the large no number of parties involved in the construction process, i.e., clients, users, designers, regulators, contractors, suppliers, subcontractors, and consultants.

As witnessed by many scholars, the construction industry is one of the main sectors that provide important ingredients for the development of an economy. The construction is the tool through which a society achieves its goals of urban and rural development.

In the last two decades, Ethiopia has witnessed a glooming in the construction industry where the government takes the lion share in owning many infrastructure based mega projects in different sectors. However it is observed that delay is the major challenge of the construction industry leaving the projects with a minimum of time and cost overrun not mentioning the other related effects. Delay is a major challenge to meet the planned target by the government as seen in all major projects.

As stated by Divaya.R&S.Ramaya 2015, construction delay is considered to be one of the most recurring problems in construction industry and it has an adverse effect on project success in terms of cost, time, quality and safety. The study indicated that delay may be caused by clients, users, consultants, designers, owners, contractors and suppliers.

By focusing on ETSIP2 lot I project, this paper studies the causes of substation construction project delay to draw up possible recommendations in methods of minimizing delays for successful implementation of projects with respect to planning and managing of implementation.

1.2 .Background of the case organization and the project

Ethiopian electric power is a government owned entity which is responsible for power generation, transmission and distribution all over the country. Based on the information on the company's website; the company has passed through three major milestones. It was first established in 1958 as EELPA and acted as service provider and regulator. Secondly, in 1992 the Authority (EELPA) was unbundled into two – the Ethiopian Electric Power Corporation as service provider, and the Ethiopian Electric Agency as a regulator. Thirdly, in December 2013 the Corporation (EEPCO) was legally unbundled into two enterprises – the Ethiopian Electric Power (EEP) and Ethiopian Electric utility (EEU).EEP, is responsible for is responsible for generating, transmitting and wholesale of electricity to be utilized nationwide as well as neighboring countries and EEU, On the other hand is distributing and retail sale of electricity nationwide.

According to Ministry of Water irrigation and electricity, the installed power generation capacity of the national grid arrived 4228MW. The second GTP has intended to extend this capacity to 17000MW by the end of 2020. To meet this target EEP is currently running a lot of power generation projects, including many other network expansion projects.

The case project under this study, ETSIP2, is one of the projects owned by EEP in order to construct new substations, expand & upgrade existing ones for improving the general power distribution network in all over the country. This improvement projects have different phases where the one under the study is the second phase. This phase 2 project comprises the construction and upgrading of 20 substations in three lots in different parts of the country. The execution period of this project is 2011 to 2013. There are six project sites for the first lot and eleven under the second lot and the remaining for the third Lot. The three lots were awarded to three different European contractors on EPC contract basis. The three lot projects were financed by ADB. Both lot I and Lot II projects have suffered a significant delay almost more than two years. This study will focus on Lot I project in identifying the major cause of delay and its impact on the contractor and client.

1.3. Statement of the problem

As the construction industry is playing a significant role for development and boost up of infrastructure in any developing country, it is considered as one of the largest industries of any developing economy and contributes to about 10-12% of the National GDP and also when efficient construction projects can provide a solid platform for reviving the economy and infrastructure of developing nations and building a more balanced and independent economy during stable political conditions,(Mr.Jaspreet ,2014).

Despite the fact that numerous projects are undergoing throughout the country, Ethiopia, in different sectors especially in the construction industry, the effectiveness of these projects in delivering the deliverables within the time frame and budget is always in question. As a result of extended delays in many projects as can be witnessed to date like many road projects, power plant projects, the socio economic impact resulted from the delays is significant. Normally project delays are common problem all over the world though it is severe in developing countries as witnessed by different scholars as below.

'It is very rare to see that a construction project is completed on time' (M.Hassab, *2011*) and adds that construction delay is a universal evident reality and countries face this global fact.

Meeting the objectives of project with time and budget has been challenging long time ago where management's skills and technologies didn't ripen as now, but however with today's new technologies, project management skills and better infrastructures, construction projects continue to suffer delays and project completion dates still pushed back,(B.P.Sunjka, 2013).

Based on a preliminary interview conducted with a senior Engineer and the project Manager at EEP the researcher was able to identify that ETSIP 2 LOT I project has faced a delay of two and half years. To the best knowledge of the researcher, no scientific research is conducted in this project. As a result the researcher highly believed that this study is necessary to investigate the causes of delay of the project. Therefore, the purpose of this study is to investigate the causes of delay of ETSIP2 LOT I substation construction project to answer the research questions.

1.4. Research questions

The paper will try to answer the following questions:

- What are the causes of project delay in ETSIP2 Lot I project according to perceptions of client and contractor?
- What is the relative importance of project implementation delay for substation construction project?
- To what extent the client and the contractor agree on the ranks of the causes of project delay?

1.5. Objective of the study

The purpose of this research is to identify the major causes of delay in project implementation, effect of delay and its implication on Ethiopian electric power mission and method of minimizing delays in similar projects owned by EEP. To achieve the aims, objectives have been identified as following:

a) To identify the causes of delay in substation construction due to clients
b) To identify the causes of delay in substation construction due to contractor
c) To identify the causes of delay in substation construction due to consultants
d) To identify the causes of delay in substation construction due to external factors

1.6. Delimitation and limitation of the study

The study of this paper will be limited to ETSIP2 lot I substation construction project six project sites of new substation construction, expansion and upgrading of existing ones. The project sites are placed in northern (Alamata, Muhoni, Mekelle) and eastern (koka,Hurso and Awash 7k) part of the country.

The study has the following limitation .Firstly the project is completed and the staff of most of the stakeholders is moved to other places which makes difficult to collect necessary data and hence the sample size is limited to staff that are available. For the same reason the consultant which is the key player in this project couldn't be included in the sample which is another limiting factor for the balance

of reasoning between groups. In addition the study is limited only to this lot project only and it will have a limitation in generalization of the findings. The paper has also a limitation in trying to analyze the importance of each factor in causing delay as it only tries to identify and rank causes of delay factors in each category.

1.7. Significance of the study

This work has significant contribution to project stakeholders. It provides information to project stakeholders (client, contractor and consultant) on the major causes of delay and help avoid or at least minimize the effects of project delay. Delays can lead to many negative effects such as lawsuits between clients and contractor, subcontractors and contractors, increased costs and contract terminations. In addition in case of EEP, project delay is the main bottle neck not to full fill the country power demand. The client as well as the government will be beneficial from this study by taking action against identified causes of delay. Furthermore; this study will help other researcher as a resource to make further research in the area.

1.8 Organization of the Study

This study was organized into five main chapters.

The first chapter is the introduction which includes the background to the study, problem statement, research questions, research objectives, scope and limitation of the study, significance and organization of the study.

Chapter two discusses the relevant literatures from the perspectives of scholars in this area of study. Chapter three constitutes of the methodology employed in the study. It includes the research design, source of data, sample and sampling technique, data collection techniques, data analysis.

The fourth chapter of this work includes analysis, presentations and interpretations of collected data.

The final chapter, chapter five provides summary of major findings, the conclusion of the study and suggests possible remedial recommendations.

CHAPTER TWO:

LITERATURE REVIEW

2.1. Introduction

In this chapter a critical review of different literatures' which were conducted on the area of both project management and construction project delays and their effects is conducted. Most of the literatures' discussed here under are conducted on different countries and situations to ascertain the fact that delay factors could be different in different countries and situations. The purpose of this chapter is to refer it and integrate with the finding of this study.

2.2. Definition of Project

A project is a temporary endeavor undertaken to create unique product, service, or result *(PMBOK, 2008.).* The temporary nature of projects indicates a definite beginning and end. According to *PMBOK*, the end is reached when the projects objectives have been achieved or when the project is terminated because its objective will not or cannot be met, or when the need for the project is no longer exists. Temporary does not necessarily mean short in duration. PMBOK implies the fact that, temporary does not generally apply to the product, service or result created by the project; most projects are undertaken to create lasting outcome.

Project management is the application of knowledge, skills, tools and techniques to project activities to meet the project requirements (*PMBOK, 2008).* The PMBOK guide divides project management processes in to initiating, planning, execution, controlling and closing process. A central idea is that these processes form a closed loop: the planning process provides a plan that is realized by the executing process, and variances from the base line or requests for change lead to correction sin execution or changes in further plans, (Howell, 2002).

According to *Mohamed, (2013)* Project success is measured by the planned time, cost and quality as they have their proven importance as a prime measures for project success. As it is prevailed above project requirements are commonly assumed to be time, quality and cost of a project. Success and failure of any project will be measured by these three requirements.

2.3. Construction Projects:

As defined by Mulyani, (2006), construction projects are series of projects related to the construction field who have limited time dimension with specific allocation of resources, in order to realize an idea and a particular purpose, after the idea is feasible. The main elements that are within a project are:

a) Cost: finance and investment.

b) Quality: the size of the desired quality and obvious requirements.

c) Quantity: large or dimensions of the project.

d) Time: when and how long it takes for the implementation of the building.

In the normal case construction projects go through a long and very complex process. Construction projects comprises a series of sequential and related many other project activities .Construction process starts with planning, design, and financing until the structure is ready for occupancy. Series of activities consisting of planning, design stage, the stage of the procurement, the implementation phase, maintenance phase, and preparation for use.

As explained by Belete , (2017) due to its nature, management of construction project is quite different from the management of other projects. The differences mainly stems from the nature and characteristics of construction projects. Considering these differences is very important for successful management of construction projects. The construction projects are usually capital intensive, complex; and require significant management skills, involvement and coordination of a wide range of experts in various fields (Chartered Institute of Building, 2002); and it is relatively labor intensive that consume large amount of materials and physical tools (Wubishet, 2004). Moreover, construction projects are subjected to a variety of laws and regulations that aim to bind all parties involved in the play and to ensure public safety and minimize environmental impacts, (Bennett, 2003).

On the other hand, the construction industry is the sum of all economic activities related to civil and building works starting from conception, planning, execution, and maintenance. Such works normally comprise capital investment in the form of roads, railways, airports, ports and terminals, dams, power generating stations, irrigation schemes, health centers and hospitals, educational institutions, warehouses, factories, offices and residential premises. Construction is widely acknowledged as the most important sector in a developing country’s investment program. Because of such a high contribution, the construction industry has a major influence on the economic growth of a country, (Belete, 2017).

2.4. Definitions of Construction Project Delay

As a unique nature of project, timely completion of the project is one of the measures for success of a project. Since project has different phases starting from its initiation to its closing, it may experience delays in its different phases. The focus of this paper is mainly delay in the implementation phase of a project.

Being a global phenomena project delay is defined by different scholars in different times as presented below.

In the study of Alaghbari, et al. (2007), delay is generally acknowledged as the most common, costly, complex and risky problem encountered in construction projects. Because of the overriding importance of time for both the Owner (in terms of performance) and the Contractor (in terms of money), it is the source of frequent disputes and claims leading to lawsuits.

The construction process is usually divided into 3 distinct phases: planning, design and construction (Baldwin et al. 1971) and it is in this last phase, where many unpredictable factors are involved, which usually occur most delays (Chan, Kumaraswamy 1998).

As indicated in the study of Divaya, 2015, construction delay is considered to be one of the most recurring problems in the construction industry and it has an adverse effect on project success in terms of cost, time, quality, and safety. There are several factors that cause delay in construction. Delay may be caused by clients, users, consultants, designers, owners, contractors and suppliers. Delay in construction project is considered one of the most common problems causing a multitude negative effect on the project and its participating parties. In addition in same study ,delay is defined as the time over run either beyond completion date specified in a contract or beyond the date that the parties agree upon for delivery of a project

According to Assaf et al. (2006) in construction, delay could be defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and due to labor cost increases. Kikwasi, (2012) ,in construction, the word “delay’’ refers to something happening at a later time than planned, expected, specified in a contract or beyond the date that the parties agreed upon for the delivery of a project , (Pickavance, 2005). Lo, Fung and Tung (2006) define delay as the slowing down

of work without stopping construction entirely and that can lead to time overrun either beyond the contract date or beyond the date that the parties have agreed upon for the delivery of the project.

2.5. Types of Delay

Theodore (2009) mentioned that there are four basic ways to categorize type of delays:

1. Critical or noncritical
2. Excusable or non-excusable
3. Compensable or non-compensable
4. Concurrent or non-concurrent

In the process of determining the effect of a delay on the project, the analyst must determine whether the delay is critical or noncritical. The analyst must also assess if delay are concurrent. All delays that are identified in the analysis will be excusable or non-excusable. Delay can be further categorized into compensable or non-compensable delays.

2.5.1. Critical Versus non – Critical delays

Delays that affect the project completion, or in some cases a milestone date, are considered as critical delays, and delays that do not affect the project completion, or a milestone date, are noncritical delays. If these activities are delayed, the project completion date or a milestone dater will be delayed. The determining which activities truly control the project completion date depends on the following:

a) The project itself

b)The contractor's plan and schedule (particularly the critical path)

c) The requirement of the contract for sequence and phasing

d)The physical constraint of the project, i.e. how to build the job from a practical perspective

2.5.2. Excusable versus Non-Excusable Delays

All delays are either excusable or non-excusable. An excusable delay is a delay that is due to an unforeseeable event beyond the contractor's or the subcontractor's control. Normally, based on common general provisions in public agency specifications, delays resulting from the following events would be considered excusable:

a. General labor strikes b .Fires, c. Floods d. Acts of God e. Owner-directed changes

f. Errors and omissions in the plans and specifications

g. Differing site conditions or concealed conditions

h. Unusually severe weather

i. Intervention by outside agencies

j. Lack of action by government bodies, such as building inspection

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

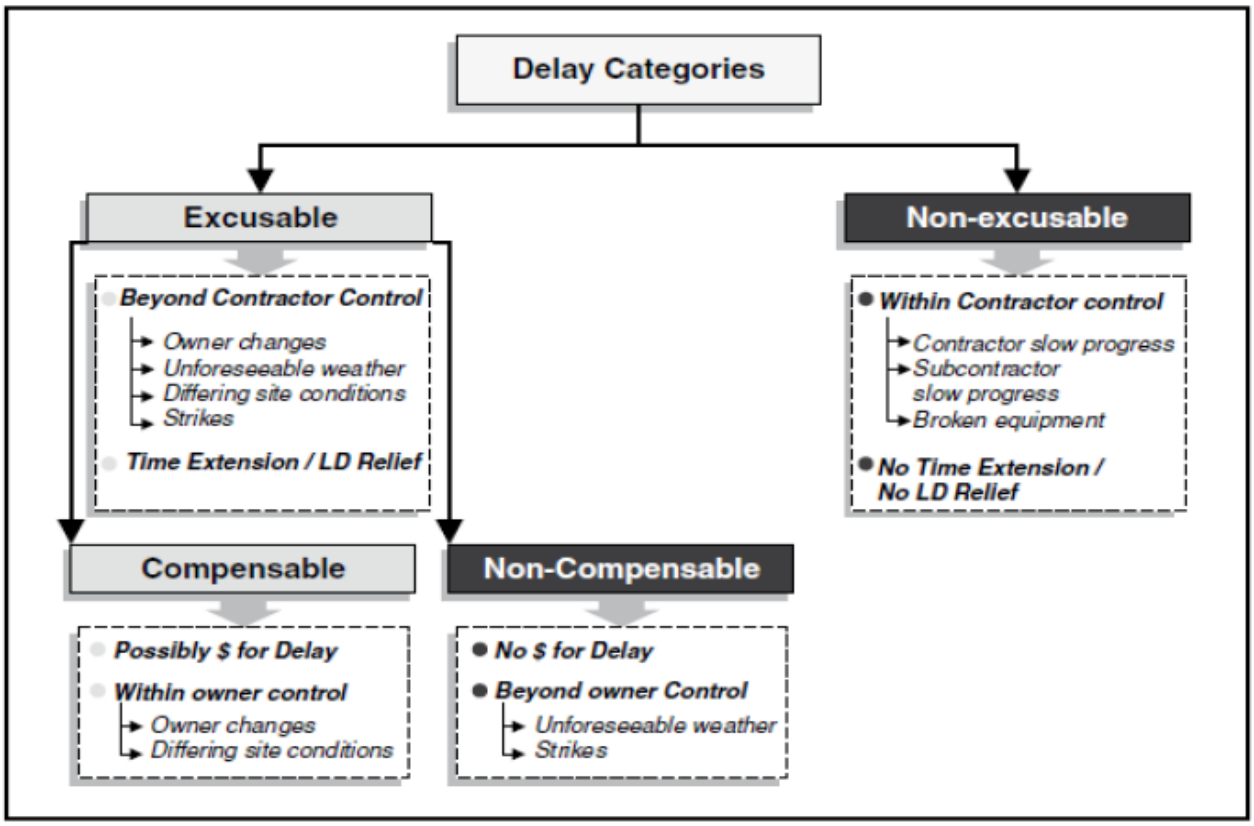
a. Late performance of sub-contractors

b. Untimely performance by suppliers

c. Faulty workmanship by the contractor or sub-contractors

d. A project-specific labor strike caused by either the contractor's unwillingness to meet with labor representative or by unfair labor practices.

Figure 2.1.: Delay categories (Theodore, 2009) page 25



2.5.3 .Compensable Delays versus Non-Compensable Delays

A compensable delay is a delay where the contractor is entitled to a time extension and to additional compensation.

Relating back to the excusable and non-excusable delays, only excusable delays can be compensable. Non-compensable delays mean 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 whether a delay is compensable must be answered. Additionally, a non-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 the 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.

2.5.4. Concurrent Delays

The concept of concurrent delay has become a very common representation as part of some analysis of construction delays. The concurrency argument is not just from the standpoint of determining the project's critical delays but from the standpoint of assigning responsibility for damages associated with delays to the critical path. Owners will often cite concurrent delays by the contractor as a reason for issuing a time extension without additional compensation. Contractors will often cite on current delays by the owner as a reason why liquidated damages should not be assessed for its delays. Unfortunately, few contract specifications include a definition of concurrent delay and how concurrent delays affect a contractor's entitlement to additional compensation for time extension or responsibility for liquidated damages.

In analyzed concurrent delays, each delay is assessed separately and its impact on other activities and the project duration is calculated. There are some guidelines for concurrent delays classification. Firstly, if excusable and non-excusable delays occur concurrently, only a time extension is granted to the contractor. Next, if excusable with compensation and excusable without compensation delays occur concurrently, the contractor is entitled to time extension, but not to damages. Lastly, if two excusable with compensation delays occur concurrently, the contractor is entitled to both time extension and damages.

In addition, although the guidelines are useful for the purpose of carrying out the delay analysis, it is in the best interest of all parties involved in a construction project to agree, at the beginning, the definitions of such delays and accommodate them throughout the contract language. There was no reliable method to differentiate the impact of contractor caused delays from client caused delays until the development of CPM schedule analysis is developed. By the available of sophisticated computerized techniques, the possibility to segregate the impacts of apparently concurrent client and contractor delays would be higher.

Table 2.1. Types of delay and responsible party as summarized by Ghiasur Rehman(2015)

Types of Delays			
Sr NO	Description	Responsible Parties	Results
1	Excusable/ compensation provided to contractor	Client	Generally Client takes the responsibility and accordingly contractors have the right to claim time and money
2	Excusable however no compensation is	Contractors	This kind of delay is excusable however contractor cannot claim compensation.
3	Non-Excusable delay	Contractors	Contractors are delayed in such cases and ends up paying liquidated damages
4	Concurrent delay	Either	Due to concurrent situation no compensation is granted however anything beyond is compensated

2.6. Causes of Delay

Construction delays are very common phenomena all over the world. There are many factors that contributed to causes of delays in construction projects. These range from factors inherent in the technology and its management, to those resulting from the physical, social, and financial environment. Being a common problem, many studies have been conducted in different countries with common and unique outcomes based on the environment the research is conducted. Working cultures, management style, project characteristic, methods of construction, local construction practices, geographical condition, stakeholders, the government policy, and economic situation, availability of resources, political situation and also different perspective of researchers are some of the reasons of delay variation in literature (Asnaashari et al., 2009)

As per Abebit (2013), delay in implementation of projects and cost increase are common phenomena in projects worldwide. However, these are especially severe in developing countries. Delayed

implementation gives a project a difficult star. Unduly long time taken for project implementation results in time-overrun which is invariably followed by cost overrun. Cost-overrun has the ill effect of affecting the financial viability of the project.

Based on the study conducted by Divya.R[1], S.Ramya[2], the top affecting causes of delays category wise are late in revising and approving design documents by owner, ineffective planning and scheduling by contractor, mistakes and discrepancies in design documents by consultant, changes in material types and late procurement of materials, equipment breakdowns, personal conflict among labors, and rise in prices of materials. When the causes were ranked overall, the main causes for delay are ineffective planning and scheduling by contractor, rise in prices of materials, late in revising and approving design documents by owner. The top effects of delay are time overrun and cost overrun, (Divya.R[1], S.Ramya[2] 2015).

Table. 2.2. Summary of delay causes in different countries

N0	County	Authors	Major factors
1	UAE	Zaneldin (2006)	Several factors including change order, ineffective communication, etc.
2	Turkey	Gündüz, Nielsen and Özdemir (2013)	Several factors including ineffective communication, conflicts between contractor and owner, et
3	Saudi Arabia	Assaf and Al-Hejji (2006)	Slow preparation and approval of shop drawings Late contractor payments Change orders Human resources Poor workmanship
3	Zambia	Kaliba, Muya and Mumba (2009)	Extreme weather Environmental protection and Mitigation cost, schedule delay ,strikes and technical challenges

4	Libya	Elharare,Elhaniash&Stevovic (2016)	Causes of delay depends on types of the project, its nature, size and complexity of the project, external influences- include economic, social, political physical environment, and Human Factors- include project manager, client, contractor, consultants, subcontractor, supplier, and manufacturers.
5	Vietnam	Van,Sang and Viet (2015)	Information delays, and lack of information exchange between the parties, Incompetent owner, incompetent supervision consultant, inadequate contractor's human resources, difficulties in financing project by owner, incompetent design consultant, difficulties in financing project by contractor, shortage of equipment of contractor ,etc
6	Iran	Alavifar,&Motamedi (2014)	Insufficient data collection and survey before design, Improper construction methods implemented by contractor, Difficulties in financing project by contractor, delay in progress payments by owner, Change orders by owner during construction, Rework due to errors during construction, Late in

			revising and approving design documents by owner, Original contract duration is too short, legal disputes b/w various parts, Delay in progress payments by ownerand poor communication and coordination by owner and other parties
7	India	Prakash& Joseph (2014)	Identified seven factors as: Client related, contractor related, consultant related, materials, equipment, labor and external factors
8	Uganda	Alinaitwe, Apolot, &Tindiwensi(2013)	Delayed payment, inadequate &inefficient equipment, rework due to poor quality, bureaucracy, change in work scope, high inflation & interest rate, poor Monitoring & control, fuel shortage
9	Nigeria	Ibronke,Oladinrin,Adeniyi&Eboreime(2013)	Insufficient amount of equipment, inaccurate time estimate, monthly payment difficulties, change order & inaccurate cost estimate
10	Nigeria	Mohammed &Isah(2012)	Improper planning, Lack of effective communication, Design errors, Shortage of supply like steel, concrete, Slow decision making, Financial issues, Shortage of material, etc
11	Singapore	Ayudhya(2011)	Contract and specification

			category, Insufficient working drawing details, Inaccurate bill of quantities, Inability of main contractor to sublet the contract during bidding, Violating condition of the contract, Poorly written contract, mistakes and discrepancies in design documents, Change orders, Shop drawing approval, Delay in progress payment by owner, Main contractor financial problems, etc.,
12	Tanzania	Geraldine John Kikwasi	Design changes, delays in payment to contractors, information delays, funding problems, poor project management, compensation issues and disagreement on the valuation of work done
13	Kenya	MsafiriAtibuSeboru(2015)	Payment by client, slow decision making and bureaucracy in client organization, inadequate planning and scheduling, and rain.
14	Pakistan		Natural disaster like flood and earthquake and some others like financial and payment problems, improper planning, poor site management, insufficient experience, shortage of materials

			and equipment etc
15	Ghana	Yaw Frimpong, Jacob Oluwoye Lynn Crawford	Monthly payment difficulties from agencies; poor contractor management; material procurement; poor technical performances; and escalation of material prices
15	Ethiopia	Werku and Jha, (2016).	contractor's financial difficulties, escalation of materials, ineffective planning and scheduling by contractors, delay in progress payments for completed works, lack of skilled professional in construction project management in contractor organization

As we have seen above there are various causes of delays in different countries. It can be seen that there are some common factors though different in their order of occurrence in different countries. Here below are list of causes of delay categorized into 7groups by Theodore (2009).

Table 2.3 .list of causes of delay by category

No	**Category of delay**
Group 1. Causes of delay by Client	1. Delay in progress payments by owner
	2. Delay to furnish and deliver the site
	3. Change orders by owner during construction
	4. Late in revising and approving design documents
	5. Poor communication and coordination
	6. Slowness in decision making process
	7. Conflicts between joint-ownership of the project
	8. Suspension of work

Group 2: Causes of delay by contractor	1.Difficulties in financing project by contractor
	2. Conflicts in sub-contractors schedule in execution of project
	3. Conflicts between contractor and other parties (consultant and owner)
	4. Ineffective planning and scheduling of project
	5.Difficulties in financing project by contractor
	6. Delays in sub-contractors work
	7. Inadequate contractor's work
	8. Frequent change of sub-contractors
	9. Poor qualification of the contractor's technical staff
	10. Delays in site mobilization
Group 3. Causes of delay by consultant	1. Delay in approving major changes in the scope of work
	2. Poor communication and coordination
	3. Inadequate experience of consultant
	4. Mistakes and discrepancies in design documents
	5. Delays in producing design documents
	6. Unclear and inadequate details in drawings
	7. Insufficient date collection and survey before design
	8. Un-use of advanced engineering design software
Group 4. Causes of delay by materials	1.Shortage of construction materials in market
	2. Changes in material types and specifications during construction
	3. Delay in material delivery
	4. Damage of sorted material while they are needed urgently

	5. Delay in manufacturing special building materials
	6. Late procurement of materials
Group 5. Causes of delay by Equipment	1. Equipment breakdowns
	2. Shortage of equipment
	3. Low level of equipment-operator's skill
	4. Low productivity and efficiency of equipment
	5. Lack of high-technology mechanical equipment
Group 6. Causes of delay by labors	1. Shortage of labors
	2.Working permit of labors
	3.Low productivity level of labors
	4.Personal conflicts among labors
Group 7. Causes of delay by external factors	1. Effects of subsurface conditions (e.g. soil, high water table, etc.)
	2. Delay in obtaining permits from municipality
	3. Hot weather effect on construction activities
	4. Traffic control and restriction at job site
	5. Accident during construction
	6. Changes in government regulations and laws

2.7. Effects of Project Delay

In her studies Anita Rauzana(2015) has explained the impact or effects of delay in the three main parties of project ,owner ,consultant and contractor .Impacts attributed to contactor are increase in overhead cost, increase the length of time for implementation. Overhead costs include costs for the company as a whole, regardless whether there is a contract that is being addressed. In the case of consultant, experiencing a loss of time, and will be delayed in doing other projects, and he owner, it means loss of income from the buildings which should already be used or rent. If the owner is the government, for public facilities such as hospitals would delay will be detrimental to public health services, or detrimental to the service program has been prepared. These losses cannot be valued in money that cannot be paid back. Meanwhile, if the owner is a non-government, such as the construction of buildings, shops, or hotel, of course the use of the building schedule will retreat from the planned time, so there is an empty time without getting any money.

Aibinu and Jagboro (2002) studied the effects of construction delays on project delivery in Nigerian construction industry. The six effects of delay identified were:

a) Time overrun;

b) Cost overrun;

c) Dispute;

d) Arbitration;

e) Total abandonment; and

f) Litigation.

Though the above list comprises the most common effect of delay identified most scholars, there are some more effects identified by other researchers, here below is a table with the summary of most common effects of delay with associated authors as summarized by GhiasurRehman,(2015).

Table 2.4 Common effects of delay

Sr. No	Common effects/consequences of delay	Researched and Identified by:
1	Risk related Acceleration, interruption, interference, loss of floats, site congestions	Kiswaki G.J (2012), Bower(2000), Hanna(1999, 2002,2004,2005
2	Others related factors- Arbitration, litigations, disputes, claims, law suits, poor professional relationships, damage of reputation	Kiswaki G.J. (2012), Sambasivan& Soon (2007), Arain&Pheng (2005)Haseeb et al (2011), Motaleb&Kishk (2010), Aibinu&Jagboro (2002).
3	Bankruptcy	Kiswaki G.J (2012)
4	Cost Related- Cost Overrun, increase in over heads, overtime costs, compensations, loss of earnings	Kiswaki G.J. (2012), Sambasivan& Soon (2007), Arain&Pheng (2005)Haseeb et al (2011), Motaleb&Kishk (2010), Aibinu&Jagboro (2002), Li et al (2000), Ramabodu&Verster (2010).
5	Create stress of Contractors	Kiswaki G.J (2012)
6	Delay by the client to return the loan	Kiswaki G.J (2012)
7	Delaying in getting profit by client	Kiswaki G.J (2012)
8	Idling Resources	Kiswaki G.J (2012)
9	Negative Social Impact	Kiswaki G.J (2012)
10	Negotiations	Haseeb et al (2011),
11	Poor Quality of works due to hurry	Kiswaki G.J (2012)), Li et al (2000)
12	Time Overrun	Kiswaki G.J. (2012), Sambasivan& Soon (2007), Arain&Pheng (2005), Hanna

		(1999, 2002,2004,2005), Bower (2000)Haseeb et al (2011), Motaleb&Kishk (2010), Aibinu&Jagboro (2002), Ramabodu&Verster (2010).
13	Total Abandonment	Kiswaki G.J. (2012), Sambasivan& Soon (2007)Haseeb et al (2011), Motaleb&Kishk (2010), Aibinu&Jagboro (2002).

2.8. Methods of Minimizing Construction Delays

Though of this study is mainly to identify major causes of project implementation delay and its effects, method of delay mitigation is reviewed to some extent.

When construction delay occurs, there is no question that the owner suffers financially, but the extent which the owner can recover its loss of income from the contractor, and more importantly minimizing the risk that such delays will occur, depends largely on how the construction contract was drawn up. Based on several studied of projects factors and ratifications of delays in construction projects, a total of 11 methods have been identified as follows (Abebit 2013)

As summarized by Abebit the following delay mitigating mechanism are suggested by Majid 2006, Long, 2006 and Assaf, 2006.

- ✓ Effective strategic planning (Majid,2006)
- ✓ Use of up to date technology
- ✓ Accurate initial cost estimation
- ✓ Proper material procurement
- ✓ Proper emphasis on past experience
- ✓ Proper planning and scheduling
- ✓ Frequent coordination between parties involved & By Long ,2008
- ✓ Site management and supervision & By Assaf ,2006

- ✓ complete and proper design and specification of the project on time

2.9. Conceptual frame work.

The conceptual frame work of the study flow is as shown below.

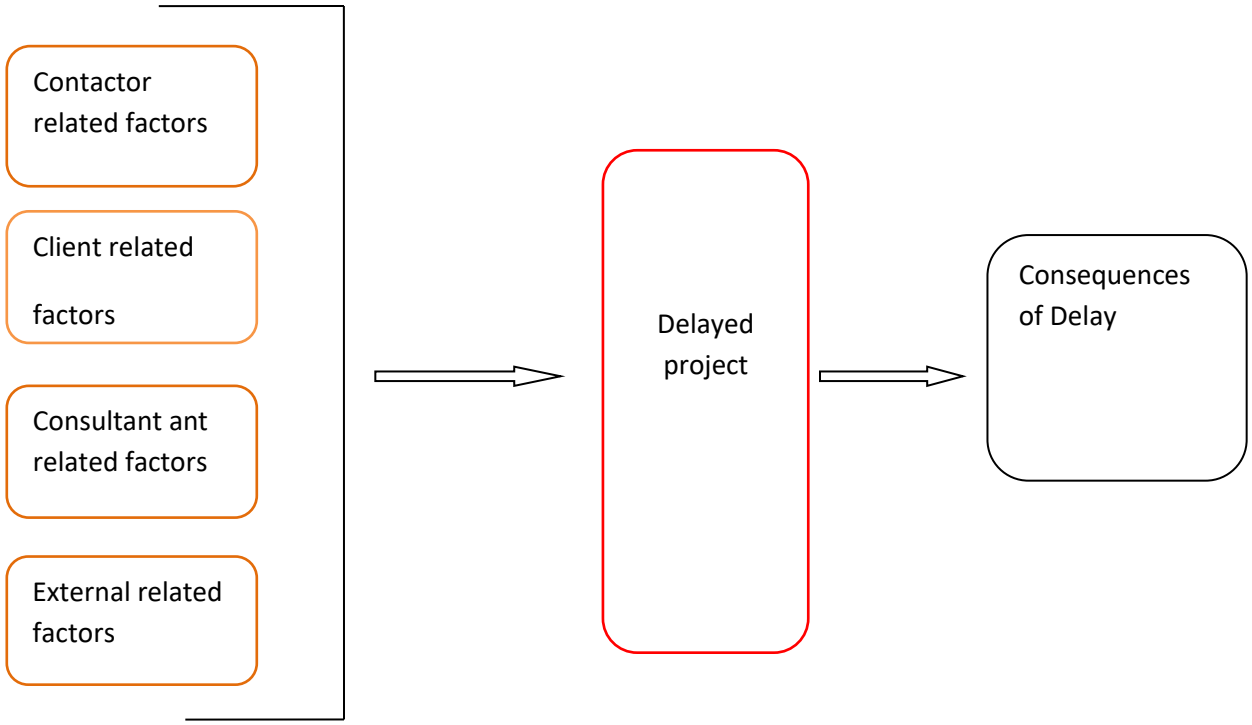


Figure 2.2. Conceptual frame work

CHAPTER THREE

RESEARCH ETHODOLOGY

This chapter briefly outlines the methodology followed in the course of the study. Design of the research, sources of data, data collection technique, population of the study, sampling technique, sample size, and ethical considerations are highlighted.

3.1. Research Design

Research design is a detailed outline of how a research will be conducted. A research design typically include how data is to be collected, what instruments will be employed, how the instruments will be used and the intended means for analyzing data collected.

The approach followed for this study is quantitative research method with descriptive theme. The rationale for the use of these methods is that such studies are more helpful to describe and interpret the result of facts that exist. It was also aimed to better meet the objectives of the study set out under the first chapter.

3.2. Source of data

The study used primary and secondary data source. Primary source of data collected through structured questionnaire from the case project while secondary data gathered through review of contract documents, reports and mints of meetings of the case project. In addition secondary source of data was collected from different source like books, Journals and different articles from the internet.

3.3. Data collection

Primary data were collected directly from the contractors and clients directly from the project through questionnaires and unstructured interviews. The questionnaires were addressed in close ended form. In addition unstructured interview is conducted with key personnel of the client and the contractor for

justification of the results of the analysis. Likert type scale of measurement was used to determine the level of agreement.

3.4. Sampling Design

3.4. 1 Population of the Study

The pools of population for this study were substation construction workers of the contractor, consultant and the client. The population includes project Manager, Site Manager, engineer, and Project member. The contactor is an international company with a local office located in Addis Abeba. Including site representatives, the contractor on average has had around 40 workers out of which 7 are engineers which is around 21.80%. From the client side there are 15 workers under the project office of which 6 are engineers involved in design review and site supervision. The percentage of the engineers is from client side is 40%. From the consultant side; there are 14 workers of (local office base) which is 64.23 % (9) are engineers. Total population is 40+15+14=69.

3.4.2 Sampling procedure/Sample size

Non-probability (deliberate or purposive) sampling techniques were applied for this study. The method applied because of the population is limited to only Engineers who participated in the case project.
Based on Mugenda & Mugenda (2003), when the target population is small (less than 1000 members), a minimum sample of more than 30% is a representative of the whole population, and considering the other research limitations at the execution of the research and the homogeneity of the target population, 40.58% sample of the target population were selected which means 28 sample respondents were selected.

3.5 Methods of Data Collection

A questionnaire survey designed based on the objectives of the study, which is mainly identifying causes of construction project implementation delays and consequences of delay in client and in contractor. The questionnaire survey includes close ended causes of factor categorized in four groups, and open ended question for the consequences of delay. The unstructured interview is also used to validate causes of delay sighted from literature review and to understand the special situations in this

project. In addition the unstructured interview is used to justify the why behind the different causes of delay.

Due the fact that the project is almost closed, the project team is moved to other places. So questioner was distributed mainly through internet using their email address to the contractor and client respondents. The questionnaire survey is developed to get understanding and opinion from the experienced respondent regarding to the delay of construction work. The questioner is classified in three parts:

1. Part I. Background of respondents

In this part, trials will be made to obtain the respondents' information. The questionnaire includes the position of the respondent in the company and the experience of the respondent in the construction project.

2. Part II. Causes of project implementation delay

The second part of the questionnaire focused on causes of substation construction delay. The respondents were asked to indicate their response on forty six well-recognized identified by Theodore, (2009) and other researchers as indicated in the literature review. Some additional factors are also added in relation with the uniqueness of the project and the contract type. The causes of delay are categorized in to four major groups as follows.

1. Client related factors.
2. Contractor related factors:
3. Consultant related factors:
4. Others or External factors:

The questionnaire is mainly based on Likert‟s scale of 5 ordinal measures from 1 to 5 according to level of contributing.

(5) = Very high contributing

(4)= High contributing

(3) =Medium contributing

(2) =Low contributing

(1)= Very low contributing

3.6 .Methods of Data Analysis

The analysis determines to establish the relative importance of the various factors that contribute to causes of construction delays. It consists of two steps to analyzing the data:

a) Calculating the Relative Importance index (RI I),
b) Ranking of factors in each category based on the Relative Importance Index (RII).

3.6.1 Relative Important index

Fagbenle et al, (2004) used the relative importance index method to establish the relative importance of the various factors identified as responsible for construction delay. The same method was adopted in this study within the various groups of respondents – clients, consultants, Contractors and external factors. The score for each factor is computed by summing up the scores given to it by the respondents. The Relative Importance Index (RII) was computed using the following formula:

$$RII = \frac{\sum PUi}{N(n)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where, RII = Relative Importance Index
Pi = respondent's rating of cause of delay
Ui = number of respondents placing identical weighting on cause of delay
N = No of respondents
n = the highest attainable score on cause of delay

Each individual cause's RII perceived by all respondents were used to assess the general and overall rankings in order to give an overall picture of the causes of construction delays in Etsip 2 lot 1 project.

3.6.2 The Spearman's Rank Correlation Coefficient

Spearman‟s rank correlation coefficient is a nonparametric measure of statistical dependence between two variables. It assesses how well the relationship between two variables can be described using a monotonic function. If there are no repeated data values, a perfect Spearman‟s correlation of +1 or −1 occurs when each of the variables is a perfect monotone function of the other. The value of the Spearman‟s rank correlation coefficient ranges from +1 (perfect positive correlation), to 0 (no correlation), to −1 (perfect negative correlation).

3.7. Ethical Considerations

The researcher made use of different data collection instruments from different sources. Utmost effort was exerted to acknowledge materials referred & the researcher takes the responsibility to keep confidentiality of respondents‟ opinions & unanimity of the rest of the information.

CHAPTER FOUR

DATA PRESENTATION ANALYSIS AND INTERPRETATION

This chapter presents analysis of the data collected from respondents using questioner. In order to assess and analyze the cause of delay in construction projects and its effect twenty (28) questioners distributed to the targeted client and contractors. The questionnaire survey was completed by project managers, project engineers, site manager, designers/engineer, and supervision engineers. The unstructured interview was conducted with EEP project coordinator, contractor project manager and contractor staff mainly on consequences of the project delay on each party and on other general issues of explaining the why behind the causes and general description of the project.

4.1. Background of the Respondents

4.1.1. Questionnaires distributed and collected

Twenty eighty questionnaires were distributed to the targeted consultant and client employees, fifteen questionnaires to each one which participated directly and indirectly. From the contractor side, as the company was international company, expatriates (14%) were included in the distribution. From the twenty eight sample distributed twenty one of them responded, 21(75%) of them responded.

Table. 4.1. Questionnaire distribution

	No distributed	No Returned	% Returned
Client			
Male	13	10	76.9
Female	1	1	100
Contractor			
Male (local)	13	9	69.23
Female(local)	1	1	100
Total	28	21	75

Source: survey data ,2018

The data presented in Table 4.1 demonstrates that there was a disparity in the representation of both male and female in the survey at 90.5 % and 9.5 % respectively. This could be due to the fact that the project requires mostly field works which in most cases not preferable by females in related to family responsibility and security issues. But it could be an indicator for further study especially in relation with the impact that it would have if fifty- fifty of the genders or the reverse of the current situation.

4.1.2. Educational background

Table 4.2. Respondent's educational background

Respondents educational background	Quantity
Masters	3
Degree	18

Source: survey data

4.1.3. Respondents experience in similar projects

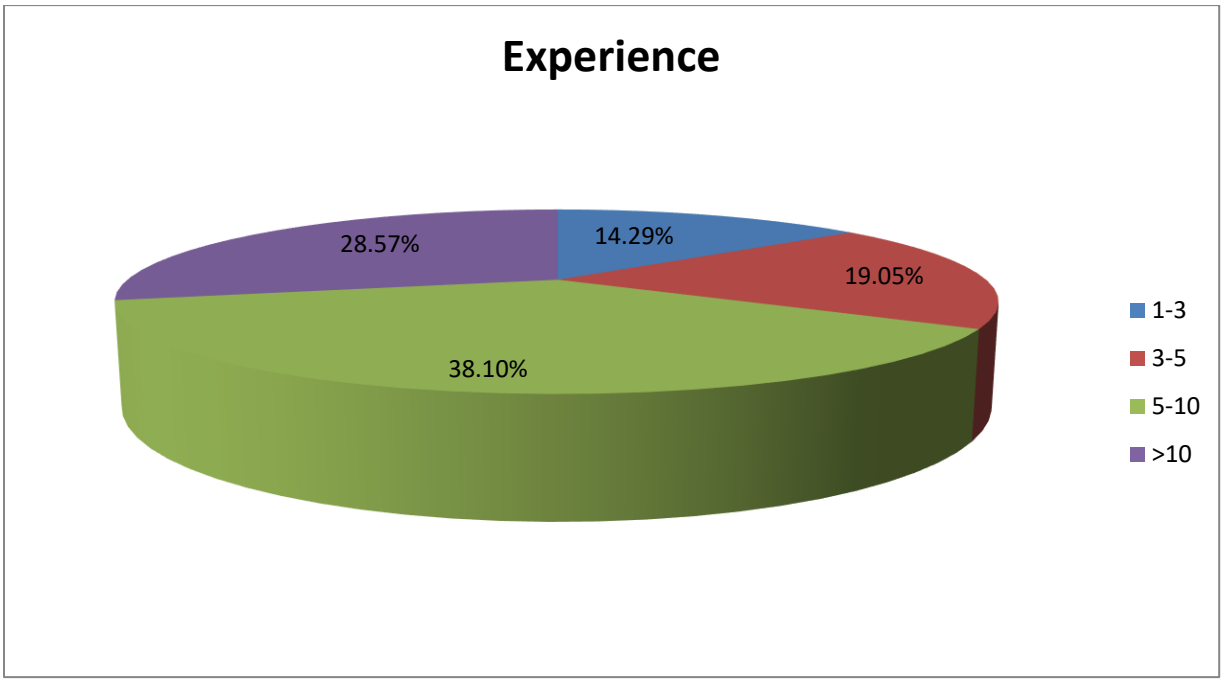


Figure 4.1 Respondents experience in similar projects

4.2 Data presentation and Analysis

In order to establish the groups of causes identified from the literature review and secondary data taken from the project like reports ,mints and different letters including the contract agreement ,the questioner was developed with open and closed ended questions. The causes of delay are categorized in four groups. Ranking method with relative index of each cause of delay was analyzed in order to identify the most influencing causes of delay. In addition to individual delay cause analysis; group causes analysis is also conducted to identify the major category of causes of delay from the four categories namely, client related, contractor related, consultant related and external factors related.

4.2.1 Client Related Delay

As identified in literature review, there are a number of factors that cause delay in construction project implementation in related with the owner of the project that is the client. Among different factors, I picked up the twelve more probable cases of delay specific to the case project. Analysis of the results from the questioner is presented below. Depending on relative importance index, the factors that cause delay in construction projects on behalf of client were ranked accordingly between groups of respondent of client and contractor. Referring the below table 4.2, lack of skill in contract administration is the first prioritized causes of delay by clients while slow decision making by client is the most contributing causes of delay by the client for the contractor. Delay in progress payment is ranked the third most causes of delay factor while the client respondents rated it as the second factor. In most literature review delay in progress payment is found the most influential factor. With a cross check the researcher made with unstructured interview with the contractor staff, it is in sighted that the main problem related with progress payment was getting approval or consensus for the take off and get signed. Once it is signed the duration it took to release the payment was in most of the time within the range of contract duration which was two month. The client is expected to pay progress payment within two month of delivering the request which by itself is long period from the perspective of the contractor. The contractor admits that the project office of the client tries to facilitate the payment once the request arrived in the head office signed by resident engineers and site supervisors.

In general from the overall result the first six most influencing factors in substation construction project delay are:

1. Lack of skill in contract administration
2. Slow decision making
3. Delay in progress payment by owner
4. Indecisiveness of client top management to consultant or contractor request
5. Failure to provide necessary system information and existing system drawings
6. Delay in revising and approving design documents

Table 4.3. Client related causes of delay

Client related delay causes	Client		Contractor		Average	
	RII	RANK	RII	RANK	RII	RANK
Lack of skilled manpower in contract administration	0.927273	1	0.7200	2	0.823636	1
Slow decision making	0.8000	3	0.7800	1	0.79000	2
Delay in progress payments by owner	0.836364	2	0.6800	5	0.758182	3
Indecisiveness of client senior Management to consultant's/contractor's request	0.781818	4	0.6000	8	0.690909	4
Failure to provide necessary system information and existing system drawings	0.672727	6	0.7000	3	0.686364	5
Delay in revising and approving design documents	0.690909	5	0.6800	5	0.685455	6
Type of bidding and contract award	0.581818	8	0.7000	3	0.640909	7
Late delivering of the site	0.563636	9	0.6600	7	0.611818	8
Change orders by owner during construction	0.654545	7	0.5400	11	0.597273	9
Discrepancies and/or deficiencies in contract agreement document	0.563636	9	0.5800	9	0.571818	10
Suspension of work by owner	0.418182	12	0.5600	10	0.489091	11
Selection of the lowest bidder contractor	0.527273	11	0.4200	12	0.473636	12

Source: owns survey, 2018

4.2.2 Contractor Related Delay

In table 4.4 below, the sixteen factors related to contractor for the delay of substation construction projects distributed in the form of questionnaires to the group of contractors and clients of respondents were analyzed and ranked depending on relative importance index. Poor cash flow of contractor ,poor management of the project ,and poor and unorganized procurement goods and services are the first three important delay factors related to contractor as rated by client while poor and unorganized procurement of

goods and services ,delay in subcontractors work ,poor planning and scheduling of the project were rated the first three important issue for the delay of the project . Poor Cash flow is the most important and challenging issue in construction projects. The contractor's poor cash flow could be due to different factors but one reason is the low performance of the contractor in each month which results in less amount of certification/approval for payment. So it makes difficult for the contractor to run the project. In this project, it is depicted that the general contractor fails to pay the subcontractor and the subcontractor fails to deploy enough manpower and machinery. In the other hand the contractor claims that the poor cash flow is resulted from poor performance of the subcontractors in each month and the contractor is obliged to finance the project from other sources. Poor and unorganized procurement of the goods and services was rated first by the contractors; this claim is mainly due all the major procurements of goods and services of the project that are on the critical path were all conducted from the contractor main head office abroad. The procurement department was in abroad and the project manager has confessed that there was information gap between the local and the head office. Electromechanical equipments were not arrived on time and also there was problem in sending complete part of equipment with full accessories which stops one millstone of work due to small missing item. Poor planning and scheduling is rated the third important delay factor by the contractor, this was due to mainly the unorganized procurement which makes impossible to do feasible schedule. Though the rank is a little different the client and the contractor groups of respondents agreed to some degree for the most important factors rated from one to four. In addition the result shows that the contractor has owned the delay causes related to it. Moreover, both respondent groups reached consensus on their least contributing factor which is delay in site mobilization and conflict of subcontractor's schedule. Though it is least contributing as delay factor, the researcher learnt that it is one of the most causes of conflict and it may lead to suspension of work if not solved on time.

As it can be seen in literature review, the top rated contractor related delay factors are non-excusable type of delays and don't entitle the contractor to compensation. In general the results of this research is more or similar to the findings of the other researchers in related to contractor related delay factors in construction projects .

In overall analysis the first six most contributing factor of delay related to contractor are:

1. Poor and unorganized procurement
2. Delay in subcontractors work
3. Difficulties in financing project due to poor cash flow of the contractor
4. Poor management of the project by the contractor
5. Poor planning and scheduling of project
6. Lack of appropriate machinery in the work site

Table 4.4 contractor's related causes of delay

Contractor related delay causes	Client		Contractor		Average	
	RII	RANK	RII	RANK	RII	RANK
Poor and unorganized procurement	0.872727	3	0.9600	1	0.91636	1
Delays in sub-contractors work	0.854545	4	0.9400	2	0.89727	2
Difficulties in financing project by contractor due to poor cash flow	0.909091	1	0.8800	4	0.87455	3
Poor management of the project by the contractor	0.890909	2	0.8000	10	0.84545	4
Poor planning and scheduling of project	0.763636	10	0.9200	3	0.84182	5
Lack of appropriate machinery in the work site	0.781818	9	0.8800	4	0.83091	6
Late procurement of electromechanical equipments	0.8000	7	0.8600	6	0.83	7
Design error that lead to wrong construction & rework	0.818182	6	0.8400	8	0.82909	8
Lack of support from top management	0.763636	10	0.8600	6	0.81182	9
Contractor' poor site management	0.80000	7	0.8200	9	0.81	10
Repeated design change	0.836364	5	0.6800	13	0.75818	11
Inadequate and unclear details in drawings	0.690909	14	0.8000	10	0.74545	12
Equipment damage and missing due to poor site management	0.709091	13	0.7600	12	0.73455	13
Poor qualification of the contractor's staff	0.727273	12	0.6800	13	0.70364	14
Conflicts in sub-contractors schedule in execution of project	0.654545	15	0.6400	15	0.64727	15
Delays in site mobilization	0.654545	15	0.5800	16	0.61727	16

Source: owns survey, 2018

4.2.3 Consultant Related Delay

Table 4.5 shows the results of questionnaires analysis of causes related to consultant with regard to substation construction delay. This table shows the manipulation of factors rank using relative importance index. Accordingly, both client and contractor groups agree on the first and second most contributing factor related with the consultant are as poor contract management by the consultant and late identification & resolution of drawings & specification errors & omissions. Though the consultant was a well known international company, the staffs assigned for this project were not that qualified, claims the client and the contractor .The staffs were contracted from other African countries or very old workers that were not even able to move on site were assigned. Due to lack of experience and competency drawings were rejected for very minor issue and it was impossible to precede construction on site and manufacturing of equipments of equipments. In addition the contract agreement was developed by the consultant but the standard, specified for some materials to be used in the project are international standard while the civil work is to be done by local contractor with local materials. Due to this the consultant was requesting some items that were not in the local market and it wasn't approving the local available replacement. In addition in such kind of projects the consultant must have professional that have expertise in power system protection, control and telecom issues. But the consultant's staff that was revising all protection control and telecom issues was unable to identify a major design error which was lately identified and done after the site is commissioned and start functioning. The second rated cause in relation to the consultant is an important issue, if design errors or omission are not identified on time it may cause rework or in some cases very risky or may cause a great failure when it is for protection or control system.

As the contract was EPC type the contractor was responsible to develop all design documents and the consultant has to revise and approve to start construction and also production of any equipment. Though it is not possible to start anything without getting approval from the consultant, for any error or omission in the design document the consultant is not liable. The researcher didn't get a chance to investigate what international contract standard relives the consultant from being responsible for all design approval it gives.

The researcher believes that this area could be researched more whether there is article making consultants free of responsibility for the design they approve and for the contract they manage or there is the article but it is not practiced.

Looking at the overall analysis, the most influencing factors related with consultant are:-

1. Poor management of the project by the consultant
2. Late identification & resolution of drawings & specification errors & omissions
3. Delay in approving design documents

Table 4.5. Consultant Related Delay

Consultant related delay causes	Client		Contractor		Average	
	RII	RANK	RII	RANK	RII	RANK
Poor management of the project by the consultant	0.872727	1	0.9000	1	0.886364	1
Late identification & resolution of drawings & specification errors & omissions	0.854545	2	0.8600	2	0.857273	2
Delays in approving design documents	0.745455	5	0.8600	2	0.802727	3
Poor communication and coordination	0.8	3	0.8000	4	0.8	4
Delay in approving major changes in the scope of work	0.763636	4	0.7800	5	0.771818	5
Week contractual enforcement between client and consultant	0.727273	6	0.6200	6	0.673636	6

Source: owns survey, 2018

4.2.4 External Factors Related Delay

There are twelve factors identified as external related delay factors global and specific to this project that are deemed to cause delay in substation construction projects. The factors are ranked based on relative important index from both contractors and contractor perspective as shown in Table 4.5. Both Client and contractors have ranked low productivity of labors as the most contributing factor .This may be due to lack of experience in such kind of projects. Lack of electromechanical equipment accessories in local market is rated second contributing factor by the contractor. Whenever some accessories or other small electrical materials are missing or finished it is not easy to find replacement in the local market, sometimes it becomes impossible even to get appropriate galvanized bolt and nut and it becomes obligatory to wait till it's imported from abroad by Cargo. Though the civil work is normal construction work, it is very sensitive and its error tolerance is almost zero in case of steel structure and other electromechanical equipments. Both contractor and client respondents agreed on the third most external related factor of delay that is equipment damage during transportation. Here equipment refers to the main component of substation switchyard equipment like HV transformers, circuit breakers, current transformers and the likes. Due to different causes (not researched in this paper) these equipments found damage on arrival on site. Since these equipments are manufactured based on an order and cannot be found in market, it may need minimum six month to year to get back that equipment. The researcher learnt that in this project there were five transformers damaged

during transportation and go back to maintenance to the manufacturer which took almost a year to get back the equipments after maintenance.

Prolonged process in Ethiopian revenue and customs offices is rated the fourth delay factor related to external causes of delay by contractor. Almost all equipments are imported with EEP's duty free privilege and a minimum of three to four days is necessary to finish the process .And in addition new regulation are introduced in different times which results in repeated work. Both respondents agree on the last three least influencing external factors, accident during construction, change in government regulation and price escalation of construction materials.

In general from the table, the first six influencing external factors related delay causes substation construction are:

1. Low productivity level of laborers
2. Lack of electromechanical equipment accessories in local market
3. Equipment damage during transportation
4. Prolonged process in ERCA
5. Shortage of skilled laborers
6. Location of sites and associated infrastructure.

Table 4.6. External factors Related causes of delay

Due to external factors	Client		Contractor		Average	
	RII	RANK	RII	RANK	RII	RANK
Low productivity level of labors	0.727273	1	0.7600	1	0.743636	1
Lack of electromechanical equipment accessories in local market	0.654545	4	0.7200	2	0.687273	2
Equipment damage during transportation	0.672727	3	0.6800	3	0.676364	3
Prolonged process in ERCA	0.563636	9	0.6600	4	0.611818	4
Shortage of skilled laborers	0.618182	6	0.6000	5	0.609091	5
Location of sites and associated poor infrastructure	0.6000	7	0.6000	5	0.6000	6
	0.636364	5	0.5600	7	0.598182	7
Shortage of construction materials in market	0.690909	2	0.5000	10	0.595455	8
Unstable political situation	0.581818	8	0.5400	9	0.560909	9
Price escalation of construction materials	0.545455	10	0.5600	7	0.552727	10
Changes in government regulations and laws	0.527273	11	0.4600	11	0.493636	11
Accident during construction	0.363636	12	0.4200	12	0.391818	12

Source: owns survey, 2018

4.2.5 Individual Cause Analysis by Relative Importance Index

Depending on the aforementioned tables and as indicated in the methodology a total of forty six causes that contributed to the delay of substation construction project were identified, ranked and analyzed as indicated in Annex 2.

Accordingly, for client respondents the top five causes of delay for the case project are:

1. Difficulty to run the project due to poor cash flow of the contractor
2. Poor management of the project by the contractor
3. Poor and unorganized procurement of goods and services
4. Poor management of the contact by consultant
5. Delay in subcontractors work

For contractor respondents, the top five causes of delay are:

1. Poor and unorganized procurement of goods and services
2. Delay in subcontractors work
3. Poor planning and scheduling of the project
4. Poor management of the contact by consultant
5. Lack of appropriate machineries in the work site.
6. Difficulty to run the project due to poor cash flow of the contractor

In summary the top ten delay factors identified are:

1. Poor and unorganized procurement
2. Delays in sub-contractors work
3. Poor management of the contract by consultant
4. Difficulty to run the project due to poor cash flow of the contractor
5. Late identification & resolution of drawings & specification errors & omissions
6. Poor management of the project by the contractor
7. Poor planning and scheduling of project
8. Lack of appropriate machinery in the work sites.
9. Late procurement of electromechanical equipments
10. Design error that lead to wrong construction & rework

As discussed in the literature review the tope delay factors can be more categorized in type of delay, accordingly the first , second ,fourth and from six to tend delay factors go to contractor related and are non excusable and non compensable type of delay as the contractor is responsible for all procurements construction works and all subcontractors works. The third and the fifth delay factors go to consultant related and it is excusable type of delay but it needs further study to classify it compensable or non compensable type of delay.

4.2.6 Group Cause Analysis by Relative Importance Index

As it was stated in the methodology, the causes of substation construction delay were categorized in to four main groups. All of them analyzed and ranked by group using relative importance index. As depicted in the table below for client respondents, contractor related delay and consultant related delay are the first and the second while for contractor respondent's consultant related delay and contractor related delay factors are the first and the second rated category of delay factors. Both client and

consultant agreed on the third and fourth category of delay which is client related and external related respectively.

Looking at overall analysis, the order of delay categories from the most contributing to least contributing are:

1. Contractor related causes of delay
2. Consultant related causes of delay
3. Client related causes of delay
4. External factors related delays.

As can be seen in the group cause analysis, the most contributing delay factors belong to contractor related which is more of non excusable and non compensable delays except in special conditions. In this case project, the researcher is able to learn that, the contractor was not granted for any time extension and also didn't present any claim for the client or the consultant for extended delay of the project.

Table 4.7. Group cause analysis by Relative importance index

Due to external factors	Client		Contractor		Average	
	RII	RANK	RII	RANK	RII	RANK
Contractor Related causes of delay	0.782955	1	0.8063	2	0.794602	1
Consultant Related causes of delay	0.778788	2	0.8100	1	0.794394	2
Client Related causes of delay	0.668182	3	0.6350	3	0.651591	3
External factors related causes of delay	0.598485	4	0.0633	4	0.330909	4

Source: owns survey, 2018

4.2.7. Agreement Analysis

The Spearman's rank correlation coefficient (ρ) is used to show the degree of agreement between the rankings of the two parties (Contractor and clients). The Spearman's rank correlation coefficient (ρ) is calculated as follows:

$$\rho = 1 - \frac{6\Sigma d2}{n(n2-1)} \quad \text{..... (2)}$$

Where:

d = the difference between the ranks given by any two respondents for an individual cause and

n = the number of causes or groups, which in this case is 46 causes or 4 groups.

Using excel Data analysis it found that the ranking of delays factor between the two groups, client and contractor is highly correlated as shown in the below table.

Table 4.8 .Correlation of relative importance index of client and contractor group

	Client	*Contractor*
Client	1	
Contractor	0.796561	1

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The main objective of this study is to identify the major causes of substation construction delay from the perspective of Client, contractor and consultant. The study identifies a total of forty six causes of substation construction delay factors in four categories, Client related, Contractor related, Consultant related and external factors related.

From the forty six factors identified the top ten main causes are identified using RII from the respondent selection as listed below in descending order.

1. Poor and unorganized procurement
2. Delays in sub-contractors work
3. Poor management of the contract by the consultant
4. Difficulty to run the project due to poor cash flow of the contractor
5. Inadequate experience of consultant
6. Poor management and supervision of the project by the contractor
7. Lack of appropriate machineries in the work site
8. Poor planning and scheduling of project
9. Late procurement of electromechanical equipments
10. Design error that lead to wrong construction & rework

The 46 factors were categorized into three major groups and were ranked.

1. Contractor related factors
2. Consultant related factors
3. Client related factors

The overall result shows that contractor related delay factors are rated first followed by consultant related factors in substation construction projects.

5.2 .Recommendation

Based on the findings, the study recommends that all project stakeholders to pay greater attention in influencing the top ten delay causing factors described in the right way and at the right time to increase the likelihood of project success.

The study critically recommends that the project stakeholders need to pay attention on their respective issues related to them in their order of importance namely:

Clients to pay higher attention on:

1. Developing skills in contract administration; this will make EEP administer project by itself and to capacitate itself to control and supervise the consultant when the contract administration is outsourced. Currently most projects are outsourced to Consultants.
2. Developing better organizational culture in regard to on time decision making so that consultants and contractor can take action without any delay. In addition Client has to make improvements in providing progress payments on time in order to have a normal and continuous activity of the project.
3. Client has to make proper care in selecting right contractor and consultant. Since most contract types are EPC type contractor will be responsible for all engineering work, procurements of goods and service and construction and the consultant is the project manager approving every milestone of the project. A wrong contractor or a wrong consultant will cause adverse effects in the success of the project.
4. Proper follow up of contractors and consultants: Though the management of such projects is though consultant and all responsibilities are the contactor for any damage of the facilities or equipments of the project, the client has to be an active participant in supervising every activity since every minute wrong action impacts the final success of the project. The client has to be capable of questioning and intervening the decision of the consultant whenever necessary. In parallel, the client should have a list or a database for prior performance of local subcontractor so that international contractor who doesn't have the right information doesn't fall in the wrong subcontractor which plays a great role in timely completion of the project.

On the other hand, contractors' especially international contractor should take care of the following points

- The head office must have a good communication with local office and should ensure there is not any information Gap.
- The contractor should supervise and follow up each activity in site and has to guide and control all the subcontractors.
- Contractor should first study the cultural issue of local peoples before starting projects in order to deal with local subcontractors.
- It is better to have a procurement team in local office that works in collaboration with the team in head office.
- Contactor should take great attention to logistic issues for all the equipments sent from abroad.

References:

Abd El-RazekM.E, Bassioni HA, MobarakAM.(2008) Causes of delay in building construction projects in Egypt. Journal of construction Engineering Management, 134(11):831–41.

Abebit H.mariam: Causes and effects of project Implementation delay on Loan Recovery Performance May 2013 page 19

Adams, J., Khan, H., Raeside, R., & White, D. (2007). Research Methods for Graduate Business and Social Science Students. Response Books; New Delhi

Aibinu AA, Jagboro GO. The effects of construction delays on project delivery in Nigerian construction industry. Int J Project Manage 2002; 20:593-9.

Alaghbari,W. E., M. Razali,A. Kadir,A.Salim and Ernawati (2007). "The significant factors causing delay of building construction projects in Malaysia." Engineering, Construction and Architectural Management 14(2): 192-206.

Assaf, S.A. and Al-Heiji (2006), Causes of Delays in Large Construction Projects. International Journal of Project Management, Volume 24, 349 -357.

Belete Botre: A study on cause's construction project Delay: Case of Mojo Dry port, June 2017.

Contract document, ETSIP 2 LOT I Project.

Chan, D.W.M. and Kumaraswamy, M.K., "Compressing Construction Durations: Lessons Learned from Hong Kong Building Projects," *International Journal of Project) Management*, Vol. 20, pp. 23-35 (2002).

Duran,O. (2006).Current risk management applications in Turkish construction Economics, 26(4): 395–408

EEA (2006/07) Report on the Ethiopian Economy: The current State of the Construction Industry, Volume VI.

Fikirte wondimu: Analyzing the causes and effects of road construction delays : the case of Rama construction,: June 2017.

Gerring, J. (2004). What Is a Case Study and What Is It Good for? *American Political*

Haseeb, M. (2011) "Causes and effects of delays in large construction projects of Pakistan." Kuwait Chapter of Arabian Journal of Business and Management Review.1(4),18-42

Kerzner,H.(2003) Project Management. A Systems Approach to Planning, Scheduling, and Controlling. John Wiley and Sons Inc., New Jersey

Lo,T.Y., Fung, I. W. H., Tung, K. C. F. (2006), 'Construction delays in Hong Kong civil engineering projects. Journal of Construction Engineering and Management 132(6) 636-49.

Long L.H., Lee Y.D. and Lee J.Y (2008). Delay and Cost Overruns in Vietnam Large Construction: A Comparison with Other Selected Countries. KSCE Journal of Civil Engineering. Volume 12. Issue 6. Pages 367-377.

Majid, I.A. (2006). Causes and Effects of Delays in Aceh Construction Industry. Master of Science in Construction Management.UniversitiTeknologi Malaysia.

Marczyk, G., DeMatteo, D., & Festinger, D. (2005). Essentials of Research Design and Methodology, New Jersy: John Wiley & Sons, Inc.

Mugenda, O. and Mugenda, A. (2003) *Research Methods: Quantitative and Qualitative Approaches.* Nairobi, Acts Press.

Mulyani, E. (2006).*Construction Management*. Aceh Besar: FakultasTeknikUntan.

National Plan Commission (2016), Growth and Transformation Plan-II, Vol.1, Addis Ababa.

Parviz, F (2002).Project estimating and cost management Parviz F. Rad. p. cm. - (Project management essential library)

Pickavance, K.2005.Delay and disruption in construction contracts, 3rdedition.Informal Legal Publishing UK.

PMI (2013); A Guide to the Project Management Body of Knowledge,(PMBOK-Guide) 8thed

Popescu, C. M., & Charoengam, C. (1995).*Project Planning, Scheduling, and Control in Construction*. Canada: John Willey & Son, p.188.

Divya.R,Ramya S.(2015).Causes, Effects and Minimization of Delays in Construction Projects, National Conference on Research Advances in Communication, Computation, Electrical Science and Structures (NCRACCESS), www.internationaljournalssrg.org

Scott,S.,(1993) "The nature and effects of construction delays", Construction Management and Economics, 11(5) 358- 369, 1993

Scott, S. (1997). Delay Claims in UK Contracts. Journal of Construction Engineering and Management, Sept 1997, p.238

Sunjka,B.P and Jacob U.(2013), Significant Causes and Effects of Project Delays in the Niger Delta Region, Nigeria, Proceeding of SAIIE25 , paper presented at South Africa SAIIE, SAIIE25 Proceedings, South Africa ,July,9th – 11th

Wubshet Jakal (2004).performance for public construction project in Developing countries, Federal Road and Educational Building projects in Ethiopia, Norwegian University of Science &Technology, Norway

Theodore J. Trauner Jr. et al. (2009). Types of Construction Delays. Construction Delays (Second Edition), 2009, Pages 25-36

Long L.H., Lee Y.D. and Lee J.Y (2008). Delay and Cost Overruns in Vietnam Large Construction: A Comparison with Other Selected Countries. KSCE Journal of Civil Engineering. Volume 12.Issue 6. Pages 367-377

Kikwasi, G.J. (2012) 'Causes and effects of delays and disruptions in construction projects in Tanzania', Australasian Journal of Construction Economics and Building, Conference Series, 1 (2) 52-59

Zinabu Tebeje Zewdu, : Projects Delay and Their Antidotes: The Case of Ethiopian Construction Sector April 2016

Annex I.
Questionnaire.

Addis Ababa University
College Of Business and Economics
School of Commerce
MA in Project Management
Questionnaire for Project Work

Note of Permission:

Dear Respondents, My name is Aster Muluneh . Currently, I am undertaking a research to analyze causes of project delay and its effects in case of ETSIP lot I project in EEP. The research paper is intended for the partial fulfillment of Masters Degree in Project Management at Addis Ababa University School of commerce. The information you provide will be used only for the purpose of the study and will be kept strictly confidential. Please do not write your name or contact details on the questionnaire. Thank you in advance for your kind cooperation. For further information, you can contact me through: *Tel: (+251)-920-878120 & email add: asterm98ster@gmail.com*

Part 1: General Organization Information

1. Name of organization you're part of _____
2. Gender Male □ Female □
3. Level of education

1st degree □Masters □others please specify_____

2nd degree □ PhD □

4. Job title_____
5. Relevant working experience **(**Years**)**:

1-3 Yrs □ 5-10 Yrs □

3-5 Yrs □ >10Yrs □

Part 2. **Factors that Contributing to Causes of Construction Delays**

Please use a tick (√) mark to answer the following statements

Each scale represents the following rating:

(5) Very high contributing (4) High contributing (3) Medium contributing

(2) Low contributing (1) Very low contributing

Categories	**Causes of delay**	**1**	**2**	**3**	**4**	**5**
1.Client Related delay causes						
1.1	Late delivering of the site					
1.2	Change orders by owner during construction					
1.3	Delay in progress payments by owner					
1.4	Delay in revising and approving design documents					
1.5	Slow decision making					
1.6	Suspension of work by owner					
1.7	Selection of the lowest bidder contractor					
1.8	Lack of skilled manpower in contract administration					
1.9	Failure to provide necessary system information and existing system drawings					
1.10	Indecisiveness of client senior Management to consultant's/contractor's request					
1.11	Discrepancies and/or deficiencies in contract agreement document					
1.12	Type of bidding and contract award					
2. Contractor related delay causes						
2.1	Inadequate and unclear details in drawings					
2.2	Repeated design change					
2.3	Design error that lead to wrong construction & rework					

Categories	Causes of delay	1	2	3	4	5
2.4	Difficulties in financing project by contractor					
2.5	Conflicts in sub-contractors schedule in execution of project					
2.6	Late procurement of equipment electromechanical equipments					
2.7	Poor planning and scheduling of project					
2.8	Delays in sub-contractors work					
2.9	Lack of appropriate machinery in the work site					
2.10	Contractor' poor site management					
2.11	Poor qualification of the contractor's staff					
2.12	Poor management of the project by the contractor					
2.13	Equipment damage and missing due to poor site management					
2.14	Poor and unorganized procurement					
2.15	Delays in site mobilization					
2.16	Lack of support from top management					
3.Consultant Related causes of delay						
3.1	Delay in approving major changes in the scope of work					
3.2	Poor communication and coordination					
3.3	Late identification & resolution of drawings & specification errors & omissions					
3.4	Poor management of the contract by the consultant					
3.5	Delays in approving design documents					
3.6	Week contractual enforcement between client and consultant					
4. External Factors Related						
4.1	Effects of subsurface conditions (e.g. soil, high water table, etc.)					
4.2	Price escalation of construction materials					
4.3	Lack of electromechanical equipment accessories in local market					
4.4	Accident during construction					
4.5	Changes in government regulations and laws					

Categories	Causes of delay	1	2	3	4	5
4.6	Prolonged process in ERCA					
4.7	Shortage of construction materials in market					
4.8	Complexity of the project					
4.9	Unstable political situation					
4.10	Equipment damage during transportation					
4.11	Shortage of labors					
4.12	Low productivity level of labors					

Thank you!!!

Annex 2. Individual cause analysis by relative importance index

Causes of delay	Client		Contractor		Average	
	RII	RANK	RII	RANK	RII	RANK
Poor and unorganized procurement	0.872727	4	0.9600	1	0.916364	1
Delays in sub-contractors work	0.854545	5	0.9400	2	0.897273	2
Late identification & resolution of drawings & specification errors & omissions	0.890909	2	0.9000	4	0.895455	3
Difficulties in financing project by contractor	0.909091	1	0.8800	5	0.894545	4
Poor contract management by the consultant	0.854545	5	0.8600	7	0.857273	5
Poor management of the project by the contractor	0.890909	2	0.8000	14	0.845455	6
Poor planning and scheduling of project	0.763636	16	0.9200	3	0.841818	7
Lack of appropriate machinery in the work site	0.781818	13	0.8800	5	0.830909	8
Late procurement of electromechanical equipments	0.8	10	0.8600	7	0.83	9
Design error that lead to wrong construction & rework	0.818182	9	0.8400	11	0.829091	10
Lack of support from top management	0.763636	16	0.8600	7	0.811818	11
Poor communication and coordination	0.781818	13	0.8400	11	0.810909	12
Contractor' poor site management	0.8	10	0.8200	13	0.81	13
Delays in approving design documents	0.727273	19	0.8600	7	0.793636	14
Slow decision making	0.8000	10	0.7800	16	0.79	15
Delay in approving major changes in the scope of work	0.745455	18	0.7800	16	0.762727	16
Delay in progress payments by owner	0.836364	7	0.6800	24	0.758182	17
Repeated design change	0.836364	7	0.6800	24	0.758182	17
Inadequate and unclear details in drawings	0.690909	24	0.8000	14	0.745455	19
Low productivity level of labors	0.727273	19	0.7600	18	0.743636	20

Equipment damage and missing due to poor site management	0.709091	23	0.7600	18	0.734545	21
Lack of skilled manpower in contract administration	0.727273	19	0.7200	20	0.723636	22
Poor qualification of the contractor's staff	0.727273	19	0.6800	24	0.703636	23
Indecisiveness of client senior Management to consultant's/contractor's request	0.781818	13	0.6000	33	0.690909	24
Lack of electromechanical equipment accessories in local market	0.654545	30	0.7200	20	0.687273	25
Failure to provide necessary system information and existing system drawings	0.672727	28	0.7000	22	0.686364	26
Delay in revising and approving design documents	0.690909	24	0.6800	24	0.685455	27
Equipment damage during transportation	0.672727	28	0.6800	24	0.676364	28
Week contractual enforcement between client and consultant	0.690909	24	0.6200	32	0.655455	29
Conflicts in sub-contractors schedule in execution of project	0.654545	30	0.6400	31	0.647273	30
Type of bidding and contract award	0.581818	37	0.7000	22	0.640909	31
Delays in site mobilization	0.654545	30	0.5800	36	0.617273	32
Late delivering of the site	0.563636	39	0.6600	29	0.611818	33
Prolonged process in ERCA	0.563636	39	0.6600	29	0.611818	33
Shortage of skilled laborers	0.618182	35	0.6000	33	0.609091	35
Location of sites and associated poor infrastructure	0.6	36	0.6000	33	0.6	36
complexity of project	0.636364	34	0.5600	38	0.598182	37
Change orders by owner during construction	0.654545	30	0.5400	41	0.597273	38
Shortage of construction materials in market	0.690909	24	0.5000	43	0.595455	39
Discrepancies and/or deficiencies in contract agreement document	0.563636	39	0.5800	36	0.571818	40

Unstable political situation	0.581818	37	0.5400	41	0.560909	41
Price escalation of construction materials	0.545455	42	0.5600	38	0.552727	42
Changes in government regulations and laws	0.527273	43	0.4600	44	0.493636	43
Suspension of work by owner	0.418182	45	0.5600	38	0.489091	44
Selection of the lowest bidder contractor	0.527273	43	0.4200	45	0.473636	45
Accident during construction	0.363636	46	0.4200	45	0.391818	46