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School of Graduate Studies
Masters of Business Administration in Project Management

**Assessment of Factors Influencing Schedule Delay in Road
Construction Projects in Oromiya Region: The case “Sansuse –
Tatek” and “Tulu Bolo-Kela” design and build road project**

**A Research Project Work Submitted to the School of Graduate Studies of
St.Mary’s University in Partial Fulfillment of the Requirement for the Degree
of Master of Arts in Project Management**

By: Tadele Zewdie
Advisor: Chalachew Getahun (PhD)

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Region: The case “Sansuse –Tatek” and “Tulu Bolo-Kela” design and build road project

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Approved by board of examiners

_____	_____	_____
Advisor	Signature	Date

_____	_____	_____
Internal Examiner	Signature	Date

_____	_____	_____
External Examiner	Signature	Date

Statement of Certification

This is to certify that Tadele Zewdie have carried out his project work on the topic “Assessment of Factors Influencing Schedule Delay in Road Construction Projects in Oromiy Region: The case of Sansuse –Tatek and Tulu Bolo-Kela design and build road project” under my supervision. In my opinion, this work qualifies for submission in partial fulfillment of the requirements for the award Degree of Master of Arts in Project Management.

Signature _____ Date _____

Chalacew Getahun (PhD)

Declaration

I, the undersigned, declare that the study entitled -Assessment of Factors Influencing Schedule Delay in Road Construction Projects in Oromiy Region: The case “Sansuse –Tatek” and “Tulu Bolo-Kela design and build road project” is the result of my own effort and study that all sources of materials used for the study have been acknowledged. I have conducted the study independently with the guidance and comments of the research advisor.

This study has not been submitted for any degree in any university. It is conducted for the partial fulfillment of the requirement for the Degree of Master of Arts in Project Management

Tadele Zewdie

Signature _____

Date _____

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Acronyms

RII: Relative Importance Index

ERA: Ethiopian Road Authority

GTP: Growth and Transformation Plan

IPMA: International Project Management Association

PMBOK: Project Management Body of Knowledge

PMI: Project Management Institute RII: Relative Importance Index

RSDP: Road Sector Development Program

ROW: Right of Way

PMC: Project Management Consultant

FIFA: Federation International de Football Association¹

ADR: Alternative Dispute Resolution

EOT: Extension of Time

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Abstract

Schedule delays are common in road construction sector and create major concerns for project performance. Road Construction schedule delays are caused by many factors. This study identified and assessed schedule delay factors on road construction projects and analyzed these factors with relative importance index method. For this purpose, 83 different delay factors were identified and categorized into nine major groups. Results from relative importance index presented according to their importance. Ranking shows that the equipment -related factors (RII=0.752) are the most significant factor that cause road construction delays. The second most significant factors are material related (RII=0.713) while the third significant factors are contractor related (RII=0.707) factors. Owner-related factors (ERA)/Client (RII=0.704) is the fourth factors whereas consultant-related Factors (RII=0.704) and design-related factors (RII=0.686) are the fifth and six most important group respectively. Externality-related factors (RII=0.634 ranked as the seventh most important group and Labor-related factor (RII=0.616) is the eighth most important group. Finally, Project-related factors (RII=0.601) is the last and least important group. The factors and effect of schedule delays groups contributing the most to delays (those needing attention) were discussed, and some recommendations were made to minimize and control delays in road construction projects. Based on the above-mentioned results and findings of this study, different recommendations were suggested to help minimize and control schedule delays in road construction projects.

Keywords: Road construction projects; Relative importance index method; Schedule delay

CHAPTER: ONE INTRODUCTION

1.1 Background of the Study

Schedule delays in road construction projects are problems faced in the entire world (Bangash, 2016) and Ethiopia is not an exception. Construction delay can be defined as the time overrun either beyond the contract date or beyond the date that the parties agreed upon for delivery (Assaf & Al-Hejji, 2006). In the same line of argument, Awari et Al., (2016) defined delay as the time overrun & cost overrun either beyond completion date specified in a contract or beyond the date that the parties agree upon for delivery of a project. According to Zack, (2003) delay is an act or event which extends required time to perform or complete work of the contract and manifests itself as additional days of work. According to Mohamad, (2010) excites that delay is an act or event that extends the time to complete or perform an act under the contract. Delay, as described by Aibinu & Jagboro, (2002) is a situation where the contractor and the project owner jointly or severally contribute to the non-completion of the project within agreed contract period. Alkathani, (2004) states that delay can be defined as extra time required finishing a given construction project beyond its original planned duration, whether compensated for or not. However, for the purposes of this research, the study adopts the definition of delay given by (Assaf & Al-Hejji, 2006). Delay in projects is counted as a common problem in construction projects (Sullivan & Harris, 1986). Delay apparently means loss of income according to and for the owner or client. In case of contractor, delay implies higher costs due to longer work time, labor cost increase and higher fabrication costs. While on-time completion of construction project is a signal of project efficiency and success as argued by (Mansfield et.al., 1994), (Anees & Sabarinathan, 2016) and (Al Hammadi et al., 2016), there are many unpredictable factors resulting from various sources affecting construction projects. Although there is no consensus on the factors affecting construction delay, it is generally understood that construction delay is the most critical problem causing failure to deliver the project in time, within a specific budget constraint, and expected quality. In Ethiopia, just like in any developing country, the construction sector is a key indicator of economic performance; therefore it is vital to take control of the factors affecting road construction project delay.

The construction industry is the tool through which a society achieves its goals of urban and rural development (Enshassi et al., 2006). It has a great effect on the economy of all countries (Leibing, 2001). It is one of the sectors that provide important ingredients for the development of an economy. However, it is becoming more complex because of the sophistications of the construction process itself and the large number of parties involved in the construction process, i.e., clients, users, designers, regulators, contractors, suppliers, subcontractors, and consultants (Enshassi et al., 2006). Cost, time, and quality have their proven importance as the major measures for project success. According to Ahmed et al., (2003), delays on construction projects are a universal phenomenon. They are usually accompanied by cost overruns. Delay has a negative effect on clients, contractors, and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration, cash-flow problems, and a general feeling of consternation toward one other (Ahmed et al., 2003). This problem is not unique to developed countries but is also experienced in most of the developing economies (Kaliba,2009). A project may not be regarded as a successful endeavor until it satisfies the cost, time, and quality limitations applied to it. However, it is not uncommon to see a construction project failing to achieve its goal within the specified cost, time, and quality (Nega, 2008).

Many researchers conducted studies on the causes of schedule delay in different kinds of construction projects to find factors and causes of time overrun.(Fugar,et.al.,2010) conducted survey on 130 randomly selected engineers. Identified causes of time overrun were delayed payments, material shortage, changes in selected material prices, poor site management, and problems in bank credit. Chan et al., (1996) identified 83 common factors of time overrun and arranged these factors in 8 groups. By using relative importance index five causes of time overrun (delay) were identified which were poor supervision at site and site management, delay in making decisions, owner interference in the project, ground conditions, and necessary changes from the owner. Mansfield et al., (1994) identified 16 causes of time overrun (delay), the top5 being: financial problems faced by the contractor, poor contract management, site supervision, lack of planning, and delay in material supply. Ogeno, (2016) carried out a survey through questionnaire distribution to selected experts of construction industry in Nigeria. Identified causes of schedule delay (time overrun) were inexperienced sub-contractors, shortage of labor,

poor site management, shortage of selected materials and mistakes during works. Emam et.al, (2015) conducted survey about the causes of time overrun in infrastructure projects of Qatar. The results of the survey revealed that major causes of schedule delay (time overrun) were design changes, inadequate planning and scheduling, changes in scope of project, inadequate estimation project time duration, and shortage of skilled labor. Hoai et al., (2008) identified the major causes of schedule delay (time overrun) through quantitative approach in construction projects of Vietnam. The main causes of schedule delay (time overrun) were poor monitoring, poor project management and financial problems faced by owner.

The aim of this study is to identify factors influencing schedule delay in road construction project from stakeholders' perception, such as project manager, project engineer, contractor, owner, design consultant, supervisory consultant, and community surrounding the project etc. Many road construction projects in Ethiopia and in many countries are never completed within the estimated time and cost in addition to the numerous quality problems. Other issues of concern include: change of scope, delayed payments, changes in selected material prices, poor site management, and problems in bank credit. poor supervision at site and site management, delay in making decisions, owner interference in the project, ground conditions, financial problems faced by the contractor, poor contract management, site supervision, lack of planning, and delay in material supply shortage of skilled labor, inadequate planning and scheduling, inadequate estimation project time duration, poor monitoring, poor project management and financial problems faced by owner, and right of way (ROW) problems. It is rational to determine the most significant factors affecting road project performance and decisively deal with so that the scarce resources are directed where they are most needed. Findings have revealed that poor project planning and poor management of the implementation have remained the major factors affecting road project performance. The solution to the road construction project performance problem will not only help in the tackling of Ethiopia National Development Plan of strengthening the country's underdeveloped physical infrastructure, but will also the academicians, policy makers, construction parties and all other stakeholders will benefit from this information with consequences of better road construction networks that will spur social-economic transformation and development across Ethiopia.

In Ethiopia, the contribution of the economic infrastructure development plan which is aimed at meeting the infrastructure need of the economy is a key milestone towards the realization of Ethiopia's vision of becoming a lower middle- income country by 2025(RSDP V). Road, railways, dry ports, air transport, energy, telecom infrastructure will be expanded with the aim of attracting investment, opening new market opportunities, reducing the price of commodities, creating competitive market environment to speed up regional economic integration. For all these, the required infrastructure to support rapid economic growth and structural transformation need to be fulfilled. Road construction, is a major component of infrastructure development, and as such is always in the upper percentile of funding amongst development projects in Ethiopia; funding is estimated at not less than 10 per cent of the national budget. Road is the backbone for the country's accelerated economic growth and social development (National Planning Commission May, 2016 Addis Ababa). Ethiopia Road Authority (ERA) plays an important role in the accomplishment of Road Sector Development Program (RSDP) goals, and the road sector development plan and through the provision of basic infrastructure facilities to the public by developing, maintaining, rehabilitating and managing of road networks in the country. Due to the importance of roads in socio-economic development of the country, the government has in the recent past steadily increased budget allocation to the road sub-sector. However, road projects in Ethiopia have been facing various challenges, which include schedule delay in completion, cost overruns, destruction of residential and businesses houses and unsuccessful work. Therefore this study focuses on two projects "Sansuse –Tatek and Ttulu Bolo-Kela" design and build road project.

In the context of Ethiopia, road is the most important infrastructure that provides access to rural and urban areas in the country. Road plays key role to reduce transportation cost and hold up economic growth in the country. However, in the late 1990's; the road network coverage was limited to major urban areas and some rural areas. Most areas in the country were far from economic centers, market and basic social services. The existing road network was largely declined and unsafe. The Government of Ethiopia has well recognized that limited road network coverage and poor condition of the existing road network has been an obstacle to economic recovery and economic growth. Therefore, to address the problems in the road sector; the Government has launched the Road Sector Development Program RSDP in 1997. Since then,

four phases of RSDP were implemented over the period of 1997 - 2015 and the fifth phase; RSDP V has been implemented since July 2015 (ERA 2016).

- From July 1997 to June 2002 (5 years plan)-phase one
- RSDP II - From July 2002 to June 2007 (5 years plan)- phase two
- RSDP III - From July 2007 to June 2010 (3 years plan)- phase three
- RSDP IV - From July 2010 to June 2015 (5 years plan)- phase four
- RSDP V - From July 2015 to June 2020 (Ongoing)- phase five

With the major objectives of

- Improve transport operating efficiency and reduce road transport costs for freight and passengers so as to encourage production, distribution and export;
- Provide access to previously neglected food deficit rural areas to support efficient production, exchange and distribution throughout the country, and
- Develop adequate institutional capacity of the road sub-sector both at central as well as regional level.

In Ethiopia road transport is the leading mode and accounts for 90 to 95 percent of motorized inter-urban freight and passenger movements. However, because of its limited road network, provision of infrastructure has remained one of the alarming challenges for Ethiopia in its endeavor towards socioeconomic development and poverty reduction. (ERA, 2008a).

In general, to improving road construction efficiency by means of cost-effectiveness and timeliness would certainly contribute to cost savings for the country as a whole. Efforts directed to time effectiveness were associated with managing time, one of the main objectives and policies of any public or private sectors dealing with the execution of projects have to upgrade projects performance, through reduction of costs, completion of projects within their assigned budget and time constraints, and improve quality.

It is hard to imagine how a project could be successful without some planning. Project plans are considered consisting of three fundamental “dimensions”

- Cost: how much money that will be spent and how it's budgeted over time
- Time: how long it will take to execute work—individually and as a total project
- Scope: what is to be done?

Project success will have defined as meeting goals and objectives as prescribed in the project plan. A successful project means that the project has accomplished its technical performance, maintained its schedule, and remained within budgetary costs. Project management tools and techniques play an important role in the effective management of a project.

Time management is one of the tools and techniques in project management. Therefore, a good project management lies in the management of tools and techniques used to manage the project. Project management involves managing the resources, workers, machines, money, materials and methods used. Some projects are effectively and efficiently managed while others are mismanaged, incurring much schedule delay and cost overruns.

Assessing road construction projects' time management is critical in today's market-driven economy. Delay to projects is one of the foremost concerns of the road construction industry in the Ethiopia. The schedule delays to the road projects are affecting the economies throughout the country. Delay to projects mean the slowdown of development in all other related fields. The main aim and objective of this research is to assess the various types of schedule delays and the reasons for those schedule delays that are currently affecting the projects. Therefore, the purpose of this study is to investigate the influence of project schedule delays and to improve and assess the impact of time management on selected site .Thus, the study on time management of this specific project aims to understand effects of schedule delays in order to answer the following basic questions: What is project schedule delay and what is time overrun in the project? What are the factors influencing road construction projects schedule delay in the projects? What are the schedule delay causes in the projects? Therefore, the study has assessed the perceived influence of project implementation delay in the projects.

1.2 Statement of the Problem

Over the past years of Road Sector Development Program (RSDP) history the performance was improved but still there is a big gap for improvement. The issue of addressing huge network expansion and improvement as well as backlogs of maintenance needs under funding constraints, weak local construction industry, few international contractors, weak capacity of own force with leaner qualified staffing resources is indeed a great challenge for Ethiopian road sector. In addition slow pace of institutional change, weak implementation capacity of the local construction industry, high turnover of professional and managerial staffs, and lengthy contract procurement processes can be cited as major challenges (ERA 2016). Delays in construction projects are more likely to happen in almost all projects due to the miscommunication between contractors, subcontractors, property owners or any other reasons. Delays are constantly occurring in road construction projects and they could cause great impact on economic growth. 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,2013) 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). Delays and cost overruns are the most common problems causing delay in the construction industry in both developed and developing countries (Enshassi, et al.,2009) .Delays occur in every construction project and the magnitude of these delays varies significantly from project to project and country to country (Wael et al., 2007) . Cost and time overruns are the key problems of any construction projects. These issues are causing the negative impact on the development of country economic growth and prosperity (Raj K. Shah, 2016).

A number of researches also carried out to investigate the factors of delay in construction projects. Al-Momani (2000) “investigate the causes of delay in 130 public projects in Jordan”. According to his research the important delay factors were related with: (I) design (II) user changes, (III) weather, (IV) site conditions, (V) late supply, (VI) financial conditions and (VII) 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.

R.F.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 Mahamid I, (2013) the top risks causing time overrun in road construction projects in Palestine are: financial status of the contractors, payment delays by the owner, the political situation, poor communication between construction parties, lack of equipment efficiency and high competition in bids. Study in Zambia also indicate that; delayed payments, financial processes and difficulties on the part of contractors and clients, contract modification, economic problems, materials procurement, changes in drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site, changes in specifications and labor disputes and strikes were found to be the major factors of schedule delays in road construction projects (C. Kaliba et al., 2009). According to Tsegay and H.Luo (2017) the influential factors of schedule 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. Worku Koshe and K.N.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 factors 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 factors influencing of schedule delay in road construction projects in the case of Sansuse –Tatek and Tulu Bolo-kela design and build road project and it also aimed to provide an input for the project management of the ERA to mitigate the possible factors of schedule delay in construction projects.

1.3 Research Questions

- What does the situation of existing road construction projects look like in terms of schedule delay?
- What are the factors influencing road construction projects schedule delay in the selected study sites?

1.4 Objectives of the Study

1.4.1 General Objective

The main objective of this study is to identifying the factors influencing of schedule delay in road construction projects.

1.4.2. Specific Objectives

The primary aim of this study is:

- To describe the existing situation of schedule delays in road construction projects problem
- To investigate factors influencing schedule delay
- To identify the effects of schedule delays in the selected road construction project

1.5 Significance of the Study

This research will have a significant importance in understanding the degree of schedule delay in road construction projects. It will also help us to know the major factors of road construction project delay and the apportioning of these factors to the major stakeholders in road construction projects. Besides it can also propose way of improvement in order to control and mitigate project delay causes and provide inputs for the management of Ethiopian Road Authority (ERA) in order to take corrective actions and make informed decisions to promote the successful completion of projects by mitigating the most common factors of delay. In addition it will also be important to the researcher as it add theoretical and practical knowledge on how to conduct research and it may also significantly important to scholars and researchers who require basis for further research in this area.

1.6 Scope and Limitations of the Study

1.6.1 Scope of the study

The construction industry is one of the broadest industries, which involve many kinds of projects under it. So investigating the industry as a whole will be costly and time consuming. Due to this, the study will focus only on the two selected site road projects which are held by Ethiopia road construction authority (ERA).

1.6.2 Limitation of the study

There are some problems that may be met while undertaking this study. The first is problems on data collection, which most respondents may not return the questionnaire on time. The second is frequent power failure, which is not taken into account at the beginning of the project. The last but not the least is the Hawthorne effect (Benti et al, 2004), that reduces the strength of the data collected, i.e. some contractors and consultants will not be willing to provide exact information on delayed projects.

1.7 Organization of the study

This study is organized in five consequential chapters. The first chapter deals with the introduction part of the paper comprising background of the study, statement of the problem, objectives of the study and scope & limitations of the study. The second chapter focuses on review of literatures related to the topic of this study. The third chapter deals with the research methodology, design, approaches used throughout the data collection and analysis. The fourth chapter presents the overall finding of the study which prevails about the most important and frequently occurring causes of schedule delay from the perspectives of the main groups (clients/owner, contractors, consultant and the responsible stakeholders). The last chapter, chapter five encompasses the conclusion and recommendation part of the study. Conclusions are made from the previous chapter so that we can make some recommendations.

CHAPTER TWO: REVIEW OF RELATED LITERATURES

The focus area of this chapter is on literature review of related to the topic under the study. The related with the literature review area of project management and mainly significantly literatures are selected from road and other construction project management areas. Literature review includes different books, International journals, articles, thesis papers, reports which are related to the study topic. Most of the literatures discussed here under are conducted on different countries, environment under different conditions and time to determine the fact that factors affecting schedule delay could be in different countries and under different situations.

2.1.Overview of Project, Project Management,Project Schedule and Schedule Delays

2.1.1 Project

According to the Project Management Body of Knowledge (PMBOK GUIDE), a project is a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates that a project has a definite beginning and end. The end is reached when the project's objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists. Projects can also have social, economic, and environmental impacts that far outlive the projects themselves (PMBOK 5th edition). International Project Management Association (IPMA) defines a project as a time and cost constrained operation to realize a set of defined deliverables up to quality standards and requirements. On the other hand the Association of Project Managers (APM) defines a project as a unique, transient endeavor undertaken to achieve a desired outcome. According to Robert K. Wysocki (2014) definition Project is a sequence of unique, complex, and connected activities that have one goal or purpose and that must be completed by a specific time, within budget, and according to specification. A Business-focused definition of a Project by the same author Robert K. Wysocki(2014) is a sequence of finite dependent activities whose successful completion results in the delivery of the expected business value that validated doing the project. Gary R. H. (2003) also defines a project as a temporary endeavor undertaken to achieve a particular aim. A project is actually the response to a need, the solution to a

problem. Further, it's a solution that promises a benefit—typically a financial benefit. The fundamental purpose for most projects is to either make money or save money .By definition, a project is temporary in nature; that means that it has a specific start and finish. A project consists of a well-defined collection of small jobs (tasks) and ordinarily culminates in the creation of an end product or products (deliverables). There will be a preferred sequence of execution for the project's tasks (the schedule). A project is a unique, one-time undertaking; it will never again be done exactly the same way, by the same people, and within the same environment (Gary R. H., 2003). Some of the special features of a project according to Rory B. and Steve B., (2007) include:

- A project has a clear start and finish.
- A project passes through a number of distinct phases (initiation, design, implementation and handover).
- Projects are often time-limited (they must finish by a certain date).
- Projects have a clear budget which is usually broken down to a budget per work package.
- Activities are essentially unique and non-repetitive - you only get one opportunity to get it right.
- Resources may be sourced from different functional departments and contractors, and need to be coordinated.
- The project manager as project leader is responsible for the successful completion of the whole project.
- Multi-disciplined project teams are formed to manage the project. In large companies the project team would probably work within a matrix organization structure.

2.1.2 Project Management

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (PMI, 2013). This application of knowledge requires the effective management of the project management processes. A process is a set of interrelated actions and activities performed to create a pre-specified product, service, or result. Each process is characterized by its inputs, the tools and techniques that can be applied, and the resulting outputs. Project management is accomplished through the appropriate application and

integration of the 47 logically grouped project management processes, which are categorized into five Process Groups.

These five Process Groups are:

- Initiating,
- Planning,
- Executing,
- Monitoring and Controlling, and.
- Closing PMBOK5th edition.

2.1.3 The Ten Knowledge areas of Project Management

A Knowledge Area represents a complete set of concepts, terms, and activities that make up a professional field, project management field, or area of specialization. These ten Knowledge Areas are used on most projects most of the time. Project teams should utilize these ten knowledge Areas and other Knowledge Areas, as appropriate, for their specific project. The Knowledge Areas are: Project Integration Management, Project Scope Management, Project Time Management, Project Quality Management, Project Human Resource Management, Project Communications Management, Project Risk Management, Project Procurement Management and Project Stakeholder Management (PMI, 2013).

2.1.4 The concept of Project Schedule

A schedule is the change of a project action plan into an operating time table. As such, it serves as the basis for monitoring and controlling project activity and, taken together with the plan and budget, is probably the major tool for the management of projects. In a project environment, the scheduling function is more important than it would be in an ongoing operation because projects lack the continuity of day-to-day operations and often present much more complex problems of coordination. Indeed, project scheduling is so important that a detailed schedule is sometimes a customer-specified requirement. Properly designed, detailed schedule can also serve as a key input in establishing the monitoring and control systems for the project (Jack R. M., Samuel J.M., 2009).

2.1.5. The concept of schedule delay

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. It is also a project slipping over its planned schedule and was considered as common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rentable space or a dependence on present facilities. 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.

Completing projects on time is an indicator of efficiency, but the construction process is subject to many variables and unpredictable factors, which result from many sources. These sources include the performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations. It rarely happens that a project is completed within the specified time. The construction industry is large, volatile, and requires tremendous capital outlays.

Even with today’s advanced technology, and management understanding of project management techniques, construction projects continue to suffer delays and project completion dates still get pushed back. Stumpf,(2000).

2.1.6. The concept of Project Delay

Delay in construction is a global phenomenon (Sambasivan and Soon, 2007) affecting not only the construction industry but the overall economy of countries as well (Faradi and El-Sayegh, 2006). Delay (Time overrun) is a condition the actual work does not complete in an estimated time period. Delay or time overrun is defined as a condition where a construction project does not complete within the designed time period. It happens when the work of contract does not complete in its prescribed time. Time overrun is a most common incident which occurs nearly in all the projects related to the construction industry. Time delay is critical in developing countries

where it exceeds its 100 % of estimated time while constructing a project (Muhammad A. et al., 2017). Delay in government construction projects, especially the road sector, has had a significant impact on economic activities in the country. Several road construction projects have littered the length and breadth of the country for which government has commenced that has yet to be completed (Twana A, 2015).

2.1.7. Delay in Construction Projects

Cost, time, and quality have proven their importance as the prime measures for project success. According to Ahmed, et al., (2003) delays on construction project are a universal phenomenon. They are usually accompanied by cost overruns. Delay has a negative effect on clients, contractors, and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration, and cash flow problems. A project may be regarded as a successful endeavor until it satisfies the cost, time, and quality limitations applied to it. However, it is not uncommon to see a construction project failing to achieve its goal within the specified cost, time, and quality. Construction delays are more likely to happen in almost all projects due to the miscommunication between contractors, subcontractors, property owners or any other reasons. In many cases, construction projects are delayed because of inaccurate estimate of time and project cost that was initially presented to the clients or project owners. Delays and cost overruns are the most common problems causing delay in the construction industry in both developed and developing countries (Enshassi et al., 2009). In practice, delays occur in every construction project and the magnitude of these delays varies significantly from project to project and country to country (Wael et al., 2007). Cost and time overruns are the key problems of any construction projects. These issues are causing the negative impact on the development of country economic growth and prosperity (Raj K. Shah, 2016).

2.2 .Theoretical Literature Review

2.2.1. Types of delay

According to the classification of Syed, et al. (2002) delays can be non-excusable delays, excusable non-compensable delays, excusable compensable delays and concurrent delays.

Non-excusable delays

Non-excusable delays are caused by lack of performance of the contractor on the construction project such as a contractor failure to provide an adequate material to complete their job. These delays can be caused by underestimates of productivity, improper project planning and scheduling, poor site management and supervision, wrong construction methods, equipment breakdowns, unreliable subcontractors or suppliers. Therefore, it is contractor's responsibilities to continue their work with no entitlement to claim for extension of time or delay damages until they completed the project.

Excusable delays

Excusable delay is a delay that is caused due to an unforeseeable event beyond the contractor's or the subcontractor's control. Usually, based on common general provisions in public agency specifications, delay resulting from the following events would be considered excusable such as fires, floods, owner directed changes, errors and omissions in the contract drawing, unusually severe weather and etc. Excusable delays can be further classified into excusable with compensation and excusable without compensation.

Excusable delays with compensation

Compensation delays are caused by the owner or the owner's agents. An example of this would be the drawings late release from the owner's architect. An excusable, compensable delay normally leads to a schedule extension and exposes the owner to financial damages claimed by

the contractor. In this scenario, the contractor incurs additional indirect costs for both extended field office and home office overhead and unabsorbed home office overhead.

Excusable delays without compensation

Non-compensable delay is a delay that is caused by third parties or incidents beyond the control of both the owner and the contractor. Examples typically include: unusual weather, strikes (Trauner et al., 2009), fires, and acts of government in its sovereign capacity, etc. In this case, the contractor is normally entitled to claim extension of time but no compensation for delay damages. According to Ethiopian civil law/code Article 1973, Strikes that are foreseeable at the time of signing the contract are not considered excusable causes of delay.

Concurrent Delay

Concurrent delay is a problem that happens on most of the construction industry project. In this situation, both owner and contractor are responsible for the delay (Rubin et al., 1983). Commonly concurrent delays which involve any two or more excusable delays result in extension of time. When excusable delays with compensation and non-excusable delays are concurrent, an extension of time can be issued or the delay can be distributed between the owner and the contractor. Concurrent delay can be categorized in three types of delays:

If excusable and non-excusable delays occur concurrently, the contractor can only claim for extension of time:

If excusable with compensation and excusable without compensation delays occur concurrently, the contractor is entitled to claim extension of time but no delay damages:

If two excusable with compensation delays occur concurrently, the contractor is entitled to claim extension of time and delay damages.

2.3. Empirical Literature Review

2.3.1 Factors of Schedule Delay in Construction Projects

There are several factors or factors of delays that have been identified by researchers in the field of project management in the construction industry. Some of these researchers have even attempted to categorize the causes of delays based on certain factors. These categories may have some geographical limitations and as such cannot be applied using a wholesale approach. This probably explains why there are several researches on the causes of delays in construction projects from several countries. Although there are some similarities in these findings, the differences restate the need to have geographic dimension to this subject matter (Twana A., 2015).

Many researchers have examined the main factors of construction delay in various types of construction projects. In Malaysia, Aftab H. M. (2014) in his study ‘Contractor perspective on time overrun factors in Malaysian construction projects’ he concluded that the top ten most significant causal factors contributing to construction time overrun are frequent design changes; change in the scope of the project; financial difficulties of owner; delays in decisions making; unforeseen ground condition; delay in progress payment by owner; shortage of site workers; mistakes and Errors in design; delay preparation and approval of drawings; and incompetent subcontractors. Another study by Aftab et al., (2011) on their study ‘Time overrun in construction projects from the perspective of Project Management Consultant (PMC)’ in Malaysia: they concluded that major causes of time overrun by PMC are cash flow and financial difficulties faced by contractors; contractor's poor site management; inadequate contractor experience; shortage of site workers; ineffective planning and scheduling by contractors; escalation of material prices; practice of assigning contract to lowest bidder; problems with subcontractors; and lack of communication among parties.

Raj K. Shah (2016) on his study “An Exploration of Causes for Delay and Cost Overruns in Construction Projects”: in Australia, Malaysia & Ghana he identified the most influential factors of delay in Australia are (1) planning and scheduling deficiencies, (2) methods of construction, (3) effective monitoring and feedback process, whereas in Ghana, (1) delay in payment

certificates (2) underestimating of project cost, (3) complexity of projects are the most influential factors. However, in Malaysia (1) Contractor's improper planning, (2) poor site management, (3) inadequate contractor experience are the most influential factors.

A study conducted by Arya A. and Kansal R. (2016) on their study 'Analyzing causes and effects of delays of construction projects in India': they summarized the importance of delay factors from the contractors and consultants perspective. Late progress payment, financial problems of owner and improper study of design and three project-related factors (poor qualification of the contractor technical staff and project team, poor site arrangement, management, and poor terrain condition, and supervision) were in the top-10 lists of combined consultants and contractors. This indicates that concerns related to the project and external factors were taken equally into account by combined contractors and consultants.

Siddesh K. Pai, and J. Raj Bharath (2013) in their study "Analysis of Critical Causes of Delays in Indian Infrastructure Projects" they concluded that too short original contract duration, delay in progress payments by owner, ineffective planning and scheduling of project by contractor, late in reviewing and approving design documents by consultant, mistakes and discrepancies in design documents, delay in material delivery, equipment breakdowns, shortage of labor, are effects of subsurface conditions (E.g. Soil, high water table) are extremely critical causes of delay. Twana A. (2015) in his study at Kurdistan Region of Iraqi Federal Government; he concluded that delayed payments, financial processes and difficulties on the part of contractors and clients, contract modification, economic problems, materials procurement, changes in drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, and poor coordination on site, changes in specifications and labor disputes and strikes were found to be the major factors of schedule delays in road construction projects.

Muhammad A. et al., (2017) on their study on Time Overrun in Public Sector Construction Projects in Pakistan as an example of developing countries: summarized their findings on the basis of average index the top most factors of time overrun in the form of non-excusable, non-compensable and compensable delay found on construction industry site as follows. Non-Excusable Delay: (1) Delay in shop drawings and sample materials; (2) Poor communication and

coordination between parties; (3) Slowness in decision making process; (4) Suspension of work. Non-Compensable Delay: (1) Fire; (2); Natural changing in environment; (3) Wind; (4) Snow fall. Compensable: (1) Poor site management and supervision by contractor (2) Poor communication and coordination by contractor with other parties; (3) Delays in sub-contractors work; (4) Delays in sub-contractors work.

Study on Schedule delay in Saudi Arabia Road Construction projects: size, estimate, determinants and effects by Ibrahim M. (2017) results show that the top five important factors affecting schedule delay in road construction projects in Saudi Arabia are: Improper planning; poor labor productivity; additional work (it can be as a deviation from an agreed upon well-defined scope and schedule); rework; and Lack of contractor experience. Baloyi L. & Bekker M. (2011) in their study “Causes of construction cost and time overruns” The 2010 FIFA World Cup stadia in South Africa: They concluded that the highest ranked contributors to time overrun on projects are concentrated around client actions, such as incomplete designs; design changes; slow decision-making; and late issue of instructions. For the contractor category the “shortage of skills” proved to be the most significant delay factor.

Remon F. Aziz et al., (2014) on their study ‘Exploring delay causes of road construction projects in Egypt’ they concluded that: financial problems, shortages in equipment, construction materials, skilled operators, inadequate experiences, reworks, changes or errors in design, delays in design submittal, soil and underground problems in investigation or management or expropriation, physical obstructions are the reasons for delay according to the questionnaire results. The cause (conflict, war, revolution, riot and public enemy) with revolution as in the 25 January revolution in Egypt made it to be from the top twenty causes of delay.

Study in Zambia by C. Kaliba et al., (2008) in their study “Cost escalation and schedule delays in road construction projects in Zambia” they concluded that: delayed payments, financial processes and difficulties on the part of contractors and clients, contract modification, economic problems, materials procurement, changes in drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site, changes in specifications and labor disputes and strikes were found to be the major factors of schedule

delays in road construction projects.

Kikwasi G. J. (2012) in his study “causes and effects of delays and disruptions in construction projects in Tanzania”: indicate seven highly ranked causes as design changes, delays in payment to contractors, information delays, funding problems, poor project management, compensation issues and disagreement on the valuation of work done. His study result also indicates that clients, consultants and contractors were involved in project delay with varying degrees. In particular, 78%, 70% and 56 for clients, consultants and contractors respectively have had projects delayed.

According to Henry A. et al., (2013) on their study on Investigation into the causes of delays and cost overruns in Uganda's public sector construction projects: The five most important factors of delays in construction projects were found to be: changes to the scope of work, delayed payments, poor monitoring and control, the high cost of capital and political insecurity and instability.

And study on factors influencing successful completion of roads projects in Kenya by Ondari P. O. & Gekara J. M. (2013) indicates that supervision capacity statistically was seen to have the most significant relationship with timely completion of projects. The findings on supervision capacity further supported by financial difficulties are the major cause of suspension of works in construction projects leading to delay in the timely completion of projects. Another study in Kenya by Msafiri A. Seboru (2015) “An investigation into factors causing delays in Road Construction projects in Kenya”: he concluded that the combined views of the overall top five factors of delay identified by both consultants and contractors were: Payment by client; slow decision-making and bureaucracy in client organization; Claims; inadequate planning/scheduling; and rain.

Aedwin R. V. and Shibi V. (2015) identified causes of delay related to owners, consultants, contractors, Labor, Equipment, and external factors. According to their study Owner related factors include (slow decision making, delay in delivering the site, payment delay, improper planning and scheduling, owner interference, change in orders, suspension of work, lack of communication, late decision making, conflicts among partners); Consultant (Inadequate

experience, delay in approving drawings and samples, inadequate detailing and clarity in drawings, quality assurance control, mistakes & discrepancies in design documents); Contractor (delay in payment, delays in sub-contractor work, poor site management and supervision, rework due to errors, inexperience, poor qualification of staff, in effective planning, frequent change of subcontractor); Labor & Equipment (shortage of labor, low productivity level of labors, inexperienced work force, delay in material delivery, shortage of materials, shortage of equipment, equipment break down, low productivity & efficiency, poor operator skill, lack of communication); and External factors (change in government, poor soil conditions regulations, delay in obtaining permits, climatic factors, accidents during construction, delay in commissioning).

I. Mahamid (2013) in his study “Frequency of time overrun causes in road construction in Palestine”: Contractors’ View; he identified factors of delay under different groups (project group, owner group, materials & equipments group, labor group, external group, contractor group, consultant group, and design group). Study in India by Divya. R., S. Ramya (2015) in their study on “Causes, Effects and Minimization of Delays in Construction Projects” they categorized the causes of delays into eight related groups namely: 1) Project group 2) Owner group 3) Materials and equipment group 4) Laborers group 5) External group 6) Design group 7) Contractor group 8) Consultant group.

2.3.2 Factors of Delay in Construction Projects in Ethiopia

Construction delay is a common problem in construction projects in Ethiopia and occurring in every type and phase of a construction projects. In Ethiopia, the construction industry is blooming and the road networks increasing from time to time all over the country. However the historical data of completed road projects shows that, none of the projects was completed as planned and within the estimated cost (Shambel and D. Pate .2018). According to Werku and Jha (2016), Construction delays are occurring in every phase of a construction project and are common problems in construction projects in Ethiopia, and this is the major factors of project failure.

A number of researches have been carried out to examine the main causes of construction delay in various types of construction projects. Abubeker J. (2015) in his study “Factors affecting time and cost overrun in road construction projects in Addis Ababa” identified the most important causes of time overrun as: right of way problem, financial problems and improper planning and according to his survey result, project time overrun ranges from 25% to 264.38% of its original contract amount.

Siraw Y. (2014), in his study on analysis of factors contributing to time overruns on road construction projects under Addis Ababa City Administration‘ in Ethiopia, he concluded that slow site clearance, Inflation, progress payments delay by owner, contractors‘ financial problems, inaccurate cost estimation, and delay in commencement were the major causes of time overrun in Addis Ababa road construction. Werku and Jha (2016), in their study ‘Investigating Causes of Construction Delay in Ethiopian Construction Industries‘ the ranking of groups based on their order of importance as: (1) Contractor’s related factors, (2) Material related factors, (3) Labor related factors, (4) Designer’s related factors, (5) Consultants/supervisors related factors, (6) Client related factors, (7) External related factors.

Tsegay and H. 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 factors of delay and investigated as external, responsibility, resource, and contract related; for all stages except they influenced by different level and sub groups of factors of delay.

1) Responsibility Related Factors

I) Client related factors: 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, Poor communication and coordination.

II) Contractor related factors: Subcontractors related problems, Poor site management

&performance, Ineffective project planning and scheduling, inappropriate construction methods, Poor communication and coordination, inadequate contractor experience, Rework for correcting unsatisfactory work.

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

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

2) Resource Related factors

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

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

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

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

3) Contract condition related factors: 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, Lack of clear understanding of contract documents.

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

In their study in different construction stage of projects Tsegay and H. Luo (2017) indicated that, the influential factors 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 performance, late release budget/funds, and ineffective project planning and scheduling.

2.3.3 Factors of road construction delay in Ethiopia

The construction sector particularly road construction is a very important sector for the development and economic growth of any developing country (M.Haseeb, 2011). Ethiopia and/or is under development and the development of road construction is vital like any other developing country if not more vital. In Ethiopia, there are many road projects constructed, under construction and planned to be constructed. But, a very common problem which is affecting almost all road construction projects in the country is the failure to meet the stated/planned completion period (schedule delay). And therefore, this chronic problem is repeatedly happening in almost all road projects in Ethiopia and we can assume list of factors to affect the on time accomplishment of projects.

2.4 .Synthesis of the Reviewed Literature

2.4.1 Methods of Minimization of construction delays

When there is a construction delay, time overrun is inevitable, there may be also a cost overrun and it can leads to the project to suffer financially, disputes may also arise among project stakeholders. Therefore project stakeholders must work to minimize risks that such delay will occur. Divya. R. and S. Ramya (2015) recommended following points in order to minimize and control delays in construction projects: Frequent progress meeting; Use up-to-date technology utilization; Use proper and modern construction equipment; Use appropriate construction methods; Effective strategic planning; Proper material procurement; Accurate initial cost estimates; Clear information and communication channels; Frequent coordination between the parties involved; and Proper emphasis on past experience.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter deals with the methodology and procedures followed to determine the approach and methods of collecting information and data from the study population through either or both of primary and secondary data sources. The aim of this study is to Assess Factor Influencing Schedule Delay in Road Construction Projects from the owner of the projects, contractor, client, consultants and stakeholders perspectives. This chapter discusses the scope of research, research design, and description of study population, study sample, methodology, location and statistical tools used in the research.

3.2 Research approach and design

The research methodology is a description because descriptive research can be quantitative. It can involve collections of quantitative information that can be tabulated along a continuum in numerical form, such as scores on a test or patterns of interaction when using technology in a group situation. Descriptive research involves gathering data that describe events and then organizes, tabulates, depicts, and describes the data collection (Glass & Hopkins, 1984). It often uses visual aids such as table and charts to aid the reader in understanding the data distribution. Because the human mind cannot extract the full import of a large mass of raw data, descriptive statistics are very important in reducing the data to manageable form. When in-depth, narrative descriptions of small numbers of cases are involved, the research uses description as a tool to organize data into patterns that emerge during analysis. Those patterns aid the mind in comprehending a qualitative study and its implications. In this study quantitative research methods were employed/adopt because this research approach was the use of statistical data as a tool for saving time and resources. Bryman, (2001, p-20) argue that quantitative research approach is the research that places emphasis on numbers and figures in the collection and analysis of data. Imperatively, quantitative research approach can be seen as being scientific in nature. The use of statistical data for the research descriptions and analysis reduces the time and effort which the researcher would have invested in describing the result. Data (numbers, percentages and measurable figures) can be calculated and conducted by a computer through the

use of relative importance index (RII) For this purpose a questionnaire was developed to assess the perceptions of owners of the projects, contractors, Client, consultants and stakeholders on the relative importance of Assessment of Factor Influencing Schedule delays in road construction projects. Quantitative data were obtained through questionnaire. The data collected through these methods were analyzed and the results were presented.

3.3 Sampling techniques

3.3.1 Study Population

The population of the study comprises the main parties of road construction projects namely ERA/client staff, Contractor (engineers, site engineers, materials engineers, quantity & senior surveyor, right of way management specialist & supervisors) and consultants (resident engineer) who are involved in road construction projects. The study population only covers all employees with engineering educational background and engaged in road construction projects. Therefore out of the total number of employees who are engaged in road construction project work, only 40 employees are professional engineers, project managers and supervisors with more than one year of experience in road project construction.

3.3.2 Sample Size

It is quite clear that the more the sample size is the more accurate and concrete the conclusion of a study will be. There are different parties evolved in each project, which are the contractor, client, sit engineer, project manager and the consultant so it is necessary to select the respondents form each party. So here on the study 40 sample are chosen from all parties involved in the selected projects.

3.3.3 Sampling Procedure

Non- probability (Purposive, deliberate) sampling technique were use to select the respondents because non-probability sampling represents a valuable group of sampling techniques that can be use in my study that follows quantitative research designs and also non-probability sampling is often used because the procedures used to select units for inclusion in a sample are

much easier, quicker and cheaper.. This method is use because of the small number to select the respondents of study population. William (2005) indicates the importance of purposive sampling method in allowing the researcher to get information from a sample of the population that one thinks knows most about the subject matter.

Types and Sources of Data

Both primary and secondary data will be use in relation to the topic under discussion. Primary source of data obtained through questionnaire results. Secondary data will collect from secondary sources of data such as project completion reports, administrative reports, contract documents and related articles from the internet. The sources of data will the main parties in the construction namely; owner/ client, contractor and consultant and other stakeholders.

3.4. Data collection technique and procedure

The data will be use in this study were gathered from the main parties in the construction (clients, contractors, project managers, engineers and consultants) who participated in the road construction project using questionnaire and document review. Questions use in the questionnaire is closing ended (based on Likert scale).

Document review will also employee to collect relevant secondary data from secondary sources (project completion reports, administrative reports, contract documents).

The questionnaire used in this study were adopted from the questionnaire used by (L. Muhwezi et al., 2014), based on the literature review and some additional suitable questions developed with the expert assistance in the field under study. The questionnaire has well-organized road construction project delay factors and these causes were categorized into 83 different delay factors and 9 major groups were identified such as consultant related, contractor related, design related, equipment related, external related, labor related, material related, owner (client) related, and project related delay factors. Delay cause and factors related to each groups are described on the questionnaire.

The questionnaire was consisted 5 point likert-scale item question and the variables

weremeasured in ordinal scale (Sheskin, 2004). And design to assess the perspective of respondents from each group on the importance and likelihood /frequency of occurrence of delay factors. Then the calculated mean has been taken to compute the Relative Importance Index and to rank each delay attribute based on their order of importance.

3.5 Data Analysis Technique

The procedure used in analyzing of data aimed at establishing the relative importance of the various factors that contribute to causes of delays and relative degree of occurrence of effects of delays. Ranking of the attributes in terms of their criticality as perceive by the respondents was done by use of Relative Importance Index (RII).The RII method to determine the relative importance of the various factors of delays for road construction projects. The same method is adopted in this study. Analysis of data in the following way:

- The RII (Relative Importance Index) method was adopted in this study to determine the relative importance of various factors affecting the quality of the road construction projects.
- Quantify the relative importance predictor variables such as (consultant,contractor,design,equipment,externality,labor,material,clint,and project related factors)
- To find the extent and the factors causing time over runs in construction projects .The **analysis** of survey is done by Relative Importance Index (**RII**) method. For the survey a questionnaire was prepared in three parts. For each sample take the total **score** aggregate and divided by n(total number of factors), that is how you get **mean score**.
- Ranking of factors in each category based on the Relative Importance Index (RII) . RII value ranges from 0 to 1 (Gündüz et al., 2013). The higher the RII value greater is the impact or frequency of occurrence of the variables.

$$RII = \frac{\sum W}{A * N}$$

Where, RII is the Relative Importance Index,

W = weighting given to each factor by the respondents (ranging from 1 to 5),

A = highest weight (i.e. 5),

N = total number of respondents.

The values of RII ranges from 0 to 1 (0 not inclusive); the higher the RII, the more important the cause of delay is. The RII value is ranked and the results are shown using tables and/or graphs. The RII is used to rank different causes. The RII then being classified based on the RII classification table as shown below in table 3.1.

Table 3.1 Classification of RII

Scale	Level of importance	RII
1	Not important at all	$0.0 < \text{RII} \leq 0.2$
2	Slightly important	$0.2 < \text{RII} \leq 0.4$
3	Moderately important	$0.4 < \text{RII} \leq 0.6$
4	Important	$0.6 < \text{RII} \leq 0.8$
5	Highly important	$0.8 < \text{RII} \leq 1.0$

A five point Likert scale ranging from very high to very low effect will be used. The same classification is used as Jawal N. A. (2015) used in his study “Assessment of delay causes of construction projects in Palestine”.

CHAPTER FOUR: RESULT AND DISCUSSION

This chapter deals with the presentation of the data collected from respondents through questionnaire and document review. Relevant data was collected from targeted contractors, Clients/owners, project managers, project engineers, consultants and other stakeholders through designed questionnaire.

Response Rate

The questionnaire used in this study has eighty-three set of questions which are related to, consultants, contractors, designs, equipment, externalities, labors, materials, owners (clients), and project related factors.

4.1. Respondents Characteristics (profile)

Among the 40 responses 50% of the respondents were from the Project engineer, 25% from the Project managers and contractor groups and the rest of the responses were from clients, consultants and other stakeholders 25% from each group.

Table 4- 1: Distributed Questionnaires, Respondents and Responses

Respondent	Questionnaire Distributed (#)	Questionnaire Collected (#)			Response from Total (%)
		Invalid/ Incomplete Questionnaire	Complete/ response	Valid	
Project engineer	20	-	20		100%
Project manager and contractor	10	-	10		100%
Client, consultant and others	10	-	10		100%
Total	40		40		100%

4.1.1 Respondents by Gender and Age

Table 4.2 below shows that among the total of 40 respondents 72.5% or 29 respondents are male and only 27.5% or 11 respondents were female and regarding the age group 57.5% or 23 respondents are 21-30 years of age, 42.5% or 17 respondents are between 31-40 years of age.

4.1.2 Respondents by Educational Background

Table 4.2 below shows that among the 40 respondents 75% or 30 respondents have 1st degree, and 25% or 10 respondents have 2nd degree (Masters Degree) in civil engineering and they have engineering background

4.1.3 Respondents Experience in Road Construction

Table 4.2 below shows that among the respondents 65% or 26 respondents have 1 to 5 years experiences, 17.5% or 7 respondents have 6 to 10 years experiences, 15% or 6 respondents have 11 to 15 years experiences, and 2.5% or 1 respondent have 16+ years experiences in road construction. Werku&Jha (2016), Aziz (2013), Owolabi J. D., et al (2014), and N. Jawal (2015) used similar groupings of respondents' years of experiences in their study as indicated below.

Table 4- 2: Characteristic variables of respondents (sex/gender, age, education, and experience)

characteristics		Project engineers	Project managers and contractors	Clients, consultants, and others	Total
Gender	M	13	7	9	29
	F	7	3	1	11
Age	21-30 years	11	7	5	23
	31-40 years	9	3	5	17
Education	1 st degree	15	7	8	30
	2 nd degree	5	3	2	10
experience	1-5 years	11	6	9	26
	6-10 years	5	2	-	7
	11-15years	3	2	1	6
	+16	1	-	-	1

4.2 Projects performance

Table 4- 3: *Projects performance on road construction*

No	Project Name	Contract Signed Date	Contract duration	Length in Km	Date of commencement	Original completion date	EOT	Revised completion date	Actual completion date	Total No. of delay in (Days)	Delay in %
1	Sansuse –Tatek	May 23,2017	913 calendar days	13.56	Nov.15, 2017	May 16,2020	333 calendar days	Apr.14,2021	Apr.14,2021	333 days	36.47 %
2	Tulu Bolo-Kela	Jun 05,2017	1278 calendar days	80	Oct.15,2017	Apr.15,2021	No	No	Apr.15,2021	NA	NA

The above Table 4.3 shows that Sansuse –Tatek road projects are not completed on their original completion date because of schedule delays factors. This ongoing projects also running far behind the schedule from the minimum of 36.47% to the maximum at their current status, the percentage of delay will also increase at their actual completion. Tulu Bolo-Kela road projects are ongoing project The causes of road construction projects delay are vary project to project based on complexity and nature of the project, location of the projects, type of contract, and communication between project stakeholders. Possible factors of delay identified and classified under nine major categories (consultants, contractor, design, equipment, externality, labor, material, owner /clients and project related) which are used on survey questionnaire.

4.3 Causes of Schedule delay in road construction projects

This part of the paper consists of results and discussion of assessment of schedule delay in road construction projects. The causes of schedule delay are discussed under nine groups, Causes related to consultants, contractors, design, equipment, externalities, labor, materials, owners (clients), and otherproject related factors. Each delay causes are assessed from the view point of clients, consultants, project managers, project engineers, and contractors. Each factor is evaluated and ranked based on their importance and possibility of occurrence as perceived by respondents and the calculated mean are taken to rank delay causes using Relative Importance Index (RII).

Table 4- 4: Over all rank delay causes using Relative Importance Index (RII)

Factor group	Number	Factors causing delays	1: Very low importance	2: Low importance	3: Medium importance	4: High importance	5: Very high importance	RII	Rank
Consultant-related Factors	1	Lack of experience of consultant in construction projects	5	0	18	10	7	0.67	42
	2	Conflicts between consultant and design engineers	5	12	10	8	5	0.58	69
	3	Delay in approving major changes in scope of work by consultants	3	8	8	16	5	0.66	45
	4	Delay in performing inspection and testing	0	10	6	14	10	0.72	26
	5	Inaccurate site investigation	0	3	10	22	5	0.745	19
	6	Inadequate project management assistance	1	1	14	10	14	0.775	13
	7	Late in reviewing and approving design documents	2	0	5	22	10	0.79	11
	8	Poor communication and coordination with other parties	0	9	10	14	7	0.695	33
Contractor-related factors	1	Frequent change of subcontractors	0	9	10	14	7	0.52	77
	2	Inadequate contractor experience	10	5	3	10	12	0.645	50
	3	Inappropriate construction methods	10	3	1	10	16	0.695	33
	4	Incompetent project team	1	10	10	7	12	0.695	33

	5	Ineffective project planning and scheduling	1	1	8	16	14	0.805	7
	6	Obsolete technology	5	3	12	20	0	0.435	83
	7	Poor communication and coordination with other parties	1	6	6	26	1	0.7	32
	8	Poor site management and supervision	1	1	12	16	10	0.615	60
	9	Rework due to errors	1	10	10	12	7	0.67	42
	10	Unreliable subcontractors	7	8	8	14	3	0.59	65
Design-related factors	1	Complexity of project design	12	5	3	14	6	0.585	66
	2	Design changes by owner or his agent during construction	0	3	11	26	0	0.715	27
	3	Design errors made by designers	0	1	16	16	7	0.745	19
	4	Insufficient data collection and survey before design	0	5	7	8	20	0.815	5
	5	Lack of experience of design team in construction projects	1	5	18	6	10	0.695	33
	6	Mistakes and delays in producing design documents	1	5	12	14	8	0.715	27
	7	Misunderstanding of owner's requirements by design engineer	5	8	16	10	1	0.57	71
	8	Poor use of advanced engineering design software	1	14	14	8	5	0.64	53
	9	Unclear and inadequate details in drawings	1	5	14	14	6	0.695	33
Equipment-related factors	1	Equipment allocation problem	0	3	9	18	10	0.775	13
	2	Frequent equipment breakdowns	1	0	5	18	16	0.84	2
	3	Improper equipment	3	5	8	10	14	0.735	23
	4	Inadequate modern equipment	3	5	8	14	8	0.735	23
	5	Low efficiency of equipment	0	3	14	16	7	0.585	66

Externality-related factors	6	Shortage of equipment	0	3	9	20	8	0.765	15
	7	Slow mobilization of equipment	1	0	7	16	16	0.83	3
	1	Accidents during construction	8	14	12	3	3	0.495	81
	2	Changes in government regulations and laws	3	16	14	6	1	0.53	76
	3	Conflict, war, and hostilities	7	8	3	14	8	0.64	53
	4	Delay in obtaining permits from municipality	1	12	5	12	10	0.69	38
	5	Delay in performing final inspection and certification by a third party	5	12	12	5	6	0.575	70
	6	Delay in providing services from utilities (such as water, electricity)	6	1	3	6	24	0.805	7
	7	Global financial crisis	10	0	12	7	12	0.655	46
	8	Loss of time by traffic control and restriction at job site	3	14	14	8	1	0.55	75
	9	Natural disasters (flood and earthquake)	10	8	5	1	16	0.625	57
	10	Price fluctuations	0	3	18	12	7	0.715	27
	11	Problem with neighbors	7	12	12	9	0	0.515	78
Labor-related factor	12	Slow site clearance	5	8	14	8	5	0.6	63
	13	Unexpected surface and subsurface conditions (such as soil, water- table)	1	1	6	22	10	0.795	9
	14	Unfavorable weather conditions	3	8	9	10	10	0.68	40
	1	Absenteeism	3	1	22	10	4	0.655	46
	2	Low worker motivation and morale	1	5	18	10	6	0.675	41
	3	Low worker productivity	0	7	14	18	1	0.665	44
	4	Personal conflicts among workers	7	18	7	8	0	0.48	82

Material-related factors	5	Labor shortage	7	7	10	8	8	0.615	60
	6	Slow mobilization of labor	6	3	12	16	3	0.635	56
	7	Strike	10	3	12	10	5	0.585	66
	8	Unqualified/inexperienced workers	3	10	10	14	3	0.62	59
	1	Changes in material types and specifications during construction	0	11	12	14	3	0.645	50
	2	Damage of sorted materials	0	14	14	9	3	0.605	62
	3	Delay in manufacturing materials	0	5	7	20	8	0.755	16
	4	Escalation of material prices	0	3	20	10	7	0.705	31
	5	Late delivery of materials	0	3	12	18	7	0.745	19
	6	Poor procurement of construction materials	0	1	10	24	5	0.815	5
Owner-related factors (ERA)	7	Poor quality of construction materials	0	8	6	16	10	0.74	22
	8	Shortage of construction materials	0	1	18	5	16	0.78	12
	9	Unreliable suppliers	1	10	18	5	6	0.625	57
	1	Change orders	0	5	11	12	12	0.755	16
	2	Conflicts between joint owners	5	9	16	10	0	0.555	73
	3	Delay in approving design documents	1	1	8	24	6	0.645	50
	4	Delay in progress payments	0	1	7	18	14	0.825	4
	5	Delay in site delivery	1	0	3	12	24	0,890	1
	6	Improper project feasibility study	5	5	12	14	6	0.685	39
7	Lack of capable representative	3	8	8	18	3	0.65	49	
8	Lack of experience of owner in construction projects	7	7	14	12	0	0.555	73	
9	Lack of incentives for contractor to finish ahead of schedule	3	3	10	12	12	0.735	23	

Project-related factors	10	Poor communication and coordination with other parties	0	7	18	15	0	0.64	53
	11	Slowness in decision making	0	3	9	14	14	0.795	9
	12	Suspension of work by owner	1	7	10	12	10	0.715	27
	1	Project complexity	3	7	18	0	12	0.655	46
	2	Inadequate definition of substantial completion	1	12	20	6	1	0.57	71
	3	Ineffective delay penalties	3	8	18	8	3	0.6	63
	4	Legal disputes between project participants	0	19	20	1	0	0.51	80
	5	Shortness of original contract duration	1	3	10	16	10	0.755	16
	6	Unfavorable contract clauses	12	5	12	10	1	0.515	78

Source: Computed from field survey analysis

Table 4- 5: Mean RII and ranking of groups of delay factor

Group of factors	RII	Rank
Equipment-related factors	0.752	1
Material-related factors	0.713	2
Contractor-related factors	0.707	3
Owner)/Client-related factors (ERA)	0.704	4
Consultant-related Factor	0.704	4
Design-related factors	0.686	6
Externality-related factors	0.634	7
Labor-related factors	0.616	8
Project-related factors	0.601	9

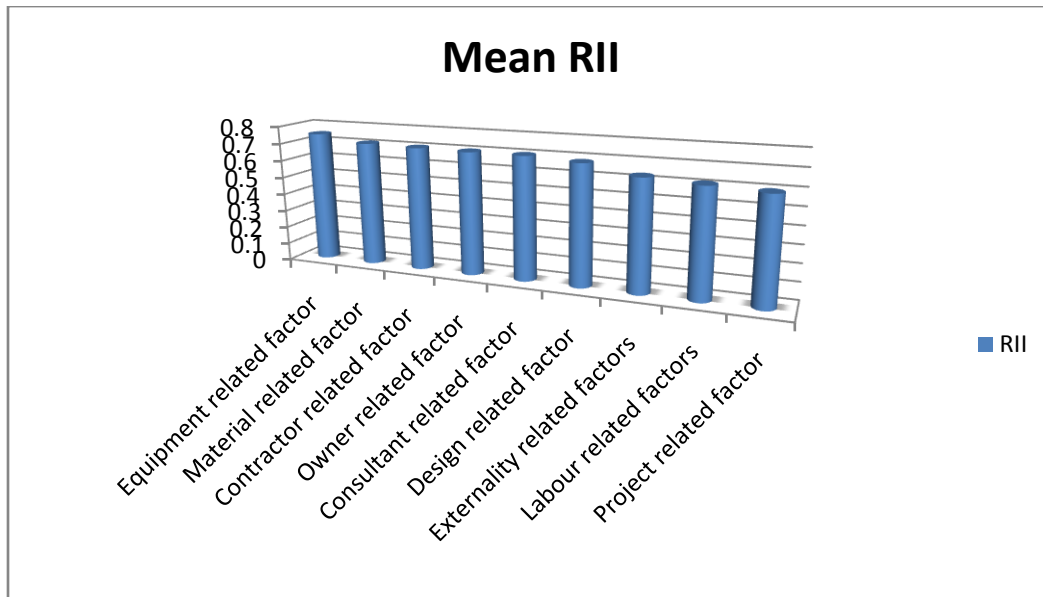


Figure 4- 1: Mean RII

Based on the ranking in Table 4.4, the mean RIIs and the ranking of all groups are shown in Table 4.5 or Figure 4.1, the top 20 most important factors causing delays are shown in Table 4.6, and the 20 least important factors causing delays are shown in Table 4.7. According to the

ranking of the groups, all factors of each group that contribute most to delays are discussed below.

4.3.1 Equipment-related factors (RII=0.752)

As displayed in Table 4.5 and graph 4.5 the equipment -related factors are the most significant factor that cause road construction delays. This was mainly due to frequent equipment breakdowns (RII=0.840), slow mobilization of equipment (RII=0.830) and equipment allocation problem (RII=0.775).As found in the literature R.F.Aziz, (2013) also identifies high-impact value of delay causes in Egypt (p-8)

4.3.2 Material-related factors (RII=0.713)

The data generated also shows that the second most significant factor delaying factor was related to material. These were due to poor procurement of construction materials (RII=0.815), shortage of construction materials (RII=0.780) and delay in manufacturing materials (RII= 0.755).

4.3.3 Contractor-related factors (RII=0.707)

The third significant factors for road construction delays were ineffective project planning and scheduling (RII=0.805) and poor communication and coordination with other parties (RII=0.700) which were related to contractors.

4.3.4 Owner-related factors (ERA)/Client (RII=0.704)

Follow the contractor, the owner-related group of delay factors ranks as the fourth most important group. The notable factors were delay in site delivery (RII=0.890), delay in progress payments (RII=0.825) and slowness in decision making (RII=0.795).As mention in literature review ” Tsegay and H.Luo ,(2017) the influential factors of schedule 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.”(P-8)

4.3.5 Consultant-related Factors (RII=0.704)

The fifth most important group was the consultant-related group. The prominent factors were late in reviewing and approving design documents (RII=0.790), inadequate project management assistance (RII=0.775) and inaccurate site investigation (RII=0.745).

4.3.6 Design-related factors (RII=0.686)

After the consultant, the design-related group of delay factors was the sixth most important group. The significant factors were insufficient data collection and survey before design (RII=0.815), design errors made by designers (RII=0.745) and design changes by owners or their agent during construction (RII=0.715).

4.3.7 Externality-related factors (RII=0.634)

Following the design-related group of factors, the externality-related group of delay factors ranked as the seventh most important group. The notable factors were delay in providing services from utilities (such as water, electricity) (RII=0.805), unexpected surface and subsurface conditions (such as soil, water- table) (RII=0.795) and price fluctuations (RII=0.715).

4.3.8 Labor-related factor (RII=0.616)

The eighth most important group was the labor-related group. The prominent factors were low worker motivation and morale (RII=0.675), low worker productivity (RII=0.665) and absenteeism (RII=0.655).

4.3.9 Project-related factors (RII=0.601)

The project-related group of delay factors was the last and least important group. The notable factors were shortness of original contract duration (RII=0.755) and project complexity (RII=0.655).

20 Most Important Factors Causing Delays

Table 4- 6: .20 Most Important Factors Causing Delays

No.	20 most important factors causing delays	Factor group	RII	Rank
1	Delay in site delivery(ROW)	Owner-related factors (ERA)	0.890	1
2	Frequent equipment breakdowns	Equipment-related factors	0.840	2
3	Slow mobilization of equipment	Equipment-related factors	0.830	3
4	Delay in progress payments	Owner-related factors (ERA)	0.825	4
5	Poor procurement of construction materials	Material-related factors	0.815	5
6	Insufficient data collection	Design-related factors	0.815	5
7	Ineffective project planning and scheduling	Contractor-related factors	0.805	7
8	Delay in providing services from utilities (such as water, electricity)	Externality-related factors	0.805	7
9	Slowness in decision making	Owner-related factors (ERA)	0.795	9
10	Unexpected surface and subsurface conditions (such as soil, water- table)	Externality-related factors	0.795	9
11	Late in reviewing and approving design documents	Consultant-related Factors	0.790	11
12	Shortage of construction materials	Material-related factors	0.780	12
13	Late in reviewing and approving design documents	Consultant-related Factors	0.775	13
14	Equipment allocation problem	Equipment-related factors	0.775	13

15	Shortage of equipment	Equipment-related factors	0.765	15
16	Delay in manufacturing materials	Material-related factors	0.755	16
17	Change orders	Owner-related factors (ERA)	0.755	16
18	Shortness of original contract duration	Project-related factors	0.755	16
19	Late delivery of materials	Material-related factors	0.745	19
20	Inaccurate site investigation	Consultant-related Factors	0.745	19

20 Least Important Factors Causing Delays

Table 4- 7: 20 Least Important Factors Causing Delays

No.	Top 20 least important factors causing delays	Group of factor	RII	Rank
1	Obsolete technology	Contractor-related factors	0.435	83
2	Personal conflicts among	Labor-related factor	0.480	82
3	Accidents during construction	Externality-related factors	0.495	81
4	Legal disputes between project participants	Project-related factors	0.510	80
5	Problem with neighbors	Externality-related factors	0.515	78
6	Unfavorable contract clauses	Project-related factors	0.515	78
7	Frequent change of subcontractors	Contractor-related factors	0.520	77
8	Changes in government regulations and laws	Externality-related factors	0.530	76
9	Loss of time by traffic control and restriction at job site	Externality-related factors	0.550	75
10	Lack of experience of owner in construction projects	Owner-related factors (ERA	0.555	73
11	Conflicts between joint owners	Owner-related factors (ERA	0.555	73
12	Misunderstanding of owner's requirements by design engineer	Design-related factors	0.570	71
13	Inadequate definition of substantial completion	Project-related factors	0.570	71
14	Delay in performing final inspection and certification by a third party	Externality-related factors	0.575	70
15	Conflicts between consultant and design engineer	Consultant-related Factors	0.580	69
16	Low efficiency of equipment	Equipment-related factors	0.585	66
17	Complexity of project design	Design-related factors	0.585	66
18	Strike	Labor-related factor	0.585	66
19	Unreliable subcontractors	Contractor-related factors	0.590	65
20	Ineffective delay penalties	Project-related factors	0.600	63

4.4 Effects of delay

The primary data collected from the third part of the questionnaire was analyzed from the perspective of owners/clients, consultants, contractors; project managers, project engineers and other stakeholders participated on project work. The calculation of RII and ranking were done as explained in the previous section. Based on the ranking show on Tabl.4.8, the important effects of construction delays as perceived by respondents were: time overrun (RII = 0.975), cost overrun (RII = 0.715), dispute (RII = 0.665), arbitration (RII = 0.620), litigation (RII = 0.550), and total abandonment (RII = 0.435). While analyzing the effects of delays, all respondents were agreed in ranking the effects. The time and cost overruns were ranked highly by the respondents. Any delay in a project can lead to cost and time overruns and these two are linked. Whenever there are delays, there are disputes as to who should accept the responsibility and the cost. These disputes often lead to an arbitration process by third parties and failure in this process leads to litigation where the disputes are settled by the court.

Table 4- 8: RII of effect of delays

No	Effect	1	2	3	4	5	RII	Rank
1	Time overrun	0	0	0	5	35	0.975	1
2	Cost overrun	0	1	7	20	12	0.815	2
3	Dispute	0	7	16	14	3	0.665	3
4	Arbitration	3	6	16	14	1	0.620	4
5	Litigation	1	20	7	12	0	0.550	5
6	Total Abandonment	14	10	12	3	1	0.435	6

4.5 Discussions

The mean relative importance index rank presented in Table 4.5 above shows that equipment-related group of causes are the most contributing factors to project schedule delay with the mean value of relative importance index (RII=0.752). This result is consistent with the findings of Werku and Jha (2016), and Aziz (2013), even though Aziz (2013) grouped delay causes into nine major groups. The material-related group causes (RII=0.713) ranked second, followed by contractor-related causes (RII=0.707). The project related factor delay causes category demonstrated the least aggregated relative importance index of (RII=0.601). The result of ranking order of group factors in this study shows that situation of existing road construction project schedule delay and factors of schedule delays are happenin selected site.

They ranked groups based on Table 4.5 or Figure 4.1 their order of importance are listed as follows: (1) equipment-related factors, (2) material related, (3) contractor-related factors , (4) owner)/client-related factors(ERA) (5) consultants/supervisors related, (6) design-related factors, (7) external related factors,(8) labor-related factors, and (9) Project-related factors. In this study delay attributes categorized under nine major groups. Therefore according to this categorization, equipment-related factors placed on the first place, followed by material-related, and then contractor related that are influences of project performance. However, the overall ranking of group factors may not consistent with other studies as Sambasivan and Soon (2007) who stated that, "The effects of delays in construction projects can be country specific".Analyzing the effects of delays, all respondents were agreed in ranking the effects. The time and cost overruns were ranked highly by the respondents (Table 4.8).

None of the studies is comparable to any other and each study has different rankings for the causes of delay and the groups as project characteristics are unique and may even be region specific. As different projects have their own unique endeavor, delay attributes to projects and their ranking may differ from country to country, region to region, even project to project. Therefore, the ranking of the causes and groups in this study may also differfrom other studies. Ahmed et al., (1999), reinforced this issue by making statement like this; construction projects vary in terms of complexity in nature, location, type of contract, communication between parties.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents conclusion and recommendations about the factors influencing schedule delay in road construction projects based on the objectives of the research.

5.2 Conclusion

This paper has examined the causes delay of road construction projects in Oromia regional state, the case of SansuseTatek and Tulu Bolo-Kela road projects.

Project schedule delay is still happening and will continue to happen in road construction for different reasons. Delays are to be expected; however, they can be avoided or minimized when their causes are effectively identified and analyzed. Thus, the objective of this research was identifying the main factors of delay that affect road construction projects in the study area.

As observed in the literature review, completing projects on time is an indicator of efficiency, but the construction process is subject to many variables and unpredictable factors, which result from many sources. These sources include the performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations. The experience of the other nations shows that the highest ranked contributors to time overrun on projects are concentrated around client actions, such as incomplete designs; design changes; slow decision-making; and late issue of instructions. For the contractor category the “shortage of skills” proved to be the most significant delay factor.

Taking this in mind, the researcher has deployed the quantitative research approach in order to entertain the research questions/specific objectives. To obtain a clear idea about the issue under study, the researcher has deployed a purposive sampling techniques. The type of research selected for this study were descriptive, and the research strategy is surveying; because it is the most appropriate to achieve the objectives of the research.

40 sample sizes were chosen from the contractor, client, site engineer, project manager and the consultant. Around 83 possible causes of delay identified and classified under nine major categories (consultants, contractor, design, equipment, externality, labor, material, owner /clients and project related) which are used on survey questionnaire. The relative importance index was used to rank the effect of each cause of delay

The findings of the study show that Sansuse–Tatekroad projects are not completed on their original completion date because of schedule delays factors. This ongoing projects are also running far behind the schedule from the minimum of 36.47% to the maximum at their current status, the percentage of delay will also increase at their actual completion. Tulu Bolo-Kela road projects are ongoing project.

The causes of road construction projects delay are varying from project to project based on complexity and nature of the project, location of the projects, type of contract, and communication between project stakeholders. Causes related to consultants, contractors, design, equipment, externalities, labor, materials, owners (clients), and other project related factors. Each delay causes are assessed from the viewpoint of clients, consultants, project managers, project engineers, and contractors. Each factor is evaluated and ranked based on their importance and possibility of occurrence as perceived by respondents and the calculated mean are taken to rank delay causes using Relative Importance Index (RII).

The importance index was used to rank the significant causes of delay and it was found that that the equipment-related factors group of delay was the most prominent delay factor. Material-related factors were considered the second most influential factors of schedule delay in road construction projects followed by contractor's related factors of delay due to frequent equipment breakdowns, poor procurement of construction materials and ineffective project planning and scheduling respectively.

5.3 Recommendation

Based on the findings of the study the following points were strongly recommended to solve the problems identified in schedule delays in road construction projects.

Road 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 factors and their effects 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 schedule delay in road construction projects.

Ineffective planning and scheduling have also a major impact on construction delays. Effective planning and programming of a project is a must to secure early completion of the project. The planning process should be developed from start of the project until completion of a project. The planning stages should be devised very carefully, starting from strategic, tactical and operational planning.

Contractor

Contractors are recommended to be careful about construction materials and prices, so they are advised to purchase the construction materials at the commencement of work. A time schedule for material delivery to the site and usage of materials to the site must be prepared in order to avoid shortage or lack of materials. Qualified staff with appropriate experience must be appointed to follow technical and managerial aspects of the project. The staff will be more effective if there are enough numbers of engineers, planning managers, technicians, and foremen, so the responsibilities would be shared between all of them. The quality of activities must be monitored continuously to set the required quality system in the different activities of the project so as to avoid any mistakes that may lead to rework of these activities, and finally time and cost overruns. Site planning and management, administrative and technical staff should be assigned as soon as the project is awarded to decide to achieve completion within the specified time with the required quality and estimated cost. Contractors are recommended to have enough cash before beginning any project to avoid any financial problems.

Consultant

Consultants are recommended to review and approve design documents, shop drawings, and payments of contractor to avoid any delay or cost overruns of the project. Consultants are advised to hire qualified and experienced technical staff to manage the project, so they would be able to overcome any technical or management problems that happen. It is also advised for consultant to have high qualifications and knowledge to give appropriate instruction at a suitable time and to be able to answer any question asked by contractors to avoid time and cost overruns. Consultants should be flexible in evaluating contractor works. They should consider compromising between cost and high quality.

Owners

Owners are recommended to revise the bid documents such as specifications, Quantity take-off, drawings and the design of the project in an organized way. This is because any discrepancy in bid documents will lead to disputes between project parties and so a delay may occur in the projects. Progress payments must be paid to the contractors on time because it impairs the contractor's ability to finance the work. They should be aware of the available materials with the contractor and to assess his financial ability to implement the project. Also, owners are advised not to depend on the lowest bid contractor to execute the project. Owners should minimize change orders as soon as possible as in order to avoid any time and cost overruns. Attempts must be made to improve communication and coordination between the local construction agencies and the international funding agencies to solve the financial issues in global projects.

Recommendations for future studies

More research on construction delays should be done in order to develop guidelines, or methods of minimizing the effects of construction delays in Oromia region in particular and in Ethiopia in general.

Furthermore, similar research should be performed in various regions, or cities of Ethiopia. In order to providing more reliable data it is required to carry out studies for each specific type of construction projects, including highways, dam construction projects, utilities and etc. Surely, detailed surveys required to be performed to find out the effect of financing and cash flow problems on delays in construction projects.

Finally, similar studies could be performed by government or other scholars in specific types of construction projects, such as utility construction projects, condominiums construction projects, and dam construction projects. Detailed studies could be carried out to estimate the probability of delay (which is very important for project success and should be considered before the bidding stage) in construction projects by developing and utilizing the findings of this study.

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Annex

I. QUESTIONNAIRE

St. Mary's University School of Graduate Studies Masters of Business Administration in Project Management Assessment of factor Influencing schedule delay in road construction projects (Questionnaire)

Dear Sir/ Madam,

My name is TadeleZewdie, a graduate student of St. Mary's University. I am conducting a research about "Factors Influencing schedule delay in road construction projects", which I had chosen as a topic to conduct research on it for my master's of project management.

The aim of the research is to study the various delay factors with regards to the road Construction environment. I kindly invite you to be a part of this research and request you to assist me in completing the brief questionnaire. I would kindly request your participation, and cooperation of your organization manager, project managers, resident engineer ,material engineer ,quality surveyor, Right of way (ROW) management specialist, and material and structural inspector in providing the required information in the questionnaire, as well as to thank you for your valuable time and efforts.

The information provided will only be used for research on an academic platform. Your kind assistance in this regard is highly appreciated. Thank You for your time and attention. I look forward to hearing from you,

Yours Sincerely,
TadeleZewdieAbebe
Graduate Student,
St. Mary's University
E-mail: tadelezewdie2003@gmail.com
Advisor: ChalachewGetahunDesta (PhD)

I. General Information

Please check which most accurately describes:

All information, including all results and personal information from participating individuals will be kept strictly confidential and be used only for research purposes.

1.1. type Organization

- Owner
- Contractor
- Consultant

1.2. Respondent gender

- Male
- Female

1.3. Age

- 21-30 years
- 31-40 years
- 41-50 years
- >51 years

1.4. Educational Background

- TVET/ Diploma
- 1st Degree
- 2nd Degree
- PhD

1.5. Experience in Road construction (in years)

- 1-5
- 6-10
- 11-15
- 16+

1.6. Job Designation

- Project manager
- Resident engineer
- Project Office Engineer
- Surveyor
- Supervisor
- Other, specify_____

II. Ranking Causes of Delay

Please evaluate the following attributes based on:

Importance (the delay impact on construction project) and; Frequency (How often the attribute is implemented or considered) on a rating scale of 1 - 5 as shown below:

Rating Scale	Very Low importance	Low importance	Medium importance	High importance	Very High importance
	1	2	3	4	5

Rate each factors according to the above rating scale by putting a thick mark for each factor stated below.

Each scale represents the degree of contribution for the delays to occur

Question: How did the following related factors below that contribute to causes of delays on road construction project?

Factor group	Number	Factors causing delay	1	2	3	4	5
Consultant-related factors	1	Lack of experience of consultant in construction projects					
	2	Conflicts between consultant and design engineer					
	3	Delay in approving major changes in scope of work by consultant					
	4	Delay in performing inspection and testing					
	5	Inaccurate site investigation					
	6	Inadequate project management assistance					
	7	Late in reviewing and approving design documents					
	8	Poor communication and coordination with other parties					
Contractor-related factors	1	Frequent change of subcontractors					
	2	Inadequate contractor experience					
	3	Inappropriate construction methods					
	4	Incompetent project team					

	5	Ineffective project planning and scheduling					
	6	Obsolete technology					
	7	Poor communication and coordination with other parties					
	8	Poor site management and supervision					
	9	Rework due to errors					
	10	Unreliable subcontractors					
Design-related factors	1	Complexity of project design					
	2	Design changes by owner or his agent during construction					
	3	Design errors made by designers					
	4	Insufficient data collection and survey before design					
	5	Lack of experience of design team in construction projects					
	6	Mistakes and delays in producing design documents					
	7	Misunderstanding of owners requirements by design engineer					
	8	Poor use of advanced engineering design software					
	9	Unclear and inadequate details in drawings					
Equipment-related factors	1	Equipment allocation problem					
	2	Frequent equipment breakdowns					
	3	Improper equipment					
	4	Inadequate modern equipment					
	5	Low efficiency of equipment					
	6	Shortage of equipment					
	7	Slow mobilization of equipment					
Externality-related factors	1	Accidents during construction					
	2	Changes in government regulations and laws					

	3	Conflict, war, and hostilities					
	4	Delay in obtaining permits from municipality(stakeholders)					
	5	Delay in performing final inspection and certification by a third party					
	6	Delay in providing services from utilities (such as water, electricity)					
	7	Global financial crisis					
	8	Loss of time by traffic control and restriction at job site					
	9	Natural disasters (flood, rains, earthquake)					
	10	Price fluctuations					
	11	Problem with neighbors					
	12	Slow site clearance					
	13	Unexpected surface and subsurface conditions (such as soil type,utility line, high water table)					
	14	Unfavorable weather conditions					
Labor-related factors	1	Absenteeism					
	2	Low worker motivation and morale					
	3	Low worker productivity					
	4	Personal conflicts among workers					
	5	Labor shortage					
	6	Slow mobilization of labor					
	7	Strikes					
	8	Unqualified/inexperienced workers					
Material-related factors	1	Changes in material types and specifications during construction					
	2	Damage of sorted materials					
	3	Delay in manufacturing materials					
	4	Escalation of material price					
	5	Late delivery of materials					
	6	Poor procurement of construction					

		materials					
	7	Poor quality of construction materials					
	8	Shortage of construction material					
	9	Unreliable suppliers					
Owner-related factors (ERA)	1	Change orders(Design)					
	2	Conflicts between joint owners					
	3	Delay in approving design documents					
	4	Delay in progress payments					
	5	Delay in site delivery(Right of way-ROW)					
	6	Improper project feasibility study					
	7	Lack of capable representative					
	8	Lack of experience of owner in construction projects					
	9	Lack of incentives for contractor to finish ahead of schedule					
	10	Poor communication and coordination with other parties					
	11	Slowness in decision making					
	12	Suspension of work by owner					
Project-related factors	1	Project complexity					
	2	Inadequate definition of substantial completion					
	3	Ineffective delay penalties					
	4	Legal disputes between project participants					
	5	Shortness of original contract duration					
	6	Unfavorable contract clauses					

Additional comment (please specify) _____

III. EFFECT OF DELAYS

Objective of the Study: Identify the effects of delays on road construction project.

Please, tick and fill in the blanks if you select others.

Each scale measures the occurrences effects, which arise from delays:

(5) = Always

(4) = Mostly

(3) = Sometimes

(2) = Seldom

(1) = Never. Questions: What do you think are the Effect due to delays?

	EFFECT	1	2	3	4	5
1	Time overrun					
2	Cost overrun					
3	Dispute					
4	Arbitration					
5	Litigation					
6	Total Abandonment					
7	Others, please specify.....					
8	Others, please specify.....					
9	Others, please specify.....					
10	Others, please specify.....					