

**ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES**



**CAUSES AND EFFECTS OF DELAY IN ETHIOPIAN RAILWAY
CONSTRUCTION PROJECT IN CASE OF AWASH-
KOMBOLLCHA-HARAGBYIA (AKH) RAILWAY PROJECT**

A Thesis Proposal to be Submitted for the Department of Management in Partial Fulfillment for the Award of Master of Arts (MA) Degree in Project Management

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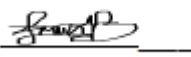

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Declaration

I, the undersigned, declare that this project work entitled “**Causes and Effects of Delay In Ethiopian railway Construction Projects: The Case of Awash-Kombollcha – Haragebyia Railway Project**” is my original work. This project work has not been presented for any other university and that all sources of material used for the thesis have been duly acknowledged.

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Statement of Certification

This is to certify that Abdurahman Badshe has carried out this project work entitled **“Causes and Effects of Delay In Ethiopian railway Construction Projects: The Case of Awash-Kombollcha – Haragebyia Railway Project”** under my supervision. This work is original in nature and it is sufficient for submission as the partial fulfillment for the award of Degree of Masters of Art (MA) in Project Management.

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Abstract

Delay is one of the biggest problems often experienced on construction project sites. Delays can instigate negative effects such as increased costs, loss of productivity and revenue, many lawsuits between owners and contractors and contract termination. The aim of this project is to investigate the causes and effects of delay on Ethiopian railway construction project. Purposive (non-probability, deliberate) sampling technique was used in this study. Population sample of 180 was used in this work. From the total sample one hundred thirty one (131) was deployed. A structured questionnaire in Likert scale was used in data collection. Thirty (30) project delay attributes were identified through detailed literature review. This research categorized the causes of delay under eight main groups of client related, consultant related, contractor related, labor and equipment related, material related, contract related, contractual relationship related and external related and then the data obtained were analyzed using the Relative Importance index (RII). Based on RII result, The top five most influential causes of railway construction project delays were identified as: (1) Poor communication and coordination of the owner with other parties (RII=0.898), (2) lack of communication between all parties involved in the project (RII=0.862), (3) Delay caused by subcontractors (RII=0.827), (4) long waiting time for approval of test and inspection (RII=0.815), and (5) mistakes in design documents (RII=0.798). In addition, six effect of delay were identified. the top major effects of delay were; time overrun, cost overrun, dispute, arbitration, litigation and abandonment.

Key Words: *Delay, Delay causes, Delay Effects, Project, Project Management, Relative Importance Index (RII), Railway construction projects*

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Abbreviations

AKH Awash-Kombollcha-Haragebyia

AALRT Addis Ababa Light Rail Transit

ERC Ethiopian Railway Corporation

NRN National Railway Network

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Infrastructure refers to the fundamental facilities and systems serving a country, city, or other area as well as the services and facilities necessary for its economy to function (Steven, 2003). For example, transportation infrastructures are critical to economic growth and an important tool for a country's overall progress. The growth of global railway infrastructure development has encouraged many countries including Ethiopia to develop railway as a key strategy to enhance the national transportation infrastructure and strengthen economic competitiveness. In addition, investment in large railway projects have to contribute like, increasing the attractiveness of public transport, improvement of its position in the market, increase of its turnover, increase of its profitability, reduction of travel time and majorly reduction of maintenance cost, Nevertheless, the development of railway infrastructure projects demands massive land use, high cost, huge resources and time. These demands have great impact on the economy, environment and social wellbeing (Spang, 2003).

A lack of railways, ports and quality roads has hindered Africa's development in recent years. But nowadays, economic heavyweights such as China and India pumping billions of dollars into Africa to transform the continent's fortunes and stake a claim in the world's next high-growth territory (Economic Times, 2016). As a result, of the major constraints in the transport infrastructure service like limited connectivity, outdated railway network, high transport cost, poor quality of transport services and growing mobility needs of people, the Ministry of Transport of FDRE was found to be careful to develop railway system in the country (Yehualaeshet,2012). As a very cost-effective means of transport over long distances, the Ethiopian railway infrastructure development projects are expected to significantly stimulate the national economy and accelerate regional integration (The Ethiopian Messenger, 2016).

The Ethiopian Railway Corporation (ERC) was set up in 2007 with the mandate to construct railway infrastructure and provide passenger and freight rail transport service in Ethiopia. The infrastructure consists of two railway project components, namely the Addis Ababa light rail transit (LRT) and National Railway Network (NRN). The NRN consists of eight corridors of

varying lengths in diversified strategic routes that will be realized in to two phases, covering over 5000 km in distance. Awash- Kombolcha-Hara Gebaya Railway Project is on part of National Railway Network (NRN) .Awash-Kombolcha-Hara Gebaya Railway Project, which has a length of 392 kms, initiating from the north east of the city of Awash and arrive to Weldia through the city of Kombolcha.The Awash-Kombolcha-Hara Gebaya Project has a significant importance as it connects the northern and eastern economic and traffic corridor of Ethiopia. The railway to be built will connect the railway lines from Mekelle to Hara Gebaya and then Addis to Djibouti, which is the main transport corridor for both passenger and freight traffic, and for transport of imported and exported goods via Djibouti Port. Furthermore, the construction of this railway will play an active and significant role in connecting the northern region of the country with the central part.

Delays in construction projects are considered one of the most common problems causing a multitude of negative effects on the project and its participating parties. Along with delay, the frequently faced consequences are project failure, reduction of profit margin, and loss of belief of citizen in government funded projects, etc. When delays do occur, they are either accelerated or have their duration extended beyond the scheduled completion date. These are not without some cost consequences. Delays also give rise to disruption of work and loss of productivity, late completion of project increased time related costs; third party claims, abandonment and termination of contract (Abdul-Rahman, 2006). The desire to finish a project on time, under the planned budget, and with the highest quality is common goals for all contracting parties, including the owner, contractor and consultant. Delay usually result in losses of one form or another for everyone. The consequences of delay are different for different parties. The general consequences are the loss of wealth, time and capacity. For owner, delay means the loss of income and unavailability of facilities. For contractor, delay means the loss of money for extra spending on equipment and materials and hiring the labor and loss of time. (Haseeb, Xinhai-Lu, Bibi and Maloof-ud-Dyian,2011).

1.2 Statement of the problem

Delays occur in construction project, and the magnitudes of these delays vary considerably from project to project. Some projects delay for a few days while others delay for over a year. Failure to achieve targeted time, budgeted cost, design specifications and specified quality result in

various unexpected negative effects on the projects are the reason that delay occurring. Normally, when the projects get delayed, either the delivery time of the project will be extended, or the progress of the project will be accelerated heavily in order to deliver it on time. The former will lead to arbitration, litigation, and penalties, etc. and the later will lead to incur additional cost, both will end up with loss of money. It is one of the common problems that upset the construction companies in terms of competitiveness and long term sustainable in the global market Sweis *et al.*, 2008, Construction projects are delayed because of several reasons. The problem of project delay still not solved even today when the technology is advanced and project management practices are more common than before (Yang *et al.*, 2013).

A number of researches also carried out to investigate the causes of delay in construction projects. Al-Momani (2000) surveyed causes of delay in 130 public projects in Jordan. According to his research the important delay causes were related with: (1) design, (2) user changes, (3) weather, (4) site conditions, (5) late supply, (6) financial conditions and (7) rise quantity of work. On the other hand according to Al-Ghafly (1995), the main causes of delay include finance, delay in agreement and decision-making by owner, variations in the plan and size (project scope), problem in gaining a work permit, and organization and communication problems.

Aziz (2013) also identifies high-impact value of delay causes in Egypt as: Funding problems, different strategies patterns for bribes, Shortage of equipment, Ineffective project planning and scheduling, Poor site management and investigation, Poor monetary control on site, Rework, Selecting non-skilled contractors, Sudden Accidents, poor planning, low-skilled working team, Inadequate contractor experience, Frequent equipment breakdowns, Global financial crisis, Complexity of the work (project type, project scale, etc.), Project Legal arguments between project stakeholders, disagreement between joint-ownership variation, poor construction method, non-skilled labor, and Conflicts.

According to Tsegay and Luo (2017) the influential causes of delay are corruption, unavailability of utilities at site, inflation/price increases in materials, lack of quality materials, late design and design documents, slow delivery of materials, late in approving and receiving of complete project work, poor site management and performance, late release budget/funds, and ineffective project planning and scheduling. According to Siraw Y. (2014), the most common and frequent

factors contributing to time overrun includes slow site clearance, supply of materials, Inflation, and exchange rate fluctuation, progress payments delay by owner, unforeseen site condition, slow equipment movement and quality of materials, contractor's financial problems and inaccurate cost estimation.

Delay is a common problem of projects in Ethiopia. In his study conducted on 15 completed projects in different regions of the country (Ethiopia), Abdissa (2003) has shown that projects were delayed from 20.66% to 500% of original contract duration. Werku and Jha (2016) on the other hand also indicated that, in Ethiopia about 91.75% of projects delayed 352% of its contractual time.

Even though a number of studies has been carried out previously on the subject under current study focuses, the previous study does not fully addressed all possible delay attributed to project delay. Because of the unique features of projects, the causes of project delay may vary for specific project from country to country, region to region, and even project to project. Therefore further study can be also undertaken to investigate major causes and the magnitude of their effect on project. Therefore, this study tried to identify the most important and frequent causes and effects of delay in Ethiopian railway construction projects in the case of Awash-Kombollcha-Haragbyia railway project and it also aimed to provide an input for the management of the company to take lessons from this project and then take an appropriate measure for the future railway construction projects.

1.3 Research Question

The study is going to answer the following key research questions:

1. What are the real causes of project delays in Ethiopian Railway constructions project?
2. What are the top five causes of project delays in Ethiopian Railway constructions project?
3. What are the effects of construction delays in Ethiopian Railway constructions project?

1.4 Objective of the Study

The study has general and specific objectives specified below.

1.4.1 General Objective

This paper will aim at determining the major causes and effects of project delay in Ethiopian Railway constructions projects specifically in the Awash- Kombollcha- Hara Gebaya Railway Project.

1.4.2 Specific Objectives

1. To identify the delay causing factors that currently exist in Ethiopian Railway constructions project specifically in AKH railway project.
2. To identify the most significant delay causing factors that affect Ethiopian Railway constructions project specifically AKH railway project.
3. To identify the effects of delay in AKH railway projects.

1.5 Significance of the Study

This research will do for the purpose of filling knowledge gap and have several of significant which consider the parties that will involve in construction. Particularly among the main project players: contractors, client and consultants. These significant include: to study the factor that causes and effects of delay in the construction of AKH railway projects. The result of the study will be the guideline to the parties that involve, so that it will avoid any source that will happen in their project; to suggest several factors that will avoid the delay in another construction project. The result of the study will give good information to the involve parties to prepare full-time work and responsibilities to ensure every activity will be done according to the plan.

1.6 Scope of the Study

Currently, Ethiopian Railway Corporation has two under construction and two completed railway projects. As part of the Growth and Transformation Plan (GTP) of the Government of FDRE 2500 Km of the proposed railway network has been given a first priority to be implemented between 2010/11 to 2014/15. The projects selected in the first phase are:

- Addis Ababa/Sebeta – Mieso – Dewenle
- Mekele – Hara Gebeya – Tadjourah
- Awash – Kombolcha – Hara Gebeya
- Addis Ababa/Sebeta – Jimma – Bedele
- Modjo – Boditi – Weito.

The study focuses on the causes and effect of the delay in Ethiopian railway construction projects specifically in AKH railway project.

1.7 Limitations of the Study

The study solely focused on the causes and delay of the AHK railway project, the result can't be generalized as it doesn't include the related project being carried out throughout the country. The population of the respondents for this study involves only the client, contractors and consultants' companies that are involved in the AKH project.

1.8 Ethical Consideration

As researchers anticipate data collection, they need to respect the participants and the sites for the research. All participants will be assured of anonymity and confidentiality. Efforts will be done to overcome ethical concerns of the participant due to sensitivity of the issue under study by careful designing and structuring the questionnaire. Clear explanation about the purpose and usefulness of the study and by excluding names and other identifying numbers from the questionnaire in order to assure confidentiality of information and assure the respondent not participating in the research couldn't cause any harm.

1.9 Organization of the research

Structurally, the paper will be composed of five chapters. The first chapter presents introductory materials, which includes background of the study, statement of the problem, research questions, research objective, significances of the study, the scope of the study, limitations of the study and ethical considerations. The second chapter presents literature review with general descriptions by different researchers on causes and effect of construction delay. The third Chapter discusses about research methodology. The fourth chapter focuses on results and discussion of the research findings. The fifth chapter presents conclusions and recommendations of the study.

CHAPTER TWO

2 REVIEW OF RELATED LITERATURE

2.1 Theoretical Review

This part of the thesis focuses on theoretical approaches to examine the meaning, cause and effect of delay in construction projects. Furthermore, related studies in Ethiopia and other developing countries and their experience related construction delay causes will be viewed.

2.1.1 Definition of delay

Delays of a construction project can be defined as the late in progress or actual completion of works compared to the baseline construction schedule or contract schedule. Vast majority of project delays occur during the construction phase, where many unforeseen factors are always involved.

In the context of building construction, the term 'delay' is used to indicate that the works are not progressing as quickly as intended and, specifically, that as a result completion may not be achieved by the completion date specified in the contract documents (Chappel et al 2005).

Delay could be defined as the time overrun either beyond completion date specified in a contract or beyond the date that the parties agree upon for delivery of a project (Divya & Ramya2015) .

According to Dinakar (2014), Delay is 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.

Aibinu and Jagboro(2002) described delay as a situation when the contractor and the project owner jointly or severally contribute to the non-completion of the project within the original or the stipulated or agreed contract period.

In the study of Assaf et al.(1995) construction delay was 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. Abd Majid(1997) defined delays as the time overrun beyond the contract date or beyond the date that the critical activities have been delayed.

Delay was also defined as an act or event which extends required time to perform or complete work of the contract manifests itself as additional days of work (Zack,2003). Majid(2006) interprets delay as a loss of time. ‘Time’ refers to the duration for completing the construction project. When the project period is delayed, it means the project cannot be completed within original schedule.

2.1.2 Classification of delay

Most importantly, delays can be seen in these four major categories as

1. Critical or Non-Critical.
2. Excusable or Non-Excusable,
3. Compensable or Non-Compensable
4. Concurrent or Non-Concurrent. (Trauner, 2009).

2.1.2.1 Critical or 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 considered as noncritical delays. If these activities are delayed, the project completion date or a milestone later will be delayed. The determining which activities truly control the project completion date depends on the following:

1. The project itself
2. The contractor’s plan and schedule (particularly the critical path)
3. The requirement of the contract for sequence and phasing
4. The physical constraint of the project, i.e. how to build the job from a practical perspective. (Dinakar, 2014).

2.1.2.2 Excusable or Non-Excusable Delays

Non-excusable delays are events that are within the contractor’s control or that are foreseeable.

These are some example of non-excusable delays:

- Late performance of subcontractors.

- Untimely performance by suppliers.
- Faulty workmanship by the contractor and subcontractors.
- A project specific labor strike caused by either the contractor's unwillingness to meet with labor representatives or by unfair labor practices (Ahmed, 2017).

Excusable delays are occurrences over which neither the owner nor the contractor have any control, e.g. extreme weather conditions, acts of God and other unforeseen future events (Srđić & Šelih, 2015).

2.1.2.3 Compensable or Non-Compensable

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 (Trauner, 2009). 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 (Dinakar, 2014).

2.1.2.4 Concurrent or Non-concurrent parallel delay

Concurrent or parallel delays occur when there are two or more independent delays during the same time period. Concurrent delays are significant when one is an employer risk event and the other a contractor risk event, the effects of which are felt at the same time (Trauner, 2009). When two or more delay events arise at different times, but the effects of the same are felt (in whole or in part) at the same time, this is more correctly termed 'concurrent effect' of sequential delay events (Keane et al, 2008).

2.2 Empirical review

2.2.1 Causes of delays

Ethiopian construction sector comprises the clients or project owners, contractors, subcontractors, suppliers, and others key professional actors responsible for design and supervision of projects. These professionals include architects, engineers and quantity surveyors. Due to this mixed variety of parties involved in projects, they often encounter difficult situations and some degree of pressures.

Delays occur in every construction project and the significant of these delays varies considerably from project to project. Many researchers have studied the causes of project delays in public construction industry. The findings of such studies have been reviewed for this research.

Assaf and Al-Hejji(2006) studied causes of delay in large construction project in Saudi Arabia. 73 causes of delay were categorized in to the following nine major groups.Owner-related factors , Contractor-related factors ,Design-related factors 4 Materials-related factors , Equipment-related factors , Project-related factors and External-related factors

(Sambasivan.M&Soon.Y.W,2007)identified 28 different causes of delay in Malaysia construction industry. They conclude 10 most important causes of construction delay in Malaysian industry. These Contractor's improper planning, contractor's poor site management, inadequate contractor experience, inadequate client's finance and payments for completed work, problems with subcontractors, shortage in material, labor supply, equipment availability and failure, lack of communication between parties and mistakes during the construction stage.

According to Samarah & Bekr (2016),delay factors are classified in to four major groups. These are:-

Group 1: included 17 factors related to clients.

Group 2: included 20 factors related to contractors.

Group 3: included 11 factors related to consultants.

Group 4: included 7 factors related to external circumstances.

Totally they identified 55 different causes of delay categorized into four groups and identified 10 top factors causing delays in public construction project in Jordan. These are inadequate management and supervision by the contractor, client's changes of the design, inadequate planning and control by the contractor, using lowest bid that lead to low performance, changes in the extent of the project, errors in design and contract documents, progress payments are not made in time by the client, Rework due to mistakes during construction, Changes in the original design and Low level productivity.

James et al. (2014) studied 15 factors causing delay on project construction in Nigeria. The factors includes lack of funds to finance the project to completion, changes in drawings, lack of

effective communication among the parties involved , lack of adequate information from consultants, slow decision making and contractor's insolvency, variations, project management problem, mistake and discrepancies in contract document, equipment availability and failure, mistakes during construction, bad weather, fluctuation in prices of building materials, inappropriate overall organizational structure linking to the project and labor strike.

Dinakar (2014) classified delay causing factors into seven major groups, these are Owner contributed factors, contractor contributed factors, consultant contributed factors, material contributed factors, equipment contributed factors, labor contributed factors and external factors. The contribution of Contractor in delay of the construction project is more than the client and consultant side. And the external factors contribute the least in delay of construction project. Improper communication between the involved parties is found as the major problem while external reasons like lack of qualified labor, equipment and material when needed comes next in row.

Haritha & Murali (2018) identified 121 causes of delay and categorized into 8 groups and ranked the major causes of delay for each group as follow.

Owner related: - Slow decision making , Suspension of work, Late in revising and approving design documents by owner ,Delay to furnish and deliver the site to the contractor ,Delay in finance and payments, Change orders and Poor communication and coordination between consultant and contractor.

Consultant related: - Inadequate experience of consultant, Delay in approving shop drawings and sample materials, Delay in performing inspection and testing and Poor communication and coordination between owner and contractor.

Contractor related: -Difficulties in the financing project by contractor, Poor site management and supervision, Ineffective planning and scheduling of project, Rework due to errors during construction, Delays in sub-contractor's work, inadequate contractor experiences and inappropriate construction methods.

Material related: -Shortage of construction materials in the market, Changes in material types and specifications during construction and Delay in material delivery.

Labor and equipment related; -Shortage of labors, Equipment availability and failure, shortage of equipment, unqualified/inadequate experienced labor, Low productivity level of labors and personal conflicts among labor.

Project related:-Effects of subsurface conditions (e.g., soil, high water table, etc.), Traffic control and restriction at job site, Unavailability of utilities in site or Delay in providing services from utilities such as water, etc, Accident during construction and legal disputes b/w project participants.

External related:-Weather effect (hot, rain, etc.), Changes in government regulations and laws, Slow permit by government/municipality and Fluctuations in cost/ currency.

Design related:- insufficient data collection and survey before design, mistakes and delay in production design document and misunderstandings of owners requirement by design engineer.

Abd ElRazaek,Bassioni&Mobarak (2008) studied Causes of Delay in Building Construction Projects in Egypt. The study identified 32 causes of delay and grouped into contractor responsibility, consultant responsibility, owner responsibility and common responsibility.

Under the responsibility of the contractor there were the following causes: shortage in construction materials, slow delivery of materials, shortage in labor, poor labor productivity, shortage in equipment, unskilled operators, poor equipment productivity, financing by contractor during construction, preparation of shop drawings and material samples, errors committed due to lack of experience, accidents during construction, controlling sub-contractors by main contractor in the execution of work, and lack of database in estimating activity duration and resources.

Under the responsibility of the consultant there were the following causes: changes in materials types and specifications during construction, design changes by owner or his agent during construction, design errors/incomplete made by designers, unexpected foundation conditions encountered in the field, mistakes in soil investigation, waiting for approval of shop drawings and material samples, and inspection and testing procedures used in the project.

Under the owner's responsibility, there were the following causes: delays in contractor's payment by owner and partial payments during construction, obtaining permits from

municipality, excessive bureaucracy in project owner operation, and slowness of the owner decision making process.

In addition, there were causes under the common responsibility which are: application of quality control based on foreign specification, the conflict in point of view between contractor and consultant, non utilization of professional construction/contractual management, the relationship between different subcontractors' schedules, poor organization of the contractor or consultant, difficulty of coordination between various parties contractor, sub-contractor, owner, consultant working on the project, and the weather effect.

Finally, the study identified the most important causes of delay. These were financing by contractor during construction; delays in contractor's payment by owner; design changes by owner or his agent during construction; partial payments during construction; and nonutilization of professional construction/contractual management.

Dixit & Sharma (2019) studied 11 significant delay factors from an intensive literature review in high rise projects in India. These were: Inaccurate Material Estimate, Unexpected Weather Condition, Shortage of Materials, Shortage of Equipment, Shortage of Skilled Labor, Inaccurate Productivity Rate calculation, Location Constraint of Project, Lack of Proper Planning, Poor Productivity of Labor, Design Variation and Inaccurate Productivity estimation of Equipment.

Zidan and Andersen (2017) studied 10 universal delay factors in construction project through an intensive systematic literature study. These top 10 universal delay factors were: design changes during construction/change orders; delays in payment of contractor(s); poor planning and scheduling; poor site management and supervision; incomplete or improper design; inadequate contractor experience/building methods and approaches; contractor's financial difficulties; sponsor/owner/client's financial difficulties; resources shortage (human resources, machinery, equipment); and poor labor productivity and shortage of skills.

In the study of factor influencing time and cost overrun in road construction project in AddisAbaba, Ethiopia (Shambel Gebrehiwot, 2018), the main causes of time and cost overrun are financial problem, improper planning and acquisition and construction delay, design change, less material and equipment supply by contractors and incomplete design.

Tsegay and Luo(2017) on their study Analysis of Delay Impact on Construction Project based on RII and Correlation Coefficient, they summarized their findings on the bases of the average relative important index (RII), the major classification of causes of delay and investigated as external, responsibility, resource, and contract related.

1) Responsibility Related Causes

I) Client related causes: Lack of on time finance and payments, Interference on execution of work, Slowness in decision making, Late in site delivery for construction work and design, Improper project feasibility study and Poor communication and coordination,

II) Contractor related causes: Subcontractors related problems, Poor site management & performance, Ineffective project planning and scheduling, inappropriate construction methods, Poor communication and coordination, inadequate contractor experience and Rework for correcting unsatisfactory work.

III) Consultant related causes: Inadequate experience of consultant, late in approving and receiving of complete work, Poor supervision and late testing & inspection and Poor communication and coordination.

IV) Designer related causes: Unclear and inadequate details and specification, late design and design documents, Design mistakes and errors and Misunderstanding of client 's requirements.

2) Resource Related Causes

I) Construction Material related causes: Lack of quality materials, Slow delivery of material, Changes in material types and specifications, Damage of materials and Inflation /price increases in materials.

II) Finance related causes: Problem of process of financial claims, Government funding processes, late release budget/ funds and Global financial crisis.

III) Labor related causes: Low productivity, less motivation and morale, Unqualified /inexperienced workers, Discipline problem (conflicts and Absenteeism) and Labor accidents and injuries.

IV) Equipment related causes: Insufficient or shortage of equipment, Low efficiency and productivity of equipment, Failures of equipment and lack of spare parts, Equipment allocation or mobilization problem and Equipment outdated.

3) Contract condition related causes: Absence of alternative dispute resolution (ADR), Mistakes & ambiguities in contract document, Unrealistic contract durations and cost, Inadequate delay penalties/poor incentives in contract, Insufficient details in contract documents and Lack of clear understanding of contract documents.

4) External Causes: Adverse weather condition, Force majeure (acts of God), Corruption, Effect of social and cultural factors, Policy and commitment of government and Unavailability of utilities at site.

Tadewos & Patel (2018) indicated that, the influential causes of delay investigated are corruption, unavailability of utilities at site, inflation/price increases in materials, lack of quality materials, late design and design documents, slow delivery of materials, late in approving and receiving of complete project work, poor site management and perform, late release budget/funds, and ineffective project planning and scheduling.

2.2.2 Effects of delay

Delay in construction can have a number of consequences in a project, such as late completion, lost productivity, acceleration, consequential damages, increased cost and contract termination. When projects are delayed, they are either accelerated or have their duration extended beyond the scheduled completion date. The subject of delay has been addressed by several researchers and they found that delay always led to the negative effects.

James et al., (2014) studied the cause and effect of delay on project construction delivery time. The identified effect of the delay were: Time overrun, increase in final cost of project, tying down of client capital due to non-completion of the project, wastage and under-utilization of manpower and resources, abandonment of building the project, reduce profit, disputes between parties involved, litigation and arbitration.

Sambasivan & Soon (2007) studied the six main effect of delay in Malaysian construction industry are

1. time overruns
2. cost overruns
3. disputes
4. arbitration
5. litigation
6. total abandonment

Aibinu and Jagboro(2002), Samarah&Bekr(2016) andHaseeb,Xinhai-Lu, Bibi,Dyian& Rabbani(2011) found the same effect of delay in Malaysian construction industry. Tsegay and Luo(2017)studies in Ethiopia critical effects of infrastructure project delay investigated cost overruns, time overrun, termination of contract, arbitration litigation, and economic impacts of communities.

2.3 Conceptual Framework

The aim of this section is to summarize the idea about past literature and to bring out the contributions for this study area. The general idea from the past literature shows that there is a relationship between causes of the delay and effects of delay in construction project. The relationship between construction delay and effects of delay can be conceptualized at a fairly general level, depicted in Figure 2.1.

The framework is developed from works of two different researchers Abdella and Hussien (2002) who categorized delay causing factors in eight groups and Sambasivamet *al* (2007) who identified six effects of delay. According to Abdella and Hussien (2002), causes of delay can be categorized in to the following eight major groups

1. Client related factors including finance and payment of completed work, owner interference, slow decision making, and unrealistic contract duration imposed by owners.
2. Contractor related factors including site management, improper planning inadequate contractor experience, mistake during construction, improper method and delays caused by subcontractors. Delays caused by sub-contractors are included among the contractor's factors because the latter is fully responsible for the delays caused by his sub-contractors.
3. Consultant related factors include contract management, preparation and approval of drawings, quality assurance/control and long waiting time for approval of tests and inspection.
4. Material factor including quality and shortage.

5. Labor and equipment factor include labor supply and labor productivity and equipment availability and failure.

6. Contract factors include change orders and mistakes and discrepancies in contract document

7. Contractual relationships factors include major disputes and negotiations during construction, inappropriate organizational structure linking all parties involved in the project, and lack of communication between these parties.

8. External factors include weather conditions, changes in regulations, problems with societies and site conditions.

Sambasivamet *al* (2007) studied the effects of construction delays on project construction industry. The six effects of delay identified were:

1. Cost overrun
2. Time overrun
3. Dispute
4. Arbitration
5. Litigation and
6. Abandonment

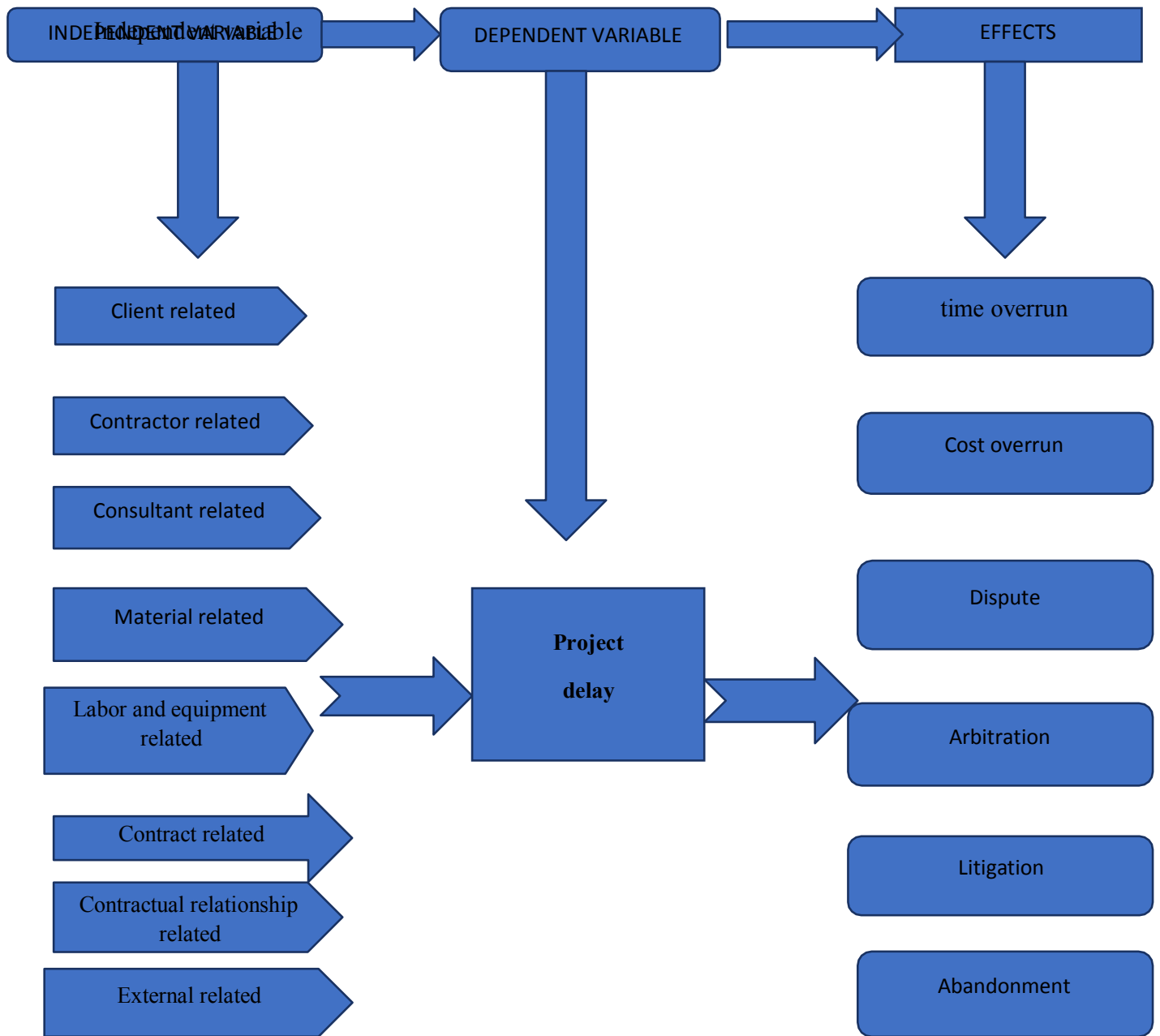


Figure 2-1 Conceptual Framework

CHAPTER THREE

3 RESEARCH METHODOLOGY

3.1 Research Approach and Design

The research methodology is a description of how the objectives can be realized. In this study quantitative research methods were employed. For this purpose a questionnaire was developed to assess the perceptions of client's, contractors and consultants on the of causes and effects of delays in AKH railway construction project. Quantitative data were obtained through questionnaire.

3.2 Data Type and Source

Both primary and secondary data were used in relation to the topic under discussion. The primary data refers to the first-hand information gathered by the researcher. The information was collecting in the survey by making use of questionnaires. The questionnaires were hand delivered to respondents and collected same wise after being filled. The secondary data used in this research are information's gathered through a literature review regarding delays in construction project. Literature reviews was carried out to enhance the understanding of theory regarding the research problem. The materials for literature reviews are such as books, articles, magazines, internet, journals, documents and other's research papers. The information, which is relevant, was used as a benchmark against primary data collected to support the research.

3.3 Target population and Sample

3.3.1 Target population

The target population of this study is the major stakeholders of the AKH railway construction project such as client, contractor, and consultant organization in railway construction projects such as Ethiopian Railway Corporation, YapiMerkezi and SYSTRA(International Consulting Engineers for Rail and Urban Transport)

3.3.2 Sampling Techniques

In this study, respondents were selected based on their experience in railway construction experience, knowledge and involvement. Purposive (non-probability, deliberate) sampling was

used for selecting samples within the group of owners, consultants and contractors. This method is chosen because of the geographical distribution of the involved members in the project are scatted and small number of study population under the client and consultant side. William (2005), indicates the importance of purposive sampling method in allowing the researcher to get information from a sample of the population that one knows most about the subject matter.

3.4 Sample size

This study applied the simplified formula provided by Yamane, (1967) to determine the required sample size at 95% confidence level, degree of variability = 0.05. The total population of the study is the employers specifically involved in AKH railway construction project in all major stakeholders. For the client , the total population who involved directly in AKH project is 33, for contractor side 282 permanent employers and 15 for the consultant side. The total population for this study become 330.

$$n = \frac{N}{1+N(e)^2}$$

Where:

n = Desired sample size

N =Total population size (330 in this case)

e = Accepted error limit (0.05) on the basis of 95 percent degrees of confidences put into decimal form

$$n = \frac{N}{1+N(e)^2}$$

$$n = \frac{330}{1+330*(0.05)^2} = 180$$

3.5 Data collection

The data used in this study were gathered from the main parties in the construction (clients, contractor, and consultants) who participated in the railway construction project using questionnaire and document review. Questions used in the questionnaire are close ended (based

on likert scale). Document review was also employed to collect relevant secondary data from secondary sources (project completion reports, books, journals, reports, contract documents).

3.6 Questionnaire Methodology

The questions are designed related to the research objectives especially on the causes and effects of construction delays. The Survey is designed based to use Likert Scale on the objective of the study to find out the causes of delays in the construction AKH railway projects and effect of the delays on overall project. The Survey was framed in such a way that the personal view of different people involved in AKH railway projects is collected and analyzed. The questionnaire basically consists of three sections as detailed below.

1. Respondent Background - This is to collect the basic information of the respondent.
2. Causes of Delays - This is used to collect the data on different causes of the delays happened in that particular project.
3. Effects of Delays - Using these questions the effects of the delays on the project are identified.

The questionnaire is based on Likert Scale of five ordinal measures from one (1) to five (5) according to level contributing. According to John F. (2001), Likert Scale is easier to use for respondent to express their level of opinion.

3.7 Data analysis

The data analysis is determined to establish the relative importance of various factors that contribute to causes and effects of construction delays. Analysis of data consists of calculating the Relative Importance Index (RII) and Ranking of factors in each category based on the Relative Importance Index (RII).

$$RII = \frac{1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5}{A * N} \dots\dots\dots \text{Equation 3.1.}$$

A*N

Where,

RII = Relative Importance Index,

n_1, n_2, n_3, n_4, n_5 = Number of respondents answer for each factor

1, 2, 3, 4, 5 = weight given for each factor (ranging from 1 to 5),

A = highest weight (i.e. 5 in our case),

N = total number of respondents.

The importance indices were calculated for all delay causes and effects then delay causes and effects were ranked accordingly.

3.8 Data Validity & Reliability

To ensure the quality of the research and make the findings credible; due care is given to both validity and reliability issues of the data, the research process in general as well as the research output. To check the questionnaire's validity selected experts invited to comment on the questionnaire as a pre-assessment means. To check the questionnaire item's internal consistency, its reliability was checked by the Cronbach's alpha test coefficient using SPSS software and the gained result was .818 which is beyond .70 result considered as "acceptable" in social science researches.

Table 3-1 Reliability Test results

Reliability Statistics	
Cronbach's Alpha	N of Items
.818	40

CHAPTER FOUR

4 DATA ANALYSIS AND PRESENTATION

4.1 Introduction

The results and discussion below is devised in three parts corresponding to the research questions and also the sections of the questionnaire. These divisions can help tackle one question at a time. The first part of the results and discussion contains the findings of the questions directed towards identifying the importance of delay causes and raking in the level of their severity. A total of 30 potential delay causes were selected from previous studies and grouped in eight categories: client related factors, contractor related factors, consultant related factors, material related factors, labor and equipment related factors, contract related factors, contractual relationship related factor and external factors.

Thus, respondents were asked to rank delay causes factors in a five-point scale range from 1 to 5 based on frequency of occurrence from rarely to greatly often. In the second part respondents were asked to identify the most important and frequent effect of construction delay. Similar to delay causes, six potential effects were selected from previous studies. These effects of delay had also a five-point scale ranged from 1 to 5 and the results of both questions are presented and discussed accordingly.

The data collected from close-ended questions of the questionnaire are analyzed using descriptive data analysis. Appropriate statistical results are presented in a tabular format followed by discussions and analyzed using the Relative Importance Index (RII) to rank causes and effects.

4.2 Questionnaire Response Rate

Questionnaires with close ended questions were designed and distributed for the research purpose. Then the questionnaire is distributed to the major stakeholders according there proportion.

$$\text{For client side} = \frac{33}{330} * 180 = 18$$

$$\text{For contractors} = \frac{282}{330} * 180 = 154$$

$$\text{For consultant} = \frac{15}{330} * 180 = 8$$

Out of the totally distributed 180 questionnaires, 131 were filled and returned. The overall questionnaire response rate 73 percent.

4.3 Respondents' General Information

Table 4-1 : Respondents Gender

Gender	Frequency	Percentage (%)
Male	105	80
Female	26	20

In the above table 4.2, from the total of 131 respondents 105(80%) were males and 26(20%) were females. From the result we showed that the total population of the females involved AKH project is much more less than the males.

Table 4-2 : respondent's educational background

Educational Background	Frequency	Percentage (%)
BA/B.Sc	50	38
MA/M.Sc	68	52
PHD	13	10

With regard to the educational status of respondents, among those participated in the survey 50(38%) of the respondents are first Degree holders, 68(52%) of the respondents are Masters Degree holders and 13(10%) of the respondents are PHD Degree holders. From this result, most of the respondents have master's degree.

Table 4-3 : respondent's educational field of specialization

Field of Specialization	Frequency	Percentage (%)
Engineering	70	53
Business	43	33
Law	14	11
Others	4	3

Looking into the respondents' educational field of specialization; among the total respondents 70(53%) are Engineers, 43(33%) Business related, 14(11%) Law and the rest 4(3%) are categorized under other subject areas.

Table 4-4 : respondent's years of experience

Years of Work Experience	Frequency	Percentage (%)
0 to 5 years	18	14
6 to 15 years	64	49
Above 15 years	49	37

Looking at the respondents' work experience, out of the total 131 questionnaire filled and returned, 18 (14%) of respondents have more than 15 years of experience, 64 (49%) with an experience between 6 to 15 years and the rest 49 (37%) respondents have a work experience of less than five years.

4.4 Respondents' reaction and Relative importance index for the causes of Delay in ERC construction projects

4.4.1 Respondents reaction on the causes of delay

Table 4-5: respondent's reaction on causes of delay

Delay causes		1	2	3	4	5
Client related	Finance and payment of completed work	-	4(3%)	15(12%)	93(71%)	19(15%)
	Slow decision making	-	9(6%)	12(9%)	92(70%)	18(14%)
	Poor communication & coordination of the owner with other parties	4(3%)	2(2%)	-	43(33%)	82(62%)
	Lack of coordination with the contractor	19(15%)	90(69%)	22(17%)	-	-
	Unrealistic contract duration imposed by owners	19(15%)	89(68%)	19(15%)	4(3%)	-
Contractor related	Poor site management	18(14%)	7(5%)	5(4%)	73(56%)	28(21%)
	Improper planning	27(21%)	8(6%)	8(6%)	61(47%)	27(21%)
	Inadequate contractor experience	30(23%)	5(4%)	17(12%)	50(38%)	29(22%)
	Mistake during construction	26(20%)	9(7%)	12(9%)	65(50%)	19(15%)
	Improper method	19(14%)	4(3%)	5(4%)	75(57%)	28(21%)
	Delay caused by subcontractor	16(12%)	4(3%)	4(3%)	73(56%)	34(26%)
Consultant related	Poor contract management	16(12%)	4(3%)	8(6%)	64(49%)	39(30%)
	Inadequate experience of consultant	16(12%)	3(2%)	10(8%)	64(49%)	38(29%)
	Mistakes and discrepancies in design documents	14(11%)	-	8(6%)	73(56%)	36(28%)
	Long waiting time for approval of tests and inspections	4(3%)	-	6(5%)	43(33%)	78(60%)
Material related	Poor quality material supply	17(13%)	22(17%)	27(21%)	43(33%)	22(17%)
	Shortage of construction material	10(8%)	11(8%)	38(29%)	55(42%)	17(13%)

Labor and equipment related	Labor supply and labor productivity	5(4%)	17(13%)	22(17%)	76(58%)	11(8%)
	Equipment availability and failure	17(13%)	33(25%)	33(25%)	38(29%)	10(8%)
Contract related	Frequent change orders	-	-	22(17%)	88(67%)	21(16%)
	Mistakes in design documents	-	17(13%)	5(4%)	87(66%)	22(17%)
	Discrepancies in contract document	17(13%)	22(17%)	55(42%)	27(21%)	10(8%)
Contractual relationship related	Major disputes	11(8%)	22(17%)	43(33%)	38(29%)	17(13%)
	Negotiations during construction	8(6%)	11(8%)	73(56%)	22(17%)	17(13%)
	Inappropriate organizational structure linking all parties involved in the project	-	10(8%)	33(25%)	55(42%)	33(25%)
	Lack of communication between these parties	11(8%)	16(12%)	19(15%)	37(28%)	48(37%)
External related	Poor weather condition	17(13%)	4(3%)	12(9%)	57(43%)	41(31%)
	Changes in regulation	18(14%)	4(3%)	5(4%)	75(57%)	29(22%)
	Problem with societies	-	21(16%)	38(29%)	55(42%)	17(13%)
	Unfavorable site condition	16(12%)	3(2%)	10(8%)	64(49%)	38(29%)

Table 4-6 shows the respondent's reaction on causes of delay. The sample size consist a total of 131 respondents. For client related causes,

Out of which 0(0%) are strongly disagree, 4(3%) are disagree, 15(12%) neutral, 93(71%) agree and 19(15%) are strongly agree for the causes of " Finance and payment of completed work".

Out of which 0(0%) are strongly disagree, 9(6%) disagree, 12(9%) neutral, 92(70%) agree and 18(14%) are strongly agree for the causes of " Slow decision making". 4(3%) are strongly disagree, 2(2%) are disagree, 0(0%) neutral, 43(33%) agree and 82(62%) are strongly agree for the causes of " poor communication and coordination of the owner with other parties". 19(15%) are strongly disagree, 90(69%) are disagree, 22(17%) neutral , 0(0%) agree and strongly agree for the causes of " lack of coordination with contractor". 19(15%) are strongly disagree, 89(69%) are

disagree, 19(15%) neutral, 4(3%) agree and 0(0%) are strongly agree for the causes of "unrealistic contract duration imposed by the owners".

For contractors related causes,

Out of which 18(14%) are strongly disagree, 7(5%) are disagree, 5(4%) neutral, 73(56%) agree and 28(21%) are strongly agree for the causes of "poor site management". 27(21%) are strongly disagree, 8(6%) are disagree and neutral, 61(47%) agree and 27(21%) are strongly agree for the causes of "improper planning". 30(23%) are strongly disagree, 5(4%) are disagree, 17(12%) neutral, 50(38%) agree and 29(22%) are strongly agree for the causes of "inadequate contractor experience". 26(20%) are strongly disagree, 9(7%) are disagree, 12(9%) neutral, 65(50%) agree and 19(15%) are strongly agree for the causes of "mistake during construction". 19(14%) are strongly disagree, 4(3%) are disagree, 5(4%) neutral, 75(57%) agree and 28(21%) are strongly agree for the causes of "improper methods". 16(12%) are strongly disagree, 4(3%) are disagree, and neutral, 73(56%) agree and 34(26%) are strongly agree for the causes of "Delay caused by sub-contractors".

For consultant related causes

Out of which 16(12%) are strongly disagree, 4(3%) are disagree, 8(6%) neutral, 64(49%) agree and 39(30%) are strongly agree for the causes of "poor contact management". 16(12%) are strongly disagree, 3(2%) are disagree, 10(8%) neutral, 64(49%) agree and 38(29%) are strongly agree for the causes of "Inadequate experience of consultant". 14(11%) are strongly disagree, 0(0%) are disagree, 8(6%) neutral, 73(56%) agree and 36(28%) are strongly agree for the causes of "Mistake and discrepancies in design documents". 4(3%) are strongly disagree, 0(0%) disagree, 6(5%) neutral, 43(33%) agree and 78(60%) are strongly agree for the causes of "long waiting time for approval of tests and inspections".

For Material related causes

Out of which 17(13%) are strongly disagree, 22(17%) are disagree, 27(21%) neutral, 43(33%) agree and 22(17%) are strongly agree for the causes of "poor quality material supply". 10(8%) are strongly disagree, 11(8%) disagree, 38(29%) neutral, 55(42%) agree and 17(13%) are strongly agree for the causes of "shortage of construction material".

For Labor and equipment related causes

Out of which 5(4%) are strongly disagree, 17(13%) are disagree, 22(17%) neutral, 76(58%) agree and 11(8%) are strongly agree for the causes of” labor supply and productivity “.17(13%) are strongly disagree, 33(25%) are disagree and neutral, 38(29%) agree and 10(8%) are strongly agree for the causes of” equipment availability and failure “.

For contract related causes

Out of which 0(0%) are strongly disagree and disagree, 22(17%) neutral, 88(67%) agree and 21(16%) are strongly agree for the causes of” frequent change order “.0(0%) are strongly disagree, 17(13%) are disagree, 5(4%) neutral, 87(66%) agree and 22(17%) are strongly agree for the causes of” Mistakes in design documents “.17(13%) are strongly disagree, 22(17%) are disagree, 55(42%) neutral, 27(21%) agree and 10(8%) are strongly agree for the causes of” discrepancies in contract document “.

For contractual relationship related causes

Out of which 11(8%) are strongly disagree, 22(17%) are disagree, 43(33%) neutral, 38(29%) agree and 17(13%) are strongly agree for the causes of” major disputes “.8(6%) are strongly disagree, 11(8%) are disagree, 73(56%) neutral, 22(17%) agree and 17(13%) are strongly agree for the causes of” negotiation during construction “.0(0%) are strongly disagree, 10(8%) are disagree, 33(25%) neutral, 55(42%) agree and 33(25%) are strongly agree for the causes of” Inappropriate organizational structure linking all parties involved in the project “.17(13%) are strongly disagree, 22(17%) are disagree, 27(21%) neutral, 43(33%) are agree, 55(42%) strongly agree for the causes of” lack of communication between these parties “.

For External related causes

Out of which 17(13%) are strongly disagree, 4(3%) are disagree, 12(9%) neutral, 57(43%) agree and 41(13%) are strongly agree for the causes of” poor weather condition “.18(14%) are strongly disagree, 4(3%) are disagree, 5(4%) neutral, 75(57%) agree and 29(22%) are strongly agree for the causes of” change in regulation “.0(0%) are strongly disagree, 21(16%) are disagree, 38(29%) neutral, 55(42%) agree and 17(13%) are strongly agree for the causes of” negotiation during construction “.16(12%) are strongly disagree, 3(2%) are disagree, 10(8%) neutral, 64(49%) agree and 38(29%) are strongly agree for the causes of” unfavorable sit condition “.

4.4.2 The Relative important Index for the causes of delay

The construction delay is universally evident reality and is counted as a common problem in construction projects. Delays in construction projects happen because of various factors and causes. A total of 30 delay causing factors were identified and classified in to eight factor groups: client related factors, contractor related factors, consultant related factors, material factor, labor and equipment factor, contract factors, contractual relationships factors and external factors.

Table 4-6 : RII and ranking of Client related delay causes

Delay causes	RII	Rank
Finance and payment of completed work	0.7939	2
Slow decision making	0.7817	3
Poor communication & coordination of the owner with other parties	0.9008	1
Lack of coordination with the contractor	0.4046	5
Unrealistic contract duration imposed by owners	0.4122	4

As shown on the above table 4.8, the most influential and highly ranked client related delay causes in the construction of Ethiopian railway projects, are poor communication and coordination of the owner with other parties (RII=0.9008), Finance and payment of completed work (RII=0.7939), Slow decision making (RII=0.7817), unrealistic contractor duration imposed by owners (RII=0.4122) and Lack of coordination with the contractor (RII=0.4046).

Tsegay and H. Luo (2017) identified improper project feasibility study the first, late in site delivery for construction work and design the second, lack of on time finance and payments the third, interference on execution of work the fourth, slowness in decision making the fifth and Poor communication and coordination the sixth most important client related factors

Table 4-7 : RII and ranking of contractors related delay causes

Delay causes	RII	Rank
Poor site management	0.7313	3
Improper planning	0.6809	4
Inadequate contractor experience	0.6656	5
Mistake during construction	0.6641	6
Improper method	0.7359	2
Delay caused by subcontractor	0.8718	1

As shown on the above table 4.9, the most influential and highly ranked contractor related delay causes in the construction of Ethiopian railway projects, are delay caused by sub-contractors (RII=0.8718), improper method(RII=0.7359),poor site management(RII=0.7313), improper planning (RII=0.6809). Inadequate contractor experience (RII=0.6656) and mistake during construction (RII=0.6641).

This finding can be agreed with what was found by Adem (2018) a study on delay caused by subcontractor is the first causes of delay for contractor related factors. But improper planning and poor site management are the second and third delay causing factors.

Table 4-8 : RII and ranking of consultant related delay causes

Delay causes	RII	Rank
Poor contract management	0.7603	3
Inadequate experience of consultant	0.7237	4
Mistakes and discrepancies in design documents	0.7786	2
Long waiting time for approval of tests and inspections	0.8612	1

As shown on the table 4.10 below, the most influential and highly ranked contractor related delay causes in the construction of Ethiopian railway projects, are Long waiting time for approval of tests and inspections (RII=0.8612), Mistakes and discrepancies in design documents (RII=0.7786),Poor contract management (RII=0.7606), Inadequate experience of consultant (RII=0.7237).

Tsegay and H. Luo (2017) identified top four consultant related causes. These are Late in approving and receiving of complete work, Poor communication and coordination, Poor supervision and late testing & inspection and Inadequate experience of consultant. Similarly Eyasu Tolera(2018), identified the top five consultant related factors. These are Weak in follow up the planned work schedule by the contractor , Inadequate planning and scheduling of work by contractor , Shortage of contractors materials on site , Poor site management and supervision by contractors and Poor project manager skills .

Table 4-9 : RII and ranking of Material related delay causes

Delay causes	RII	Rank
Poor quality material supply	0.5817	2
Shortage of construction material	0.6793	1

As shown on the above table 4.11, the most influential and highly ranked material related delay causes in the construction of Ethiopian railway projects, are Shortage of construction material(RII=0.6793) and Poor-quality material supply (RII=0.5817).

In the study Tsegay and H. Luo (2017) the most important construction material delay factors are Inflation/price increases in materials, Lack of quality materials and Slow delivery of material.

Table 4-10 : RII and ranking of Labor and equipment related delay causes

Delay causes	RII	Rank
Labor supply& labor productivity	0.7084	1
Equipment availability and failure	0.5927	2

As shown on the above table 4.12, the relative importance index and highly ranked labor and equipment related delay causes in the construction of Ethiopian railway projects, are Labor supply & labor productivity (RII=0.7084) and Equipment availability and failure (RII=0.5927).

Similarly In the study Abdella. M and Hussin .T (2002) the most important labor and equipment related delay factors are labour productivity , labor supply and equipment availability.

Table 4-11 : RII and ranking of Contract related delay causes

Delay causes	RII	Rank
Frequent change orders	0.7985	2
Mistakes in design documents	0.8357	1
Discrepancies in contract document	0.5863	3

As shown on the above table 4.13, the RII and highly ranked contract related delay causes in the construction of Ethiopian railway projects, are Mistakes in design documents(RII=0.8357) ,Frequent change orders(RII=0.7985), and Discrepancies in contract document(RII=0.5863).

Similarly In the study Abdella. M and Hussin .T (2002) mistakes and discrepancies in contract documents are the first and Change order is the second the most important contract related delay factors.

Table 4-12; RII and ranking of Contractual relationship related delay causes

Delay causes	RII	Rank
Major disputes	0.6488	4
Negotiations during construction	0.7359	3
Inappropriate organizational structure linking all parties involved in the project	0.7695	2
Lack of communication between all parties involved in the project	0.8947	1

As shown on the above table 4.14, the RII and highly ranked contractual relationship related delay causes in the construction of Ethiopian railway projects, are Lack of communication between all parties involved in the project (RII=0.8947), Inappropriate organizational structure linking all parties involved in the project (RII=0.7695), Negotiations during construction (RII=0.7359) and Major disputes (RII=0.6488).

This finding can be agreed with what was found by Adem (2018) and Abdella. M and Hussin .T (2002). Both study identified lack of communication between all parties involved in the project , Inappropriate organizational structure linking all parties involved in the project and negotiations during construction as the top three contractual relationship delay causing factors.

Table 4-13 ; RII and ranking of External related delay causes

Delay causes	RII	Rank
Poor weather condition	0.7542	2
Changes in regulation	0.7419	3
Problem with societies	0.7038	4
Unfavorable site condition	0.7603	1

As shown on the above table 4.15, the RII and highly ranked contractor related delay causes in the construction of Ethiopian railway projects, are Unfavorable site condition (RII=0.7603), Poor weather condition (RII=0.7542), Changes in regulation (RII=0.7419) and Problem with societies (RII= 0.7038).

In the study Tsegay and H. Luo (2017) corruption is the first and unavailability of utilities at site is the second, policy and commitment of government are highly influential external delay factors. Similarly, Abdella. M and Hussin .T (2002) weather condition is the first, unforeseen

ground conditions the second , problems with neighbors is the third and regulatory change and building code is the fourth external delay factors.

4.5 Top five Delay Causes

Table 4-14 Top Five Delay Causes

Delay causes	RII	Rank
Poor communication & coordination of the owner with other parties	0.9001	1
Lack of communication between all parties involved in the project	0.8947	2
Delay caused by subcontractor	0.8718	3
Long waiting time for approval of tests and inspections	0.8612	4
Mistakes in design documents	0.8357	5

In Table 4.16, as ranked by the respondent, five(5) most important factors causing delay in Ethiopian railway construction project are summarized and presented. Poor communication & coordination of the owner with other parties with RII=0.9001 is suggested as the most important factor causing delay on building construction projects. This is closely followed by lack of communication between all parties involved in the project with RII=0.8947. Delay caused by subcontractor with RII=0.8718 comes third. Long waiting time for approval of tests and inspections with RII=0.8612 comes fourth and Mistakes in design documents with RII=0.8357 comes fifth.

Adiam (2016) identified seven top delay-causing factors and proved that, poor site management, supervision by the contractor, ineffective planning, Shortage of contractors materials on site and scheduling of work by the contractor are the top five delay factors related to contractors. Similarly, Adem (2018) ranked owner interference, frequent change orders , long waiting time for approval of tests and inspection , shortage of construction material , mistakes in design documents, inappropriate organizational structure linking all parties involved in the project, mistakes and discrepancies in design documents , discrepancies in contract document, delays caused by subcontractors and lack of communication between these parties as the most significant delay factors in the Ethiopian construction project.

4.6 Respondents' reaction and relative importance index for the effects of Delay in ERC construction projects

4.6.1 Respondents reaction on the effects of delay

Table 4-15: respondent's reaction on the effects of delay

Effects	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Cost overrun	0(0%)	0(0%)	35(27%)	82(63%)	13(10%)
Time overrun	0(0%)	0(0%)	12(9%)	103(79%)	16(12%)
Dispute	0(0%)	33(25%)	10(8%)	55(42%)	33(25%)
Arbitration	21(16%)	27(21%)	11(8%)	11(8%)	61(46%)
Litigation	17(13%)	17(13%)	38(29%)	49(38%)	10(8%)
Abandonment	17(13%)	10(8%)	65(50%)	22(17%)	17(13%)

Table 4-7 shows the respondent's reaction on the effects of delay in ERC construction projects.

Out of which 0(0%) are strongly disagree and disagree, 35(27%) neutral, 82(63%) agree and 13(10%) are strongly agree for the effect "cost overrun". 0(0%) are strongly disagree and disagree, 12(9%) neutral, 103(79%) agree and 16(12%) are strongly agree for the effect "time overrun". 0(0%) are strongly disagree, 33(25%) are disagree, 10(8%) neutral, 55(42%) agree and 33(25%) are strongly agree for the effect "Disputes". 21(16%) are strongly disagree, 27(21%) are disagree, 11(8%) neutral, and agree and 61(46%) are strongly agree for the effect "arbitration". 17(13%) are strongly disagree and disagree, 38(29%) neutral, 49(38%) agree and 10(8%) are strongly agree for the effect "Litigation". 17(13%) are strongly disagree, 10(8%) are disagree, 65(50%) neutral, 22(17%) agree and 17(13%) are strongly agree for the effect "Abandonment".

4.6.2 The RII and Ranking of effects of Delay

The desire to finish a project on time, under the planned budget, and with the highest quality is common goals for all contracting parties, including the Owner, Contractor and Consultant. Delay usually result in losses of one form or another for everyone. The causes lead to the effects of delay on construction projects.

The six effects of delay identified were:

1. Time overrun
2. Cost overrun
3. Dispute
4. Arbitration
5. Litigation
6. Abandonment of the project

Table 4-16: RII and Ranking of effects of Delay

Effects	RII	Rank
Cost overrun	0.7603	2
Time overrun	0.8061	1
Dispute	0.7343	3
Arbitration	0.6977	4
Litigation	0.6275	5
Abandonment of the project	0.6198	6

Table 4.17 shows that Time overrun ranked the highest with RII of 0.8061, while cost overrun ranked second with RII of 0.7603. Time overrun and cost overrun affect the two components of project namely budget and schedule. Dispute among parties involved ranked third with RII value of 0.7343. Arbitration and litigation were ranked fourth and fifth RII values of 0.6977 and 0.6275 respectively. Abandonment of the project was ranked sixth with RII value of 0.6198.

In similar studies(Adem H. (2018), Aibinu and Jagboro(2002), Samarah & Bekr(2016) and Haseeb, Xinhai-Lu, Bibi,Dyian & Rabbani(2011)) identified Time overrun, cost overrun and dispites, arbitration, litigation and abandonment as a major effect of delay.

CHAPTER FIVE

5 CONCLUSIONS AND RECCOMENDATIONS

5.1 Introduction

This chapter includes the conclusions and recommendations that would help in solving the occurrence of delay and its effects in the Ethiopian railway construction projects. The first question of this study was to determine the real delay causing factor in Ethiopian railway construction projects. The second question was to identify the top five causes of project delays in Ethiopian Railway constructions project. The final and third question was to determine the effects of construction delays in Ethiopian Railway constructions project.

To appropriately accomplish the research objectives relevant literatures were reviewed and feasible research methodology developed. The data collected through questionnaire survey and document reviews were analyzed using statistical and qualitative techniques and the findings have been discussed in the previous sections of the paper. The upcoming final sub sections of the study will present conclusions and recommendations based on the research findings.

5.2 Conclusions

One of the most important problems that may arise in the construction project is delays and the magnitude of these delays varies considerably from project to project. Some projects are only a few days behind the schedule: some are delayed over a year. So, it is essential to define the actual causes of delays in order to minimize and avoid the delays in any construction projects.

- a) The following causes are identified as a potential delay causes on Ethiopian Railway construction projects. In this study the factors are limited to 30 factors. These delays causing factors are grouped in eight categories and they were ranked according to the Relative Importance Index. The factors: Poor communication & coordination of the owner with other parties, delay caused by subcontractors, long waiting for approval of test and inspection, shortage of construction materials, labor supply and labor productivity, mistakes in design documents, Lack of communication between all parties

involved in the project and unfavorable site condition are found to be the most influential from each category.

- b) From the 30 identified delay factors, the top five delay causing factors are poor communication and coordination of the owner with other parties, lack of communication between all parties involved in the project, delay caused by subcontractors, long waiting time for approval of test and inspection and mistakes in design documents. These delay causing factors have high RII value.
- c) Analysis was also carried out on the effect of delay on the project work. Time overrun, cost overrun and dispute among parties involved were ranked highest. Time is factor that is very essential in all activities that must be carried out, in the contract document. A specific time phase is given for delivery of project and if the time is being exceeded more money is often spent which could lead to increase in final cost of project leading to cost overrun and finally to dispute.

5.3 Recommendations

Railway construction project will be successful when the construction project activities are done by proper planning and scheduling, within the allocated budget and specified quality, under specified timeframe and by the satisfaction of the stakeholders. Delays are a part of the construction projects, however, they can be avoided or minimized when their causes are effectively identified and analyzed. Based on the above mentioned results and findings of this study, the following points can be recommended as ways to minimize and control delay in railway construction projects.

1. Improving the communication between all parties
 - Standard reporting systems must be followed.
 - Periodical meetings must be organized to facilitate the communication between all parties involved.
2. Improving the performance and capacity of contractor
 - Contractors should involve qualified and responsible subcontractors. The subcontractors must be involved with a proper contractual agreement with a contractor that can transfer risk from contractor to subcontractors.
 - Contractors shall mobilize resources without delay.

- Contractors must also allocate adequate construction equipments and ensure to avoid the shortage of construction material.
3. Improving the performance of Clients
- Clients can make timely and prompt decisions
 - Clients and consultants should also promptly respond to contractors enquires in revising and approving documents (design, drawings, submittals, sample materials etc.) without delay.
 - Clients must ensure that the demand for design changes during construction have no adverse effects on the critical activities that leads to project delay.
 - Client shall deliver/handover the site to contractors immediately after contract agreement has signed.
4. Improving the performance of consultant
- Consultant must undertake adequate site investigation and supervision and must assign competent and well experienced representative.
 - Consultants shall ensure that the documents or design & specifications issued by consultants to contractors are free from mistakes or discrepancies and any design error must be rectified immediately to avoid delay in the progress of project works.

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APPENDIX

Appendix I: Research Schedule (time Frame)

No.	List of activities to be performed	Time	Remark
1	Preparing thesis, I(Introduction,Literature Review,and Research Design &Methodology)	Up to January 20,2020	
2	Preparing and submitting data collection instrument(questionnaire)	February08-14,2020	
3	Data collection	Up February 21-March 21, 2020	
4	Preparing data analysis and interpretation of results, conclusions and recommendation	Up March 22-April 20,2020	
5	Submitting first draft of thesis II to advisor and improving it based on feedback	Up April 21-27,2020	
6	Writing the final version of the research report	Up April 21 – March 21,2020	
7	Submitting final research paper singed by the advisor to the respective school	May 19-25,2020	
8	Thesis defense	June 2020	
9	Submitting final version of the paper to the respective school	10 days after defense period	

Appendix II: Research Budget

No	Items	Amount		Remark
		Birr	Cent	
1	Stationary cost for Questionnaires and thesis	2500	00	
2	Secretarial Cost	500	00	
3	Transportation and refreshment Cost	2000	00	
4	Internet Cost and refreshment Cost	1000	00	
5	Training Cost	1500	00	
	Sub total	7500	00	
	Contingency 10%	750	00	
	Grand total	8250	00	

Questionnaire

Dear Sir/Madam

My name is Abdurahaman Badshe. I am currently doing my MSc. in Project Management at Saint Mary University, school of Graduate studies. I have finished my course work and now I am doing my MSc. Project entitled: Causes and effects of delay in Ethiopian Railway construction projects in the case of Awash- Kombollcha-Haragbyia (AKH) Railway Project. I believe your experience and educational background will greatly contribute to the success of my research. So, it's with great respect that I ask you to fill this questionnaire. I guarantee that your identity will be kept confidential and the information you provide only be used for academic purposes. I will be happy to share the findings of this research when it's completed.

Thank you in advance for taking your precious time to fill this questionnaire.

Please try to answer all the questions openly, as your answers will have an influence on the outcome of the research. Your 30 minutes or less will greatly contribute to the growth and advancement of knowledge in the railway construction projects. If you have any questions or comments, please don't hesitate to contact me.

You can reach me by;

➤ Mobile :0919412105/0960052143

➤ E-mail: abdurahmanBadshe@gmail.com

With Regards,

Abdurahman Badshe

Study title:-Causes and effect of delay in Ethiopian railway construction projects

The questions below are related to your company profile and experience in railway construction projects. Please indicate by filling the blank or by putting mark in the appropriate box.

The answers you provide are used for academic purpose only.

SECTION ONE: - General Information

1.1) Gender

Male Female

1.2) Educational Background?

BA/B.Sc MA/M.Sc PhD

1.3) Field of Specialization?

Engineering Business Law

Others (Please Specify) _____

1.4) Years of Work Experience

0 to 5 years 6 to 15 years Above 15 years

Section II: Causes of Delay in Railway Construction projects

Please rank the delay causing factors below in what you consider to be countered in a project based on the frequency of occurrence.

Please indicate on the boxes using the following criteria.

1. Strongly Disagree 2. Disagree 3. Neutral 4. Agree and 5. Strongly Agree

Delay causes		1	2	3	4	5
Client related	Finance and payment of completed Work					
	Slow decision making					
	Poor communication & coordination of the owner with other parties					
	Lack of coordination with the contractor					
	Unrealistic contract duration imposed by owners					
Contractor related	Poor site management					
	Improper planning					
	Inadequate contractor experience					
	Mistake during construction					
	Improper method					
	Delay caused by subcontractor					
Consultant related	Poor contract management					
	Inadequate experience of consultant					
	Mistakes and discrepancies in design Documents					
	Long waiting time for approval of tests and inspections					
Material related	Poor quality material supply					
	Shortage of construction material					
Labor and equipment related	Labor supply labor productivity					
	Equipment availability and failure					
Contract related	Frequent change orders					
	Mistakes in design documents					
	Discrepancies in contract document					
Contractual relationship related	Major disputes					
	Negotiations during construction					
	Inappropriate organizational structure linking all parties involved in the project					

	Lack of communication between these parties					
External related	Poor weather condition					
	Changes in regulation					
	Problem with neighbors					
	Unfavorable site condition					

SECTION THREE: - Effects of delay on construction

3.1) Please rank effects of delay below in what you consider to be the most influential effect of delay.

The five-point scale ranged from 1 to 5.

1= Strongly Disagree 2= Disagree 3= Slightly Disagree 4= Agree

5= Strongly Agree

Effects	Strongly Disagree	Disagree	Slightly Agree	Agree	Strongly Agree
Cost overrun					
Time overrun					
Dispute					
Arbitration					
Litigation					
Abandonment					

Thank you !