



**ADDIS ABABA UNIVERSITY**  
**ADDIS ABABA INSTITUTE OF TECHNOLOGY**  
**SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING**

**“IDENTIFICATION OF CAUSES FOR LATE COMPLETION OF  
FEDERAL ROAD PROJECTS IN ETHIOPIA AND SUGGESTED  
REMEDIAL MEASURES”**

**BY**  
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**THE SCHOOL OF GRADUATE STUDIES**  
**ADDIS ABABA UNIVERSITY**  
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**APPROVED BY BOARD OF EXAMINERS**

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**ADDIS ABABA INSTITUTE OF TECHNOLOGY, SCHOOL OF  
GRADUATE STUDIES  
GRADUATE PROGRAM IN CONSTRUCTION TECHNOLOGY  
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# Chapter One

## Introduction

### 1.1. Background

Ethiopia is a developing country with an agriculture led economy, having more than eighty percent of the population living in rural parts of the country. As the Country's economy is based on agriculture, transport infrastructure allows the agricultural communities to access both domestic and international markets; besides, it enables the people get access to hospitals, schools and other public service facilitates in a better way. In addition, as the country is a land locked country most imported items came from neighboring countries port on a land freight transport.

A very low road density and subsequent limited provision of services and infrastructure have become one of the difficult challenges for Ethiopia in its effort towards poverty reduction. Transport infrastructure is generally considered as an essential element for economic and social development as it provides the links required to make markets function. The development of economically vital sectors such as agriculture, industry, tourism etc is directly dependent on the existence of a working transport infrastructure system.

Hence, for the growth and socio economic growth of a country like Ethiopia the road network plays a vital role. Recognizing the importance of road transport in supporting social and economic growth and in meeting poverty alleviation, Ethiopian government has placed increased emphasis on improving the quality and size of road infrastructure. The development of the country's road network was given top priority as a core component of the country's economic progress, Hence, road authorities' needs to be scrutinized and tasked with securing the delivery of an efficient, reliable, safe and environmentally acceptable road network. As a result major roads and a network of local feeder roads are being constructed. In order to achieve this economic growth by utilizing the budget as planned and in order to facilitate the construction of the road as it is needed to serve the society, the road construction work has to be properly planned, designed, constructed and completed due program.

In 1974 the total road network in the country was only 9,260 km and this figure, incorporating all type roads has increased to 81,629 km in 2014 (ERA July 2014). Since the start of the RSDP, a number of road projects are under construction and a lot more are expected to be commenced in the coming years. The finances for the projects are secured by the government in collaboration with funds from multilateral and bi-lateral relations. Basically, the World Bank, European Union and African Development Bank are the major foreign financiers.

The main reasons for late completion of projects are Delays and Variation Orders. Hence to identify detailed causes of project late completion and give remedial measures delays and practicability of forwarded Variation Orders have to be studied.

Among the projects undertaken in recent years, most of them are delayed well beyond the expected time for completion and also were required additional budget more than the ones envisaged during the commencement of respective projects. This problem in turn is causing difficulties in:

- Financing of upcoming projects;
- Timely utilization of the facility by the public;
- The relationship of the stakeholders (Employer, Contractor, Financier, etc) involved in the construction process; etc. (Amare A, 2006)

Delays caused by the client or the consultant such as late submission of drawings and specifications, frequent change orders, and incorrect/inadequate site information generates claims from both the main contractors and subcontractors which many times entail lengthy court battles with huge financial repercussions. Delays caused by contractors may generally be attributed to attitude and poor managerial skills. Lack of planning and a poor understanding of accounting and financial principles have led to many contractors' downfall (Salman and Seid, 2003).

Delays do not always result from a single catastrophic event. They frequently develop slowly during the course of work; Minor delays are generally overlooked until their cumulative becomes financially apparent. By the time a contractor recognizes that there is a problem, many different parties and natural forces would have contributed to the situation.

Taking this into account, this research will try to investigate and identify the factors that cause delay of road projects in Ethiopia, leading to late completion of projects.

## **1.2. Objectives of the Research**

The objectives of the research is to investigate the problem why most of the road construction projects in Ethiopia have an extended completion period than the originally set date of completion and find how these problems could be substantially minimized. Hence, the main research objectives are;

- Describing the existing procurement regulation and performance of the Road Sector Development Program (RSDP) to have background information about the status of the road sector in Ethiopia.

- Identifying the factors, as exhaustively as possible, that causes delays in road construction projects in line with the context of the road construction sector in Ethiopia.
- Analyzing and ranking the identified problems in their order of significance.
- Recommending mitigation measure to substantially minimize the impacts of those identified factors in the implementation of the upcoming projects.

### 1.3. Limitation of the Research

This research was not done without its limitations which were mainly on data collection process. The questionnaire was designed to investigate the causes of delay in road projects in detail; as a result sample questionnaires were investigated thoroughly from literatures. Accordingly after designing the questionnaire as shown on Appendix A, B, C and D efforts have been made to make it as detail as possible in order to cover critical causes.

However, while collecting the responses from the three parties in the sector almost half of the respondents from the Contractor side did not respond. In addition, the personnel requested to reply for the questionnaire from the Clients organization which have more than five years of experience, did not give the responses themselves. This encountered limitations showing that the major problem starts in the overall attitude of the sector, which is irresponsible towards achieving better solution in the road construction process regarding excessive delays.

### 1.4. Organization of the Research

The study contains different parts as described below:

- **Introduction:** this part contains discussions on *background, objective, organization or layout* of the study and the methodology that will be used.
- **Literature Review:** will discuss about definition, types and causes of delays by reviewing different literatures conducted previously.
- **Procurement regulation, FIDIC condition of contract and Road Sector Development Program:** this chapter discusses about procurement regulations of the country and see clauses form FIDIC condition of contract regarding delay. Finally this chapter will evaluate the performance of RSDP programs being implemented starting from 1997G.C to date.
- **Cases in road projects of Ethiopia:** this part will assess performance of some selected projects from ERA Northern, Western and Southern Regional offices. The projects selected for the case study have extended completion time due to different factors.

- **Variables of Delays in Road Construction Projects in Ethiopia:** this part will summarize the identified variables of causes of delay from the literature review in the second chapter and personal experience.
- **Data collection and analysis:** this part will contain results of the assessment of both foreign and local contractors and consultant's response on causes of delay of the works they were previously engaged in.
- **Recommendations and Conclusions:** at the end based upon the data collected and analyzed during the study period conclusions and recommendations will be forwarded.

## 1.5. Research Methodology

The factors influencing completion of construction projects have been investigated from review of literatures. The literature review mainly focused on previously done researches in relation to time issues on construction projects as a whole, and those factors that are relevant to road projects have been carefully identified. Furthermore, a questionnaire survey has been conducted to rank the problems in their order of significance and to seek any additional variables beyond those found out from the literature review. The questionnaires have been distributed to professionals who have been involved in the road construction sector in Ethiopia working on behalf of a client, consultant and contractor.

Certain cases were also investigated to demonstrate how serious the problem in the road construction sector is. The purpose of the case study is simply to substantiate existence of the problem and its extent by presenting the status of some of the major road construction projects previously completed.

## Chapter Two

### Literature Review

One of the most important and prerequisite steps in research undertaking is reviewing the critical points of current knowledge on the particular topic and formulation of research problems. The purpose of this chapter is to identify the factors, which are the major causes of late completion of road construction projects by looking into previous studies made on the subject. This investigation is important as it provides substantial part of the inputs for the lists of factors to be considered for the research.

The execution of a project is said to be successful when it is completed within the scheduled time, without exceeding the allotted budget, and according to the specified quality and standards. There are many causes for late completion or delay of construction projects and several studies have pointed out various factors based on the underlying conditions that the specific study is concerned; that is, for a particular project type, specific location or to a particular project size.

Even though owners strive to avoid delays in construction and to minimize the time and costs associated with delays, they often find it difficult to control the circumstances causing delays. Delays occur in every construction projects though the magnitude varies considerably from project to project. Some projects are only a few days behind the schedule; some are delayed over a year. The complexity of projects, complicated schedules and hair-splitting coordination all contribute to the necessity for this attention to time. According to (Robert Palles, 1998), delay and additional cost in a construction projects are an inevitable consequence of the risk and uncertainty associated with the execution of any construction project, which is likely to be unique and prototypical in nature.

Delay, therefore, is an important issue to the construction industry. Investigation in to this problem area is needed in order to better manage delay situations and to mitigate their consequences. So it is essential to define the actual causes of delays in order to minimize and avoid the delays in construction projects. Assessing the actual causes of delay, the extent to which delay may occur and the impacts of delay can provide insights for early planning to control projects delay and improve project performance.

#### 2.1. Definition of Construction Delays

Vast majority of project delays occur during the construction phase, where many unforeseen factors are always involved. Different researchers defined construction delays differently on their own sentence as per their research and finding; According to (Callahan et al. 1992) delay in

construction claims is defined as “the time during which some part of the construction project has been extended or not executed owing to an unexpected event”. On the other hand, (Bartholomew, 1998) described delay as slowing down of a work without stopping it entirely. (Zack, 2003) defined delay as an act or event which extends the required time to perform or complete work of the contract manifests itself as additional days of work.

According to (Sadi A. Assaf ,1995) construction delay is defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rent-able 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.

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

In the construction management context, the simplest definition of delay is made by Mubarak (2005) as “an event or a condition that results in finishing the project later than stipulated in the contract.”

According to (Brimah, 2008), the term ‘delay’ in construction contract has no precise technical meaning. It can be used in different sense to mean different conditions in project execution. However the term is often used in its basic sense to mean any occurrences or events that extend the duration or delay the start or finish of any of the activities.

In another study, (Trauner et al. 2009) describe delay as “to make something happen later than expected or to not act timely”. It is usual for delays to occur on construction projects. (Sabriah D. 2010) defined delay of construction projects as the late in progress or actual completion of work compared to the baseline construction schedule or contract schedule.

## **2.2. Causes of Construction Delay**

Road projects are being contracted out by road Authorities and given to eligible contractors to perform the required work within time and cost, however almost all road projects being constructed in Ethiopia, both by local and international contractors, are delayed for one or another reasons.

What makes identification of causes of road construction delay difficult and vast is the fact that the construction is uncertain, dynamic and involves multiparty, which are client, contractor, and consultant involving in the design and supervision, suppliers, subcontractors, financiers and government bodies.

Most studies conducted so far tend to explore only causes of delays whereas some of them looked into delays along with cost overruns. (Bramble and Callahan, 1992) cited a project may be delayed as a result of the direct action of major parties, or of their failure to act especially if they have a duty to act in the circumstances. In addition outside forces could also intervene to delay a project as much as the parties involving. Hence it is very important to describe the cause of delay by looking at different factors.

Robel Assefa (April 2015) in his research studied and concluded that construction delay in Ethiopia is mostly caused due to financial problem, managerial problem or local contractor's limited capacity and ability.

Robel further stated delay causes as;

- Delay in delivering material on site, poor site management and untimely provision of documents by the contractor.
- Slow supervision and decision by the consultant.
- Delay in site handover, right of clearance, late in approving payments and lack of proper liaison work of the employer with local authorities.

Mansfield et al (1994) studied the causes of delay and cost overrun in construction projects of Nigeria and found out that seven out of ten projects suffered delays in their execution, due to financing and payment for completed work, changes in site conditions, shortage of material, poor contract management and improper panning.

Kaming et al. (1997) investigated the factors influencing construction time and cost overruns on high-rise projects in Indonesia and observed that cost overruns occur more frequently and are more severe than time overruns. According to their study the main factors influencing time overruns are design changes, poor labor productivity, inadequate planning and resource shortage.

Similarly, (Chan and Kumaraswamy, 1997) conducted a study on identification of principal causes of time overrun in building and civil engineering projects in Hong Kong. They have listed the top 20 significant delay factors, and concluded that poor site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, client initiated variations and necessary variations of works were the five more significant sources of delays as perceived by the clients, consultants and contractors. (Al-Khalil and Al-Ghafly, 1999)

identified 60 causes of delays for public utility projects in Saudi Arabia under six major categories.

Pursuant to the study conducted on causes of delay and cost overruns in construction of groundwater projects in developing countries (Frimpong et al., 2003); some of the influential factors of delay and cost overruns are poor contract management, monthly payment difficulties, material procurement, poor technical performances and escalation of material prices.

Assaf and Al-Hejji (2006) evaluated frequency of occurrence, severity and importance of seventy-three identified causes of delay for large construction projects in Saudi Arabia, after classifying them in nine groups.

Naha, Norelina (2008) found that Contractor's financial problems, shortage in construction resources, fluctuation of construction material price, poor management and planning, inadequate contractors experience, construction mistake, poor monitoring and controlling, inadequate approved payment for executed works and, lack of communication between parties are among the many reasons for cause of construction delays.

The reasons for construction delay in Lebanon differ from the different parties involved in the sector. Owners have more concerns with regard to financial issues and contractors considered contractual relationships, while consultants considered project management issues to be the most important causes of delays.

According to FIDIC 87, delays in construction work occurring mainly during implementation stage are due to delay in site hand over, late approval of payment certificates, changing the scope of the work, low contractor's financial and technical capacity, delay of drawings or instruction, unforeseeable physical condition and suspension of work up on the engineer's instruction.

### **2.3. Types of Construction Delay**

In projects procured in Traditional General Contracting methods, design and construction are executed in two different phases. In a project like this the client determines the construction duration during the design phase; and the same is informed to contractors during the tendering process so that they could provide their respective prices, based on this information they prepare their work program to complete the works by the specified time (Birkby and Brough, 2002).

Any delaying event in construction could happen from the fault of the employer, consultant, or the contractor or for a condition that is beyond the control of all parties. In this respect (Kaming et al., 1997) classified delays into three categories;

1. Those over which neither party to the contract has any control
2. Those over which the client (or his representative) has control
3. Those over which the contractor (or any subcontractor) has control

Basically, such classifications are defined for the purpose of defining the responsibility and subsequent entitlement for compensation of the impact of any delay event in the context of the conditions of contract provisions. (Alkass et al., 1996 and Yogeswaran et al., 1998) have described the aforementioned classifications as excusable non-compensable, excusable-compensable and non-excusable delays respectively.

### ***2.3.1. Excusable Delays***

Excusable delays are delays that excuse a contractor from performing within the contract period and justify an extension of time (EOT) to perform. (Alkass et al, 1996) described excusable delay as delays that are not attributable to the contractor's actions or inactions and typically include unforeseen events. The events cannot be foreseen by any experienced contractor and has to be proven that they are caused without fault or negligence of the contractor. This type of delays can have an impact on non-critical activities which needs a more detailed analysis to determine whether additional time is warranted, or if the reduction of float time can be justified (Alkass et al. 1996). However, whether the delays are excusable depends on contract provision. Excusable delays can be further classified into delays with compensation and without compensation.

#### a) Excusable delays with Compensation

If delays are caused due to the fault or negligence of the client, it is deemed compensable to the contractor (Sweet, 1977). Yates and (Epstein, 2006) identifies eleven causes of Compensable delays; among them failure of the owner to have the work site available to the contractor in a timely manner, excessive variation orders given by the client, delay in issuing notice to proceed, defective engineering designs, and so on are major causes of excusable delays with compensation.

According to (Alkass et al, 1996), contractors are entitled to a time extension as well as monetary compensation due to this type of delays. However, the contractor must show that the delay was unreasonable and prove the extent of the additional expense involved (Clough, 1975).

### b) Excusable delays with Non-Compensation

These types of delays are result of factors which are considered as force majeure as stated on different versions of FIDIC Condition of Contract, and when this happen the contractor will not be entitled for any compensation but extension of time will be given which is required by the remaining work load.

Sweet (1977) stated major elements representing non compensable delays as;

- Unforeseen events
- Events which are beyond the contractors control and
- Events which are without fault or negligence of the contractor

In order for delay to warrant an extension of contract time, the delay must affect the completion of the project. This provides the basis for the high importance attached to the use of critical path method (CPM) of scheduling for proving or disproving time related claims such as extension of time and prolongation cost (Bramble and Callahan, 1992)

#### ***2.3.2. Non –Excusable delays***

This type of delay is caused due to contractor's action or inaction, on which the contractor could have foreseen and prevented. Hence the delay presents no entitlement both to time extension and cost. According to (Alkass et al., 1996) if the delay can be proved to have affected the whole project performance, then the contractor could be entitled to liquidated damages.

Similarly, (Abd. Majid, 1997) stated that the amount of damages is dependent on the contract value of the project, which is based on the length of delay and the rate of damages per day. Such delays are inherently the contractor's responsibility and no relief is allowed. (Last, 1997) cited an unexcused delay may be considered as a breach of contract.

#### ***2.3.3. Concurrent Delays***

Concurrent delay is said to be caused when there is a situation of two or more delay occurrence at the same time or overlap to some degree. In such circumstances the combinations of the aforementioned scenarios should be considered in order to determine the possible entitlement to the contractor whether it is only extension of time or extension of time with financial compensation.

It is however not a simple task to determine the amount of extension of time and/or monetary compensations as each of the concurrent delay events shall be reviewed in line with the contractor's work program to see whether the delaying events are on the critical path or not. To this effect, (Yogeswaran et al., 1998) presented a further detailed analysis of different scenario of

concurrent delay events with critical and non-critical activities. Accordingly, when there exist such overlaps of causes usually the following approaches are applied.

- When the non-excusable delay is on the critical path and the excusable delay is non-critical, no extension of time is due.
- When the non-excusable delay is non-critical and the excusable delay is on the critical path, extension of time is due even if the non-excusable delay commenced early in the non-critical chain of activities so far as the non-excusable delay does not impact the critical activity.
- When both excusable and non-excusable delays are critical and commenced together and cease at the same time, both the employer and contractor should bear responsibility for them. The contractor is entitled to time extension and is not entitled to associate costs even if the excusable delay is a compensable delay.
- When an excusable delay occurs first on a critical path followed by a non-excusable delay on a parallel critical path, there are grounds to argue that no reimbursement should be permitted but still the case will be open for debate. Usually the dominant cause of delay should be the deciding factor.

To reach on a conclusion that the contractor is entitled to certain amount of time and/or monetary compensation or the client for liquidated damages, the agreement between the parties shall have express terms in the Contract for which type of delay events that the contractor is responsible and for which he is entitled to time and/or additional payment; otherwise the situation will even be more complicated. Besides, if there is any ambiguity in the extension of time clause, it will be construed against the party who was responsible for drafting the contract (Murdoch, 2000), being in such condition usually prevent the employer from its right to deduct liquidated damages. The figure below (Fig.2.1) classifies the different types of delays based on their various attributes.

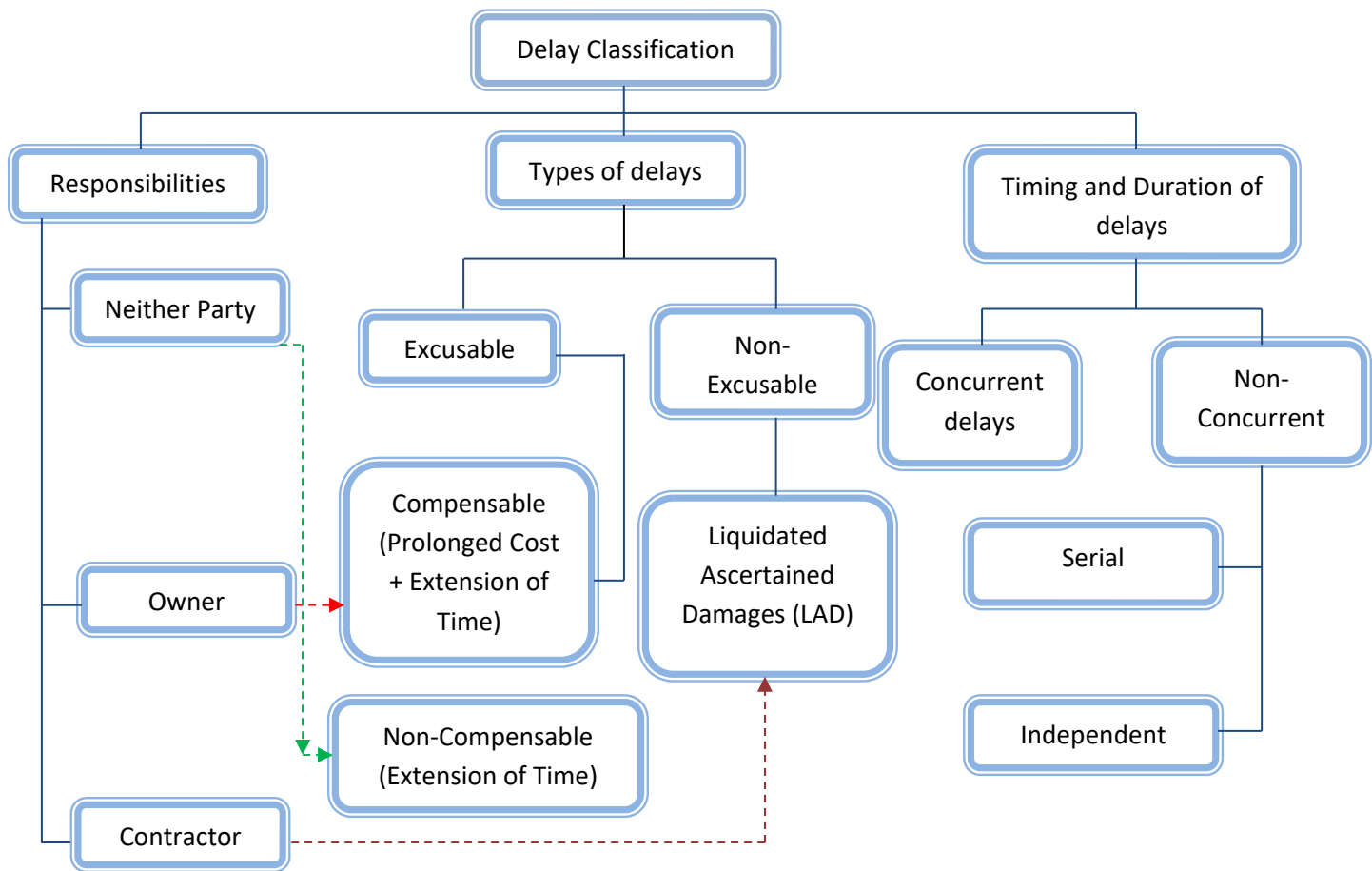


Figure 2.1: Classification of construction project delays (Bramha N, 2008)

## 2.4. Summary

This chapter reviews different literatures and sees definition, causes and types of delay of projects in detail.

Accordingly, from the referred literatures a total of seventy eight variables which are related to most delay causes in Ethiopian case regarding on the main party accountable for the causes of delay have been identified which is to be dealt with on chapter five ; moreover, before conclusion is made that causes of late completion of projects in Ethiopia are the same and depends only on the categorized variables, further study is done on actual performance and accomplishment of projects in Ethiopia by taking case study of ten road construction projects and also the listed factors are incorporated in the questionnaire.

## Chapter Three

# Procurement Regulations, Conditions of Contract and the Road Sector Development Program

### 3.1. General

Enhancement of the road sector is generally considered as an essential element for economic and social development as it provides the links required to make markets function and provide easy movement for areas on rural areas of the country. The development of economically vital sectors such as agriculture, industry, tourism etc is directly dependent on the existence of a working transport infrastructure system. Particularly, the successful implementation of Ethiopia's current economic strategy (Agricultural- Development-Led-Industrialization) depends on the availability of an effective road transport system to access the potential agricultural potential, socio-economic facilities, and services centers (Amare A. 2006). Hence, the purpose of this chapter is firstly to provide an overview of the procurement regulation, principles and procedures being adopted in the Country and then to describe about the Road Sector Development Program (RSDP) by highlighting the effort being made towards expanding the road network all over the country along with improving the quality of the existing network.

The relevance of this chapter for the research is that it gives general understanding about the limitations by the governing rules and regulations on the procurement and implementation process of the Road Sector Development Program. Besides, it shows the volume of work being undertaken in the road sector along with what is programmed until the year 2015. Knowing this fact will help to understand the effects of late completion on the road sector and subsequent importance of minimizing the problem.

### 3.2. Applicable Procurement Regulations and Procedures

The Ethiopian Constitution, Article - 40/3 states "Land is a common property of the Nations, Nationalities and Peoples of Ethiopia and shall not be subject to sale or to other means of exchange" [www.ethiopar.net]. This implies that there could not be a privately owned road in the Country. The Ethiopian Roads Authority (ERA) is the representative of the government in the road sector and is legally autonomous agency responsible for the management of the roads all over the Country. According to the government Proclamation for the Re-establishment of the ERA No. 80/1997 FDRE (1997), it has the authority to construct or improve highways through contractors. The policy of the government in the road sector is that ERA should concentrate on

planning and management of the road sector while all road construction and maintenance should be carried out by the international and domestic contractors (Amare A, 2006).

The overall idea is that, ERA will restrict itself to regulatory and policy issues and the remaining work being contracted out to the private sector including heavy road maintenance projects and routine maintenance. Basically, the procurement process is being conducted in accordance with the Proclamation for Determining Procedures of Public Procurement No. 430/2005 FDRE (2005); accordingly any procuring entity shall use open bidding except for some special cases. If a project is partly or fully financed by foreign funding agencies the respective financier regulations shall also be complied with. The standard documents being used for both national and international competitive biddings; including the World Bank's Standard Bidding Document for Procurement of Works, General conditions of works contract financed by the European Development Fund, Standard Conditions of Works Contract of the Ministry of Works and Urban Development, etc. are suitable only for Traditional General Contracting.

In projects procured with traditional General Contracting the client is required to complete the design before launching invitation to tender to contractors; the client also takes responsibility for the design of the works; and prime cost sums do not form the major proportion of the contract sum (Hughes 1992). Besides, the selection of bidder for a project is made based on selection of the least evaluated bidder, which is selection of the least bidder among those who fulfill all the pre and/or post qualification requirements.

### **3.3. Extension of Time Clauses in FIDIC Red book (1987) Condition of Contract.**

Standard condition of contract is comprehensive contractual codes that contain all practices normally encountered in civil engineering construction. The two forms of contract most frequently used in Ethiopia are the FIDIC, 1987 standard conditions and the standard Bidding Document for the Procurement of Works issued by the PPA (Version 1, January 2006).

Among the many versions of FIDIC condition of contract, the fourth edition issued in 1987 reprinted in 1988 and 1992 (old red book) by the international federation of consulting engineers is the one used for this thesis, since many contract document refer this version.

FIDIC Red book (1987) is a condition of contract for civil engineering construction; it is used when the contract is of the measurement or bill of quantity contracts. In this type of contract; construction and design are separated contracts to different firms. There is a designing team, which is employed contracted by the client, and they shall provide the contractor with a complete design (Tesfaye Ayele, 2005).

The FIDIC Red book fourth edition (1987) form of contract, for works and civil engineering construction, has two parts. Part I consists of the “General Conditions”, i.e. clauses defining the parties right and obligation and part II contains “conditions of particular application”, those clauses specifically drafted to meet the needs of the contract, including conditions unique to the locality of the project being performed, such as taxes, labor laws, local holidays, language, etc...

FIDIC Red book 87 standard of condition contains clauses providing for the granting of extensions of time linked with a clause for payment of liquidated damages by the contractor in the event of late completion. In the absence of express contractual power to extend the time for completion, the engineer could not deduct payment of liquidated damages (Uincen Powell-smith, 1990).

In delay the employer cannot insist that the contractor shall complete on time if the employer has prevented him from so completing. This is then modified by the presence of express terms for the contractor to receive extension of time for acts or omissions of the employer or those acting on his behalf, such as supervision and design Engineers. The contractor therefore has the original contract period plus the length of the delay caused to him in which to complete the project.

Delay is valid as leading to extension of time only when it leads to failure to achieve the completion date and not simply when it affects some part of the program before completion only, that is when delay is caused to activities not upon a critical path for the project and when themselves do not then become part of a new critical path (Gillian Birkby and Paul Brought, 2002)

When the contractor is not to be responsible for delay, he receives an extension of time according to the specific contractual provision.

In General the event that could give rise to the contractor’s entitlement to extension of time in FIDIC 87 are listed under sub-clause 44.1 as follows:

- A. The amount of nature or extra or addition work
- B. Any causes of delay referred to in these conditions of contract.
- C. Exceptionally adverse climatic conditions
- D. Any delay, or prevention by the employer
- E. Other special circumstances, which may occur other than, for which the contractor is responsible.

***A. The amount of nature or extra or additional work***

Under sub-clause 51.1 of FIDIC 87: - the engineer has the authority to make variations and instruct the contractor to do any of the following:

- a. Increase or decrease of quantity of any work.
- b. Omit any such work
- c. Change the character or quality or kind of any such work
- d. Change levels, lines, Positions and dimension of any part of the works.
- e. Execute additional work of any kind necessary for completion of the works.
- f. Change any specified sequence or timing of construction of any part of the work.

Even though all the works that are listed above could have delaying effect on the progress of the contractor, the contractor only could have entitled extension of time for causes (a) and (e) (Abdo Abatemam, 2006).

***B. Any causes of delay referred to in this condition***

This refers all the clauses that are listed in FIDIC 87 condition of contract, which could entitle the contractor extension of time (Abdo Abatemam, 2006). Each sub-clause is explained as follows:

- i. **Delayed drawings or instruction (sub-clause 6.4):** - This sub-clause makes provision for time extension or additional cost if the contractor suffers delays in the issuance of drawings by the engineer (FIDIC 87).
- ii. **Unforeseeable physical condition (sub-clause 12.2).** Under this clause the contractor is entitled to time extension and associated cost if the contractor encounters physical obstructions or conditions not foreseeable by experienced contractor (FIDIC 87).
- iii. **Suspension of work upon the engineer's instruction (sub-clause 40.2).** The engineer has the authority to suspend the progress of the whole works or any part of the works. The contractor is entitled to time extension and additional cost incurred for in the contract by default or breach of contract by the client, by reason of climatic conditions or necessary for the proper execution or safety of the works (not arising from any act or default by the engineer or employees or any of the employer's risks) (FIDIC 87).
- iv. **Delayed possession of site (sub-clause 42.2).** Under this clause the contractor is entitled to any time extension and additional costs incurred due to failure of the employer to give possession of site in accordance with sub-clause 42.1(FIDIC 87).
- v. **Suspension of work upon the employer's failure to pay (sub-clause 69.4).** Under sub-clause 69.4 of FIDIC 87, the contractor may, if the employer fails to pay the contractor the amount due under why certificate of the engineer within 28

days after the expiry of the time stated in sub-clause 60.10 within which payment is to be made, after giving 28 days' prior notice to the employer, with a copy to the engineer, suspend work or reduces the rate of work in accordance with the provisions of this sub-clause and there by suffers delay or incurs costs the engineer shall, after due consultation with the employer and the contractor, determine:

- (a) Any extension of time to which the contractor is entitled under clause 44, and
- (b) The amount of such costs, which shall be added to the contract price, and shall notify the contractor accordingly, with a copy to the employer.

### ***C. Exceptionally adverse climatic condition***

In order to get extension of time in this condition the climatic condition should be exceptional and at the same time it should be adverse.

### ***D. Any delay, Impediment or prevention by the employer under sub-clause 40.1***

The engineer has the authority to suspend the progress of the whole works or any part of the works, if such suspension is a rising from any act or default by the engineer or employer or any of the employer's risks (FIDIC 87).

### ***E. Other special circumstances.***

“In FIDIC 4<sup>th</sup> edition 1987, other special circumstances refer to events, which may occur, other than through, a default of or breach of a contract by the contractor or for which he is responsible. The word ‘other’ seems to refer to events, which fall outside of those listed in sub-clause 44.1 (a) to (d). Similarly, the events have to be ‘special’ as opposed to normal, to entitle the contractor to extension of time.” (Abdo Abatemam, 2006).

## **3.4. Notices for granting extension of time**

It is an essential part of the operation of the extension of time clause, in most contracts, that the contractor should have given notices of delay. The contractor is not restricted to delays which have already occurred, but must think ahead and give notice as soon as it is “reasonably apparent” that there is likely to be delay in the future. The obligation on the contractor is to give notice and the notice must be in writing and must include

- The cause or causes of the delay
- An event, which in the opinion of the contractor is relevant event
- Detail of the expected effects of the relevant which he has identified and his estimate of the extent of the day in compilation which he anticipates, whether or not

this is concurrent with delay from any other relevant event. This is to give as part of the original notice, or as so as possible afterwards.

FIDIC 87 sub-clauses 44.2 stipulate the contractor should notify the engineer within 28 days or other reasonable time that the engineer agreed in the contract documents. After such summation of notification to the engineer, detailed particulars of any extension of time should be submitted within 28 days.

### 3.5. Sources of Information for assessing delay and their causes

According to (Gillia Birkby and Paul Brought, 2002) there are a number of sources of information, which the contract administrator can use to monitor and assess delays:

- Notices of delay
- Work Programs
- Site Progress meetings
- Contractor's report (Day work sheets and contractor's allocation sheets)

**Notices of delay:** -Most contracts state the basic requirements of such a notice and its constituent parts. Generally speaking, the usual minimum notification requirement is to state the cause(s) and the period or estimated period of delay.

**Work programs:** - the contractor usually provides this and an engineer should have at least a rudimentary understanding of the principles of construction programming. The detail in any construction programs varies from project to project and usually depends up on the complexity of the project, but there are some fundamental principles that apply to any construction programs. One is that it should demonstrate how the contractor proposes to execute the works. Most programs will also show a critical path, i.e. the sequence of items, which if delayed, will have a delaying effect on the overall completion date. At the simplest level, any delay to items on the critical path might be one critical path or there may be a number that are interrelated.

The contract administrator will use the construction programs both to monitor the contractor's progress to identify delay, and to monitor information requirements so as to prevent delay. Subsequent revisions can be used to monitor how the contractor intends to complete the works and as further check on any delays that may occur after the revisions have been issued.

**Site Progress meetings:** - These are usually concerned with progress in the broadest sense, i.e. how the work is proceeding so as to achieve the date for completion, and any action to be taken by the design team so that the contractor is not prevented from doing so. The meeting will therefore review the provision of delay how these can, if possible, be overcome or mitigated. The

contract administrator may be told in the meeting about the causes of delay, which he will need to weigh against the documented evidence of delay.

**Day work sheets and contractor's allocation sheets:** - Day work sheets, where they have been used to value a variation or the contractor has presented them for 'record purposes' are an excellent means, if verified, of establishing when work was executed. The same applies to the contractor's allocation sheet, if these are made available to the contract administrator and they provide sufficient detail that can be verified.

**Contractor's report:** - The contractor often provides a report to the contract administrator for discussion at the site progress meeting, which is usually appended to the site meeting minutes. The contract may require the contractor to notify all causes of delays and he often does this in his report in addition to any written notification required by the contract.

In general the sources listed above provide a considerable body of information and records to identify the cause of delay.

### **3.6. Liquidated damage for delay**

On many projects, where time is the essence of construction, the owner and the contractor agree under the contract terms that if the contractor fails to complete the project by the stipulated date, he is financially liable to the owner for a pre agreed sum for each day beyond the specified completion date that it takes the contractor to finish the work. This amount of money represents the financial losses of the owner due to such delays, and because it is difficult to determine the real values of the owner's losses, the pre agreed sum is considered as the actual damages suffered. This assessment is referred to as liquidate damage (Edward R. Fisk sixth edition).

The estimated amount of the liquidate damages per day may be a function of many things. It can be losses to the owner in connection with revenue producing the road. Similarly it can be a function of profit the owner gets from that investment.

The basic rule is that a liquidated damages provision is enforceable if the amount represents a reasonable forecast, at the time of signing the contract, of the actual damages the owner might incur if the project is not completed by the contractual dead line. It is recognized that a precise determination of the owner's delay damage is not possible.

If the owner does not make a reasonable attempt to forecast its actual delay damages, the provision may be considered as unenforceable penalty, or an attempt to provide a negative incentive for timely contractor performance (Edward R. Fisk sixth edition).

### 3.7. Extension of Time Clauses in the Standard Bidding Document for the Procurement of Works (PPA) January 2006

**Program:** within the time stated in the Special Conditions of Contract, the Contractor shall submit to the engineer for approval a program showing the general methods, arrangements, order and timing for all the activities in the work. Moreover, regarding this the condition stipulates the program to be updated and resubmit with in the period stated in the Special Condition of Contract, otherwise the Engineer may withhold the amount stated in the Special Conditions of Contract from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue program has been submitted. Also it is stated that the Engineers approval of the program shall not alter the contractor's obligation. The contractor may revise the program and submit it to the Engineer again at any time showing the effect of Variations and Compensation Events.

**Extension of the Intended Completion date:** The Engineer shall extend the intended completion date without the contractor taking steps to accelerate the remaining work, which would cause the contractor to incur additional cost. Moreover, under this clause it stipulates the Engineer shall decide whether and by how much to extend the intended completion date within 21 days of the contractor asking the engineer for a decision upon the effect of a compensation event or Variation and submitting full supporting information. If the contractor has failed to give early warning of a delay or his failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new intended completion date.

**Delays Ordered by the Engineer:** The Engineer may instruct the contractor to delay the start or progress of any activity within the works.

**Early Warning:** The contractor shall warn the engineer at the earlier opportunity of specific likely events or circumstances that may adversely affect the quality of the work increase the contractor price or delay the execution of the works. The engineer may require the contractor to provide an estimate of the expected effect of the future event or circumstance on the contract price and completion date.

**Liquidated Damages:** The contractor shall pay liquidated damages to the employer at the rate per day stated in the special condition of contract for each day that the completion date is later than the intended completion date. The total amount of liquidated damages shall not exceed the amount defined in the special conditions of contract. The employer may deduct liquidated damages from payments due to the contractor. Payment of liquidated damages shall not affect the contractor's liabilities.

### 3.8. The Road Sector Development Program

The country's road network is not sufficient for providing adequate transport services, motorized transport accounts for only limited portion of the travel and transport demand of the country. Especially, in rural parts of the country this factor forced the use of transportation to depend on traditional means such as walking, head loading, back loading, and use of pack animals.

As part of the effort of overcoming this problem, the Government of Ethiopia with the support of different foreign financiers launched a Road Sector Development Program (RSDP) in 1997. The first 5-year phase of the RSDP was officially launched in July 1997 and ended in June 2002. The second phase, RSDP II, stretched over the period July 2002 to June 2007. The third phase, RSDP III, commenced in July 2007 and ended in June 2010. The fourth phase, RSDP IV, commenced in July 2010, and ended in June 2015.

The primarily objectives of RSDP include;

- 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 [ERA 2014].

The money for the implementation of the RSDP is acquired mainly from the government's treasury and foreign financiers such as The World Bank, European Commission, African Development Bank, OPEC Fund, Bank of Arab for Economic Development in Africa, Nordic Development Fund, and the Governments of Japan, Germany, Italy, Ireland and U.K.

The RSDP has already been implemented in the past Seventeen Years and in four successive years as follows;

- RSDP I – Period from July 1997 – June 2002
- RSDP II – Period from July 2002 – June 2007
- RSDP III – Period from July 2007 – June 2010
- RSDP IV – Period from July 2010 – June 2015

The overall summary of the past Seventeen Years RSDP Performance is summarized in the table below;

**Table 3.1: Summary of 17 years RSDP accomplishment (ERA 2014)**

Type of Work	Planned (km)	Actual (km)	% age	Budget (millions)	Disb. (millions)	% age
<b>A. Federal Roads</b>						
Rehabilitation of Trunk Roads	2,952	2,728	92	11,908.3	15,043.2	126
Upgrading of Trunk Roads	4,506	4,103	91	18,490.2	23,195.8	125
Upgrading of Link Roads	5,283	4,501	85	29,598.0	36,407.2	123
Construction of new Link Roads	7,141	6,328	89	39,595.2	52,049.8	131
Federal Roads Periodic Maintenance	10,034	11,496	115	7,236.7	5,455.2	75
Performance based Maintenance	0	0		4,133.5	4,830.9	117
Routine Maintenance	0	0		650.0	73.4	11
Others				3981.9	5,039.5	127
<b>Sub Total Federal Roads</b>	<b>29,915</b>	<b>29,155</b>	<b>97</b>	<b>115,593.7</b>	<b>142,095.0</b>	<b>123</b>
<b>B. Regional Roads</b>						
Construction	22,922	22,163	97	18,222.4	11,900.1	65
Periodic Maintenance	18,817	18,969	101	2,270.4	2,378.8	105
Others				203.0	115.4	57
<b>Sub Total Regional Roads</b>	<b>41,739</b>	<b>4,113</b>	<b>99</b>			<b>70</b>

### 3.9. Summary

This chapter demonstrates how the road sector in Ethiopia is performing in the last Seventeen years and describes the applicable procurement procedure. The following points could also be observed.

- Since the government owns the land, it is not possible to have a privately owned road in the country. Besides the Ethiopian Roads Authority is the government’s representative in the road sector and it is the employer for all major highway project in the Country.
- Any procurement in the country shall be floated in open bidding except for some limited cases.

- 
- From the start of RSDP - I until June 2014, a total of 29,155 km of federal roads were constructed, upgraded/ rehabilitated and heavily maintained, 41,132km of regional and 39,096km of community roads were constructed. The overall physical accomplishment against the plan was 86% and the total disbursement was about ETB 180.9 billion with 113% disbursement against the plan.

Accordingly, it can clearly be seen that the Government is allocating major amount of the Governments budget on construction of roads which requires to be effectively utilized in order to attain the required purpose. Hence, completion of road projects on time is without doubt one of the factors to be able to save the budget and transfer the road to the end user.

## Chapter Four

### Research Design & Methodology

#### 4.1. Introduction

Variables for delay of construction projects differ from researcher to researcher, as each independent research views the subject from different perspectives. This may be the project type, size, location, type of contract, etc. The purpose of this chapter is therefore to screen the factors identified from literature review, in Chapter 2, in line with the appropriate conditions of the road construction sector in Ethiopia; include any other relevant variables observed from the case study; and classify the relevant factors in to groups depending on the source of delay. It also deals about the contents of the questionnaire that is to be distributed to different professionals who have experience in road projects in Ethiopia.

#### 4.2. Identification of Variables

Out of the eighty-eight variables identified from the literature review, seventy eight are found to be appropriate to go with the delay causes of Ethiopia due to practicality of the causes and the actual scenario of the sector here. In addition twelve variables have been included to the list from the cases observed in the previous chapter and other similar projects and has been compiled; that is a total of ninety variables have been considered as a final list. While selecting the variables the fundamental requirements considered are the suitability for:

- Road construction projects
- Public procurement with open competitive tendering procedure
- Traditional general contracting
- Both foreign and local financing

As has been adopted by many researches [(Assaf and Al-Hejji, 2006), (Al-Khalil and Al-Ghafly, 1999), and (Kumaraswamy, 1998)] factors can be classified into groups of problems within the scope of influence. Accordingly, the ninety variables for delay are classified in to eight groups depending on the source of delay; i.e., those related to project, client, contractor, supervision consultant/engineer, design consultant, material, equipment, labor and external causes. Project related factors are those associated to a specific project, and mostly are derived from the particular provisions of tender/contract documents; such as short project duration, type of contract, unavailability of bonus for early completion, etc. Besides, external factors are the ones which happen beyond the control of any of the parties involved in a project; such as adverse

weather condition, change in legislation, effects of social and cultural factors, etc. List of variables are indicated in the following Table (Table 4.1)

**Table 4.1: List of delay variables**

<b>Item No.</b>	<b>Late completion Factors</b>
	<b>1. Client Related causes</b>
1.	Type of construction contract (Turnkey, construction only, etc.)
2.	Type of project bidding and award (selection based on least evaluated bidder)
3.	Poor Assessment of original contract duration
4.	Delay in effecting payments by the owner
5.	Delay in site possession by the owner
6.	Delay in settlement of Right of way issues by the owner
7.	Inadequate definition of substantial completion
8.	Ineffective delay penalties
9.	Delay in issuance of change orders by the owner
10.	Unavailability of incentives for early completion
11.	Excessive issuance of change order by the owner (scope change)
12.	Owners poor communication with the construction parties and government authorities
13.	Poor coordination of the owner with various parties during construction
14.	Slowness in decision making process by the owner
15.	Limitation of supervision engineers authority by the owner
16.	Interference of the owner on the construction process
17.	Excessive bureaucracy in the owner's administration
18.	Uncooperative owner with the contractor (corruption)
19.	Suspension of works by the owner
20.	Delay in settlement of contractors claim by the owner
	<b>2. Contractor Related causes</b>
21.	Poor Management of finance by the contractor
22.	Poor site management and supervision by the contractor
23.	Inefficient quality control management by the contractor leading to rework
24.	Ineffective planning and scheduling of work by the contractor
25.	Weakness in following the planned work schedule by the contractor
26.	Improper construction methods implemented by the contractor
27.	Delay in site mobilization
28.	Lack of field survey by the contractor before commencement of the work
29.	Lack of experience in project type
30.	Lack of experience of local regulations

31.	Lack of experience of project location
32.	Slow preparation of change order requests by the contractor
33.	Improper technical study by the contractor during bidding stage
34.	Conflicts between contractor and other parties (Consultant and Owner)
35.	Poor communication of the contractor with different parties involved in the project
36.	Contractors poor coordination with different parties involved in the project
37.	Delay in sub-contractors work
38.	Lack of determination to sub contract works by the contractor
39.	Miss much of contractors and sub-contractors schedule in execution of the work
40.	Problems between contractor and his sub-contractors with regard to payment
41.	Ineffective contractors head office involvement in the project
42.	Failure to apply safety rules and regulations within the contractor's organization
	<b>3. Supervision Consultant / Engineer Related causes</b>
43.	Poor qualification of consultant / engineer's staff assigned to the project
44.	Delay in the approval of contractor's submissions by the engineer
45.	Poor communication between the consultant and other parties involved
46.	Poor coordination by the consultant with other involved parties
47.	Delay in performing inspection and testing by the consultant
48.	Slow response of the consultant to the contractors inquiries
49.	Rigidity of the consultant
50.	Delay in correcting mistakes and reconciling discrepancies in the contract document
51.	Late instruction by the consultant
	<b>4. Design Consultant related causes</b>
52.	Ambiguities and inconsistencies in specifications and drawings
53.	mistakes in specifications and drawings
54.	Poor Assessment of original contract duration
55.	Unclear and inadequate details in drawings
56.	Complexity of project design
57.	Insufficient communication between owner and design engineer during design phase
58.	Lack of communication of the design engineer with local administration (Assessment of their requirement)
59.	Inadequate investigations by the designer during the design phase
	<b>5. Material related causes</b>
60.	Change in material prices
61.	Shortage of construction materials required
62.	Change in material types and specifications during construction
63.	Delay in material delivery
64.	Late procurement of materials by the contractor

	<b>6. Equipment related causes</b>
65.	Equipment breakdowns
66.	Shortage of equipment required
67.	Low level of equipment operator's skill
68.	Low productivity and efficiency of equipment
	<b>7. Labor related causes</b>
69.	Shortage of manpower (Skilled, semi-skilled and unskilled)
70.	Shortage of contractors administrative personnel
71.	Shortage of technical professionals in the contractor's organization
72.	Low skill of manpower
73.	Poor qualification of the contractor's technical staff assigned to the project
74.	Low productivity level of labors
75.	Inadequate living condition of labor
76.	Labor strikes by the contractor workforce
	<b>8. External causes</b>
77.	Effects of subsurface conditions (soil, high water level)
78.	Delay in obtaining permits from different government offices
79.	Severe weather conditions on the work site
80.	Unavailability of utilities in site (such as, water, electricity, telephone, etc.)
81.	Effects of social and cultural factors
82.	Accident during construction
83.	Changes in government regulations and laws
84.	Traffic control and restrictions on job site
85.	Survey data missing on work site
86.	Unforeseen circumstances
87.	Government tendering system requirement of selecting the lowest bidder
88.	Interference by financiers in contract administration and construction operations
89.	Bureaucracy of local administrative offices to settle right of way issues
90.	Lack of understanding of local people (creating problem on work progress)

### 4.3. Questionnaire Design

A questionnaire is prepared to gather the required information from professionals who have been involved in the road construction sector in Ethiopia working on behalf of a client, consultant or contractor; towards answering the basic research question.

The questionnaire is divided into the following three major parts.

**Part 1:**

This part covers inquiries on general background information of the respondent and the organization in which the respondent is representing for.

**Part 2:**

It incorporates list of identified possible variables of delays in road construction projects. For each variable two questions were asked; these are the degree of impact and the rate of occurrence. The degree of impact was categorized on a five point scale: Very high, High, Moderate, And Neutral and None. Whereas the rate of occurrence was categorized on four point scale: High, Medium, Low and Never.

**Part 3:**

This section incorporates ten questions, which are aimed to acquire information that will indicate the direction on how to control the time and cost overrun problems in road construction projects in Ethiopia. The respondents are asked to answer each question by selecting one of the five levels of agreement/ disagreement choices; i.e., strongly agree, slightly agree, neutral, slightly disagree and strongly disagree. If their choice is from the last three levels they are again asked to rank from the list of proposed solutions and/or to indicate their proposed solution for the problem in question.

Full set of the questionnaire is attached as Appendix.

#### **4.4. Summary**

In this chapter assessment of possible variables for causes of time overrun applicable for the road construction sector in Ethiopia was done. Accordingly, ninety variables for delay have been listed. Besides, the following points are also addressed.

- While selecting the variables check has been made whether or not they are relevant for the underlying conditions in Ethiopia.
- Identified variables have been categorized in eight major groups based on the sources of delay and accountability.
- Having all the aforementioned perception, a questionnaire was designed that consists three major sections basically aimed to acquire data on the general background information of the respondents and their organization; degree of impact and rate of occurrence of the identified variables/factors; and also on assessment of controlling mechanisms of time overrun problems.

Hence, before distribution of the questionnaire case study of some selected projects will be studied on next chapter to further identify actual cause of delay in Ethiopian case and give strength to the already identified variables.

## Chapter Five

### Selected Cases in Federal Road projects of Ethiopia

#### 5.1. Introduction

In Ethiopian road construction project cases it is a common feature to have extended delay and mostly require additional budget for different reasons. In such circumstances what matters most is the period for the completion of the project, the service it should have given and the additional budget it requires. Obviously, the higher the time the severe the repercussions would be on the client and the contractor in particular and on the project stakeholders in general.

This chapter assesses some cases of road projects in Ethiopia that are completed within the last two years and have prolonged completion dates; hence, it is intended to show the level of delay problems by comparing the originally agreed time for completion of each of these projects with the revised completion period. The main purpose of this chapter is, therefore, to show the severity of the case and the sum up loss the country is facing due to prolonged completion days of the projects, the case study is done only on some sample projects which are selected from the list of projects found within Ethiopian Roads Authority which have been recently completed and have extended completion period.

#### 5.2. Case Studies

The description of the cases of each project listed below mainly focus on the extent of delays between the originally set duration with the time required to finish the respective projects. The under listed projects are taken from Ethiopian Roads Authority recently completed projects of Northern and Southern regions which are selected as described above.

##### *5.2.1 Wukro – Adigrat - Zalambessa Road Upgrading Project*

This project was awarded to a foreign contractor and started on 22<sup>nd</sup> June 2009 with original completion date to be on 22<sup>nd</sup> December 2011 and a contract period of 913 calendar days. The original contract amount was ETB 530,187,936.79.

- However, the revised completion date of the project was on 26<sup>th</sup> December, 2013 with 735 days of total granted extension of time. Consequently, the project was completed with an amount of ETB 714,433,567.12 revised cost. The reasons for the EOT and cost variation orders were right of way and bad weather conditions. On this project overall twenty variation

orders has been given and approved due to Additional Engineers house, pipe diameter change, modification of Frewoin, Edaga hamus, Adigrat and Fatse towns, pavement change, modification of drainage structure, modification Zalambesa town approach, additional two bridge works, additional shoulder work at Fatse town, round about construction at Adigrat town, ditch cover work and so on.

### **5.2.2 Gobgob - Gashena Road Upgrading Project**

This project was awarded to a foreign contractor and started on 1<sup>st</sup> August 2006 and the original completion date was 29<sup>th</sup> January 2010. The Original contract amount was ETB 227,037,454.52.

However, the project has 325 days extension of time, consequently, the completion date was revised to 20<sup>th</sup> December 2010 with additional value of variation order 67,985,876.26 and value of claims amounting to 13,487,168. The reason for the EOT and cost was change of legislation/sur tax, missing survey monuments, increased in sub base quantity and wearing course change.

### **5.2.3 Shire - Shiraro – Humera - Lugdi (Lot 2: Adigoshu - Lugdi) Road Upgrading Project**

This project was started on 10<sup>th</sup> July 2007 by a foreign contractor and the original completion date was 09<sup>th</sup> January 2011. The Original contract amount was ETB 627,709,145.85

However, the project has 1206 days extension of time, consequently, the completion date is revised to 30<sup>th</sup> April 2014 with revised cost of ETB 1,072,706,841.73. The reason for the EOT and cost was increment of quantity due to design faults like; additional bridge and additional cross sectional structure, the other reasons were additional km which changes the total road length from 157km to 167km due to Government order, and Town section widening at Humera, Adigoshu and Rahwai towns due to administrative requirements.

### **5.2.4 Kombolcha – Mekane Selam Road Project**

This project was started on 20<sup>th</sup> February 2006 by a foreign contractor and the original completion date was 20<sup>th</sup> August 2009 with a contract period of 1277 calendar days. The Original contract amount was ETB 694,149,063.23. The project was initially gravel road construction. However, after completion of the initial project supplementary agreement is given for upgrading of the road.

The initial project has been substantially completed on 25<sup>th</sup> March 2011; that is after 573 days of the expected completion date, with a total project cost of ETB 825,153,278.15, which is an additional cost of 131,004,214.92. The revised completion time of the project was 29<sup>th</sup> January 2014. The reasons for the extension of time and cost was increase in earth work quantity, change

in width of structures, additional structures and additional access roads due to scope change of the work from gravel road to surface treatment.

### ***5.2.5 Mekane Selam -Gundewein Road Upgrading Project***

This project was started on 20<sup>th</sup> February 2006 by a foreign contractor and the original completion date was 20<sup>th</sup> August 2009. The Original contract amount was ETB 904,244,639.00.

However, after granting 2899 days of extension of time the completion date is revised to 28<sup>th</sup> January, 2014, On this project the variations given was only for extension of time without additional cost on the client and the reasons for the EOT was realignment of the road, delay in submission of working drawings, delay in testes of sub grade material, unforeseeable geotechnical problems and due to security problem the work was detained.

### ***5.2.6 Arbaminch – Jinka (Contract 3: Delbena – Jinka) Road Upgrading Project***

This project was started on 16<sup>th</sup> May 2006 by a local contractor and the original completion date was 14<sup>th</sup> May 2009 having a total of 1095 calendar days. The Original contract amount was ETB 434,567,292.42.

However, the project has 730 days extension of time; consequently, the completion date was revised to 13<sup>th</sup> May 2011 with approved additional value of variation order equal to ETB 1, 831,041.50. The reason for the EOT were Woito belly bridge collapse and reconstruction, shortage of Equipment, shortage of skilled Manpower, adverse weather condition, lack of coordination on site and bad communication between consultant and contractor.

### ***5.2.7 Humbo – Arba Minch Road Upgrading Project***

This project was started on 1<sup>st</sup> January 2008 by a local contractor and the original completion date was 2<sup>nd</sup> July 2010 having a total of 913 calendar days. The Original contract amount was ETB 521,783,421.62

However, due to the 1298 days approved extension of time the completion date is revised to 20<sup>th</sup> January 2014. On this specific project around 6 variation orders are given which is in one or another way the reason for the given extension of time. But mostly the main reasons for the projects untimely completion were contractor's failure to revise the work program as per the given extension of time and contractor's shortage of key equipment and qualified key personnel.

### **5.2.8 Afdera – Abala (Contract 1: Hawusewa - Abala) Road Project**

This project was given to foreign contractor and started on 28<sup>th</sup> August 2008 and the original completion date was 20<sup>th</sup> February 2012. The Original contract amount was ETB 746,341,435.30.

However, due to the given 1039 days extension of time the completion date is revised to 25<sup>th</sup> December 2014. In this project the extension of time was given for replacement of type A Engineers facilities to type B accordingly, the original contract amount was reduced by ETB 5,829,718.00. Moreover the project was also delayed because of incorrect survey data provided by the design consultant. In this case, the clients lack in giving immediate decisions and their related consequences and design consultants negligence in design work can be clearly seen.

### **5.2.9 Aposto – Wondo – Negele (Contract 1: Aposto - Irba Moda) Road Upgrading Project**

This project was awarded to a local contractor and started on 28<sup>th</sup> April 2009 and the original completion date was 27<sup>th</sup> April 2012 having a total of 1095 calendar days. The Original contract amount was ETB 325,578,073.09.

However, due to the approved 793 days extension of time, the completion date is revised to 29<sup>th</sup> June 2014. Reasons for the variation order to be given was; change of 900mm pipe culverts on the design to slab culvert, change of design alignments of some sections of the project and construction of retaining walls along the project route as required and introduction of medians in Aleta wondo town.

### **5.2.10 Aposto – Wondo – Negele (Contract 3: Wadera - Negele) Road Upgrading Project**

This project was started on 29<sup>th</sup> June 2009 by a local contractor and the original completion date was 25<sup>th</sup> November 2011 having a total of 910 calendar days.

However, with the 307 days approved extension of time the project's completion date was revised to 27<sup>th</sup> September 2012. The reason for the projects untimely completion is due to the contractor's poor management, improper follow up of the work and problem in performing the work as per the schedule.

### 5.3. Summary

In general the above cases could give clear picture of the extent of severity of delay problems in road projects in the Country. Major points of the cases are summarized as shown in the table below.

**Table 5.1: Summary of case study projects**

Item No.	Projects	Contractor Local/Foreign	Commencement date	Original Completion Date	Revised Completion Date	Total EOT given	Reason for EOT
1.	Wukro – Adigrat - Zalambessa	Foreign	22 <sup>nd</sup> June 2009	22 <sup>nd</sup> December 2011	26 <sup>th</sup> December, 2013	918	<ul style="list-style-type: none"> <li>• Approved variation order due to Additional Engineers house, pipe diameter change, modification of Frewoin, Edaga hamus, Adigrat and Fatse towns, pavement change, modification of drainage structure, modification Zalambesa town approach, additional two bridge works, additional shoulder work at Fatse town, round about construction at Adigrat town, ditch cover work and so on.</li> <li>• ROW and</li> <li>• Bad weather conditions.</li> </ul>
2.	Gobgob - Gashena	Foreign	1 <sup>st</sup> August 2006	29 <sup>th</sup> January 2010	20 <sup>th</sup> December 2010	325	<ul style="list-style-type: none"> <li>• change of legislation/sur tax,</li> <li>• missing survey monuments,</li> <li>• increased in sub base quantity and</li> <li>• wearing course change</li> </ul>
3.	Adigoshu - Lugdi	Foreign	10 <sup>th</sup> July 2007	09 <sup>th</sup> January 2011	30 <sup>th</sup> April 2014	1207	<ul style="list-style-type: none"> <li>• variation order given for additional km which changes the total road length from 157km to 167km due</li> </ul>

							<ul style="list-style-type: none"> <li>to Government order,</li> <li>Town section widening at Humera, Adigoshu and Rahwai towns due to administrative requirements.</li> </ul>
4.	Kombolcha – Mekane Selam	Foreign	20 <sup>th</sup> February 2006	20 <sup>th</sup> August 2009	29 <sup>th</sup> January 2014	1623	<ul style="list-style-type: none"> <li>increase in earth work quantity, change in width of structures, additional structures and additional access roads due to scope change of the work from gravel road to surface treatment.</li> </ul>
5.	Mekane Selam - Gundewein	Foreign	20 <sup>th</sup> February 2006	20 <sup>th</sup> August 2009	28 <sup>th</sup> January, 2014	1622	<ul style="list-style-type: none"> <li>Variation order given for realignment of the road,</li> <li>delay in submission of working drawings,</li> <li>delay in testes for sub grade material,</li> <li>unforeseeable geotechnical problems and</li> <li>due to security problem</li> </ul>
6.	Delbena – Jinka	Local	16 <sup>th</sup> May 2006	14 <sup>th</sup> May 2009	13 <sup>th</sup> May 2011	729	<ul style="list-style-type: none"> <li>Woitto belly bridge collapse and reconstruction,</li> <li>shortage of Equipment and skilled Manpower,</li> <li>adverse weather condition</li> <li>lack of coordination on site and</li> <li>bad communication between consultant and contractor</li> </ul>
7.	Humbo – Arba Minch	Local	1 <sup>st</sup> January 2008	2 <sup>nd</sup> July 2010	20 <sup>th</sup> January 2014	1298	<ul style="list-style-type: none"> <li>contractor’s failure to revise the work program as per the given extension of time and</li> <li>contractor’s shortage of key</li> </ul>

							equipment and qualified key personnel
8.	Hawusewa - Abala	Foreign	28 <sup>th</sup> August 2008	20 <sup>th</sup> February 2012	25 <sup>th</sup> December 2014	1039	<ul style="list-style-type: none"> <li>• Variation order given for replacement of type A Engineers facilities to type B.</li> <li>• Re surveying work due to incorrect survey data provided by the design consultant</li> </ul>
9.	Aposto - Irba Moda	Local	28 <sup>th</sup> April 2009	27 <sup>th</sup> April 2012	29 <sup>th</sup> June 2014	793	<ul style="list-style-type: none"> <li>• Variation order given for change of 900mm pipe culverts to slab culvert,</li> <li>• change of design alignments of some sections of the project</li> <li>• construction of retaining walls along the project route as required and</li> <li>• introduction of medians in Aleta wondo town</li> </ul>
10	Wadera - Negele	Local	29 <sup>th</sup> June 2009	25 <sup>th</sup> November 2011	27 <sup>th</sup> September 2012	307	<ul style="list-style-type: none"> <li>• Contractor's poor management</li> <li>• Improper follow up of the work and</li> <li>• Problem in performing the work as per the schedule</li> </ul>

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From the above table we can see that;

- For some of the projects the additional time required is almost the same as the original contract period, which is for the total project an average of 1.89%.
- Most of the major problems observed in the projects are similar, like late possession of site, variations, contractors poor planning and management, bad weather condition, etc.

In general, the severity of the problem observed from the referred cases shows the necessity of giving due attention to the issue and the need for investigating the root causes of the problem in a wider perspective; in order to be able to substantially minimize their impacts on the upcoming projects.

Therefore, based on this and previous chapters identification of possible delay factors relevant to road projects in Ethiopia is investigated in detail in the next chapter.

## Chapter Six

### Data Collection and Analysis

#### 6.1. Introduction

The purpose of this chapter in general is to illustrate the issues related to the questionnaire distribution, collection of the responses and subsequent analysis of the responses from the professionals working in three stake holders' client, consultant and contractor involved in the road construction industry of Ethiopia. The principal purpose is to rank the already identified variables which are causes for late completion of road projects and then to find out the critical factors that are required to be given due attention in order to propose remedial measure to substantially minimize the problems which results in late completion of road construction projects in Ethiopia.

#### 6.2. Questionnaire Response Rate

The required sample size for the research for each parties involved in the survey was determined statistically as cited on Kish 1995. Accordingly it was aimed to distribute the questionnaire to 42 individuals; i.e., 12 professionals working for the client (Five Regional Directorate's office and Design and Build Directorate), 15 for consultants and 15 for contractors, and it was possible to distribute same for all.

*Table 6.1: Questionnaire distribution and response*

Description	Distributed Number	Number of respondents	% of number respondents	% of number of responses
Client	12	12	100	37.5
Consultant	15	12	80	37.5
Contractor	15	8	53.3	25
Total	42	32	76.2	100

From the 42 questionnaires distributed a total of 32 responses were received, consisting of 12 (100%) from the client, 12 (80%) from consultants and 8 (53.3%) from contractors. The overall response rate was 76.2% as shown above in Table 6.1.

### 6.3. Characteristics of Respondents

The respondents from client organization have experience in new, rehabilitation/upgrading and maintenance road projects. With respect to consultants 90% of the responses are from firms that have more than 10 years of experience. Besides, 75% of contractor's respondents are from firms having more than ten years of experience. Firms of all the 8 contractors' respondents are involved in rehabilitation/ upgrading and new road projects. The overall assessment of experiences of individual respondents shows that over 78% of the total respondents have more than five years of experience in road related projects. That is, from the 12 respondents representing the client 6 have more than 5 years of experience in road related projects, and the remaining 6 have less than 5 years of experience. Similarly, out of the 12 respondents from consultants 8 have over 10 years of experience in road related projects and 4 of them have experience from 5 to 10 years. Finally, from 8 respondents from contractors 3 have over 10 years of experience in road related projects, 4 of them have experience from 5 to 10 years and one respondent have less than 5 years of experience.

### 6.4. Data Analysis Approach

For each identified and listed variables of delay, respondents were requested to indicate the degree of impact (or severity) and frequency of occurrence. The degree of impact has been categorized into five scales and the frequency of occurrence into four scales. Before the start of the analysis, weightings have been assigned to each of the categories. For degree of impact the weightings assigned are 5 for very high, 4 for high, 3 for moderate, 2 for neutral, and 1 for none. Similarly, the weightings for frequency of occurrence are 4 for high, 3 for medium, 2 for low, and 1 for never. Then the responses given by each of the respondents have been summarized and counted in their respective categories separately for client, consultant and contractor. Summaries of responses are attached as Appendix B.

The following indices as given by Assaf and Hejji (2006) have been used to analyze the data.

a) The Severity Index for each of the variables has been computed with the following formula.

$$\text{Severity Index (S.I) (\%)} = \left( \frac{\sum_{i=1}^5 A_i N_i}{5 \sum_{i=1}^5 N_i} \right) * 100\% \dots\dots\dots [\text{Eq. 6.1}]$$

Where A is the constant expressing the weighting given to each response, it ranges from 1 for none to 5 for very high; N is the frequency of the responses.

b) Similarly, the Frequency Index for each of the variables has been computed with the following formula.

$$\text{Frequency Index (F.I) (\%)} = \left( \frac{\sum_{i=1}^4 BiNi}{4 \sum_{i=1}^4 Ni} \right) * 100\% \dots\dots\dots [\text{Eq. 6.2}]$$

Where B is the constant expressing the weighting given to each response, it ranges from 1 for never to 4 for high; N is the frequency of the responses.

c) Importance Index for each of the variables has been computed as a product of both severity and frequency indices.

$$\text{Importance Index (I.I) (\%)} = [S.I (\%) * F.I (\%)]/100 \dots\dots\dots [\text{Eq. 6.3}]$$

d) Ranking of variables has been made using the Importance Index (I.I) by assigning the first rank for the highest value, the second rank to the next highest value and so on. Kendall (1970) pointed out that there are cases that two or more rankings are similar and no preference can be expressed between them. Such rankings are called tied ranks. In such cases ranks are allocated using the “mid-rank method” where the values are determined by taking the average of the ranks, which they would possess if they were untied.

e) To determine the agreement of ranks among the client, consultants and contractors Kendall coefficient of concordance (*W*) for *m* observers will be used. It is computed with the following formula (Kendall, 1970).

$$w = \frac{12S}{m^2 (n^3 - n)} \dots\dots\dots [\text{Eq. 6.4}]$$

Where S is the sum of squares of deviations of the rankings, that is:

$$S = \sum_{i=1}^n (Ri - R)^2 \dots\dots\dots [\text{Eq. 6.5}]$$

Where *m* is the number of sets of rankings,  
*n* is the number of variables being ranked,  
*Ri* is the sum of ranks for *i*<sup>th</sup> variable and  
*R* is mean of sum of the ranks.

$W$  ranges between 0 and 1,  $W = 1$  indicate a perfect agreement; but if the rankings by various groups differ very much, the sum of rankings ( $R_i$ ) will be more or less equal for each of the factors and hence the value of  $S$  becomes small and so does that of  $W$ .

Siegel and Castellan (1988) asserted that the null hypothesis is usually formulated to express purpose of being rejected; it is the opposite of an alternative hypothesis that one is attempting to prove. The null hypothesis is rejected, in favor of the alternative hypothesis, if its associated probability of occurrence is equal to or less than some small probability ( $p$ ). That probability is called level of significance; and its common values are 0.05 and 0.01. The level of significance of 0.01 is selected for this research.

The probability associated with the occurrence when the null hypothesis is true of any value may be determined after finding  $\chi^2$  with the following equation (6.6) and determining the probability associated with as large a value of  $\chi^2$  by referring to chi-square ( $\chi^2$ ) distribution table [Siegel and Castellan, 1988].

$$\chi^2 = m(n-1)w \dots\dots\dots [\text{Eq.6.6}]$$

Moreover, if the degree of freedom for delay variables is larger than the values indicated in the chi-square ( $\chi^2$ ) distribution tables, the value of significance level ( $p$ ) will be determined using Microsoft Excel function CHIDIST with degree of freedom of  $n-1$ .

## 6.5. Research Findings and Results

Analysis of the data has been made using the aforementioned statistical methods from the viewpoints of the client, consultants and contractors. The analysis illustrates the findings and results of the survey for the severity, frequency and importance indices of all the variables of delay; and also for the eight major categories of delay causes. Besides, results of each of the hypothesized questions raised under section 3 of the questionnaire have been dealt with.

## 6.6. Severities of delay causes

Severity indices of all the variables of delay have been computed using equation (Eq.6.1) for each of the three parties' client, consultant and contractor independently and ranked accordingly. Calculation of the severity indices for all the variables separately for client, consultant and contractor is indicated in Appendix C. Accordingly, the analysis of severity of variables indicates that the client is of the opinion that the five most severe causes of delay are:

1. Poor Management of finance by the contractor
2. Low level of equipment operator's skill
3. Ineffective planning and scheduling of work by the contractor

4. Equipment breakdowns, and
5. Weakness in following the planned work schedule by the contractor

This shows that the most severe causes of delay are contractor and equipment related causes.

From the consultants' viewpoint the top five severe causes of delay are

1. Poor Management of finance by the contractor
2. Inadequate investigations by the designer during the design phase
3. Poor site management and supervision by the contractor
4. Late procurement of materials by the contractor, and
5. Shortage of equipment required

This reveals that the five most severe causes of delays are related to contractor, design, material and equipment. It is also to be noted that one of the factor is similar to those asserted by the client.

According to the contractors' perspective the first five severe causes of delays are:

1. Poor Assessment of original contract duration
2. Ineffective planning and scheduling of work by the contractor
3. Delay in site mobilization
4. Delay in settlement of right of way issues by the owner, and
5. Poor management of finance by the contractor

These causes are related to client and contractor.

## **6.7. Frequencies of delay causes**

Similarly, frequency indices are calculated using the aforementioned equation (Eq.6.2). Determination of the frequency indices for all the variables separately for client, consultant and contractor is indicated in Appendix C. As a result to the client, the five most frequent delay causes are;

- Ineffective planning and scheduling of work by the contractor
- Weakness in following the planned work schedule by the contractor
- Shortage of equipment required
- Equipment breakdowns
- Shortage of construction materials required

Meanwhile, consultant's opinion is that;

- Poor Management of finance by the contractor
- Late procurement of materials by the contractor
- Ineffective planning and scheduling of work by the contractor
- Weakness in following the planned work schedule by the contractor
- Lack of field survey by the contractor before commencement of the work, are the most frequent delay causes.

On the other hand, contractor's view on the five most frequent delay causes is;

- Government tendering system requirement of selecting the lowest bidder
- Poor Assessment of original contract duration
- Change in material prices
- Late Procurement of materials by the contractor, and
- Ineffective contractors head office involvement in the project.

## 6.8. Importance of delay causes

As illustrated in equation (Eq.6.3) above the Importance index is a product of severity and frequency indices, and same is used to rank the variables. The variables were ranked independently based on the responses given by the client, consultants and contractors. Twenty-five most important delay variables from each set of rankings were selected, and these are listed in Table 6.2. Seventeen of these variables were common for the three sets; and are indicated in green color in Table 6.2. Additional seven variables were common for two of the sets which are shown in blue color, and eleven variables were included in neither of the other two sets of top twenty-five rankings.

*Table 6.2: Importance of delay causes*

Rank	Client	Consultant	Contractor
1	Ineffective planning and scheduling of work by the contractor	Poor Management of finance by the contractor	Poor Assessment of original contract duration
2	Weakness in following the planned work schedule by the contractor	Late procurement of materials by the contractor	Government tendering system requirement of selecting the lowest bidder
3	Equipment breakdowns	Slowness in decision making process by the owner	Change in material prices

4	Poor Management of finance by the contractor	Ineffective planning and scheduling of work by the contractor	Late procurement of materials by the contractor
5	Shortage of equipment required	Weakness in following the planned work schedule by the contractor	Poor Assessment of original contract duration during design
6	Inadequate investigations by the designer during the design phase	Shortage of equipment required	Ineffective planning and scheduling of work by the contractor
7	Poor site management and supervision by the contractor	Ineffective contractors head office involvement in the project	Delay in site mobilization
8	Poor qualification of consultant / engineer's staff assigned to the project	Inadequate investigations by the designer during the design phase	Poor Management of finance by the contractor
9	Improper technical study by the contractor during bidding stage	Lack of field survey by the contractor before commencement of the work	Type of project bidding and award (selection based on least evaluated bidder)
10	Change in material prices	Improper technical study by the contractor during bidding stage	Equipment breakdowns
11	Delay in site mobilization	Equipment breakdowns	Ineffective contractors head office involvement in the project
12	Late procurement of materials by the contractor	Poor Assessment of original contract duration during design	Weakness in following the planned work schedule by the contractor
13	Ineffective contractors head office involvement in the project	Lack of determination to sub contract works by the contractor	Inadequate investigations by the designer during the design phase
14	Lack of communication of the design engineer with local administration (Assessment of their requirement)	Delay in material delivery	Shortage of construction materials required
15	Poor Assessment of original contract duration	Poor Assessment of original contract duration	Delay in material delivery

16	Shortage of construction materials required	Delay in site mobilization	Delay in settlement of Right of way issues by the owner
17	Bureaucracy of local administrative offices to settle right of way issues	Delay in settlement of Right of way issues by the owner	Lack of communication of the design engineer with local administration (Assessment of their requirement)
18	Delay in settlement of Right of way issues by the owner	Low productivity and efficiency of equipment	Shortage of equipment required
19	Ineffective delay penalties	Lack of communication of the design engineer with local administration (Assessment of their requirement)	Delay in effecting payments by the owner
20	Delay in material delivery	Type of project bidding and award (selection based on least evaluated bidder)	Severe weather conditions on the work site
21	Low productivity and efficiency of equipment	Inefficient quality control management by the contractor leading to rework	Inefficient quality control management by the contractor leading to rework
22	Government tendering system requirement of selecting the lowest bidder	Change in material prices	Slowness in decision making process by the owner
23	Lack of determination to sub contract works by the contractor	Delay in site possession by the owner	Poor site management and supervision by the contractor
24	Lack of field survey by the contractor before commencement of the work	Shortage of construction materials required	Lack of field survey by the contractor before commencement of the work
25	Slow response of the consultant to the contractors inquiries	Poor qualification of the contractor's technical staff assigned to the project	Delay in the approval of contractor's submissions by the engineer

In view of this, the total number of variables indicated in all of the three sets of rankings would be 35. This is an indication for the agreement among the parties on the ranking of variables. To

determine the agreement of ranks among the client, consultants and contractors Kendall coefficient of concordance ( $W$ ) is used. Accordingly, the values of  $W$  for rankings of delay causes were found out to be 0.829247.

As described previously the probability associated with the occurrence when the null hypothesis is true of any value is determined by identifying  $\chi_r^2$  equation (6.6).

However, since the degree of freedom for delay variables was larger than the values indicated in the chi-square ( $\chi^2$ ) distribution tables, the value of significance level (p) was determined using Microsoft Excel function CHIDIST with degree of freedom of n-1, which in this case is 89. The respective results are shown in Table 6.3.

**Table 6.3: Analysis of coefficient of concordance and significance level**

Description	m	n	$S$	w	$\chi_r^2$	p
Ranking for Delay variables	3	90	453,335	0.829247	221.409	$2.84435 \times 10^{-6}$

The value of the significance level (p) based on the overall ranking is less than 0.01, and hence verifies that the null hypothesis “*there is no agreement among the sets of rankings by the parties (client, consultant and contractor)*” has to be rejected. Subsequently, the alternative hypothesis; i.e., “*there is agreement among the sets of rankings by the parties*” is supported with confidence level of more than 99%. Computation of Kendall coefficient of concordance and Level of Significance (p) is indicated in Appendix D.

## 6.9. Analysis of Major Categories of Delay Causes

It is recalled that the causes of delays have been categorized into eight major groups depending on the source of delay. Ranking of these major groups has also been exercised based on the importance indices of the variables under each of them. The importance index of each group was determined by taking the average of the importance indices of the variables under the group in question.

These groups have then been ranked and checked for the agreement among the three parties. The results of ranking and concordance test have been indicated in Tables 6.4 and 6.5 respectively. The result depicts that three of the four important categories of delay ranked by each party are common. These are contractor related, client related, and external causes of delay. The values of Kendall coefficient of concordance ( $W$ ) and the significance level (p) are found out to be 0.989418 and 0.00411 respectively. As the significance level is again less than 0.01, the null hypothesis “*there is no agreement among the sets of rankings by the parties*” is rejected, and the alternative hypothesis; is supported with confidence level of more than 99%.

**Table 6.4: Ranking of major categories of delay causes**

Item No	Major Categories of Delay	Client		Consultant		Contractor	
		Imp. Index	Rank	Imp. Index	Rank	Imp. Index	Rank
1.	Client Related causes	29.25	2	36.73	2	44.04	2
2.	Contractor Related causes	45.67	1	48.44	1	45.13	1
3.	Supervision consultant Related causes	45.16	4	36.31	5	45.97	4
4.	Design consultant related causes	45.33	5	46.11	4	48.97	5
5.	Material related causes	50.91	7	52.10	7	59.28	7
6.	Equipment related causes	58.84	8	53.57	8	53.53	8
7.	Labor related causes	39.38	6	38.68	6	42.56	6
8.	External causes	37.81	3	34.17	3	43.53	3

From the above table we can see that the result obtained from the questionnaire analysis contractor related, client related and external causes are the major categories of delay cause which are ranked 1 to 3 respectively, similarly the main reasons of delay of the selected case study projects are client related, design consultant related, contractor related and delays due to external cause, hence, since the causes except design consultant related cause are the same, and this cause is in one or the other way also the clients responsibility we can say that contractor related, client related and external cause took the major portion of delay reasons.

**Table 6.5: Analysis of coefficient of concordance and significance level**

m	n	S	w	$\chi^2$	p
3	8	374	0.989418	20.778	$4.1134 \times 10^{-3}$

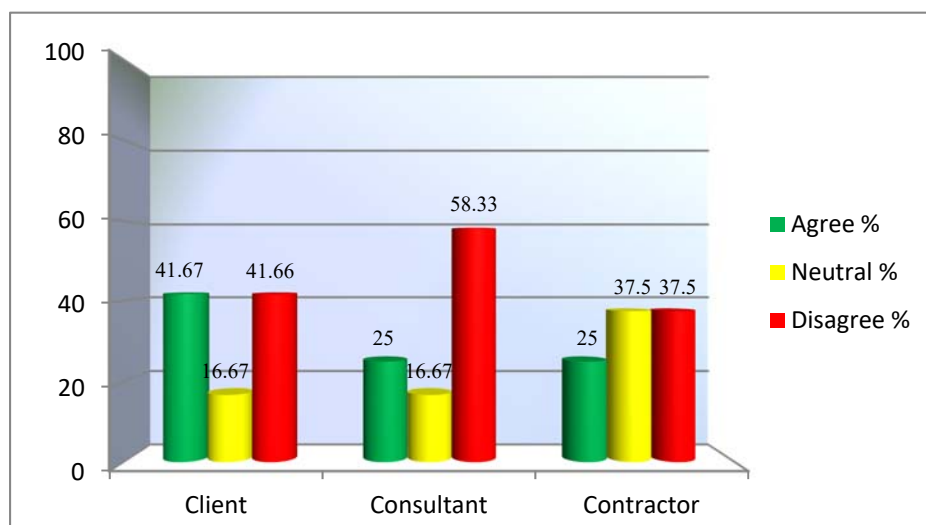
## 6.10. Analysis of Hypothesized Questions

On this section respondents were asked to express their agreement/disagreement on ten hypothesized questions. They have also been asked to give their opinion as to how the problems should be mitigated if they are disagreeing with the hypothesized questions. This was done in order to get a wider perspective in recommending solutions for the prevailing problems, which are incorporated in chapter eight. The questions were prepared to address the most common potential problem areas related to performances of the client, consultants and contractors in the design and construction processes of road projects in Ethiopia. Though the respondents are asked to respond their agreement/disagreement in five scales in order to emphasize the agreement and disagreement scales, to simplify the analysis the comparison was made on three scales; that is Agree, Neutral and Disagree. Summaries of responses have been included in Appendix B. The responses for each of the ten hypothesized questions are compared with support of charts and presented herein below.

### *Question # 1*

*Contractors commit themselves to complete projects on time, since the client is efficient in controlling contractors' progress and application of deduction of liquidated damages when projects are delayed.*

As shown below in Figure 6.1, majority of the respondents disagreed to the above hypothesis showing contractor's lack of commitment and client's inefficiency towards follow-up of contractors' progress and taking action.

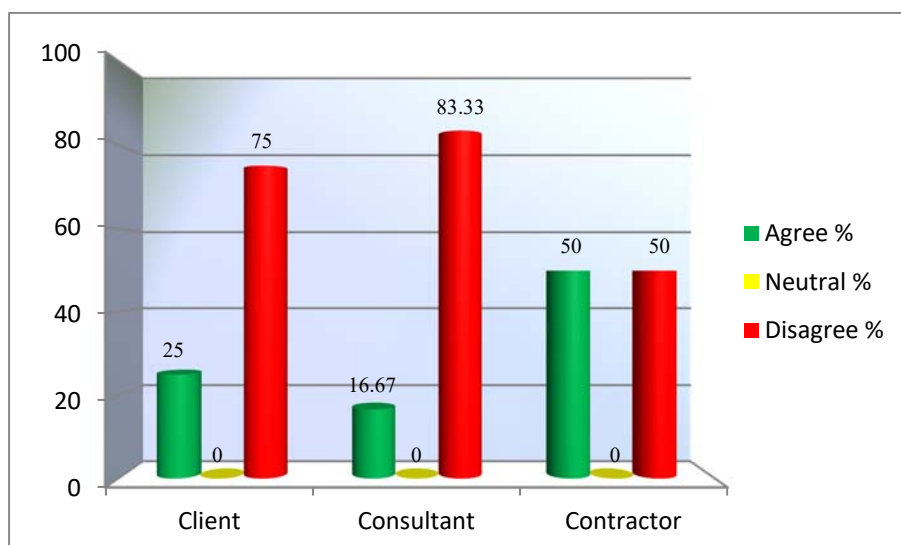


**Figure 6.1: Comparison for hypothesized question #1.**

## Question # 2

*Sufficiency and completeness of design documents and quantity estimation are reasonable.*

This question is aimed to look at the views of the respondents with respect to quality and completeness of design documents being issued to contractors. As it can be seen in Figure 6.2 below 75% and 83.33% of the respondents from client and consultants disagree on the reasonableness of the design documents issued respectively. On the contrary the contractor's response is equally distributed for agreement and disagreement, however, the overall response shows design documents and quantity estimates are mostly irrational.



**Figure 6.2: Comparison for hypothesized question #2.**

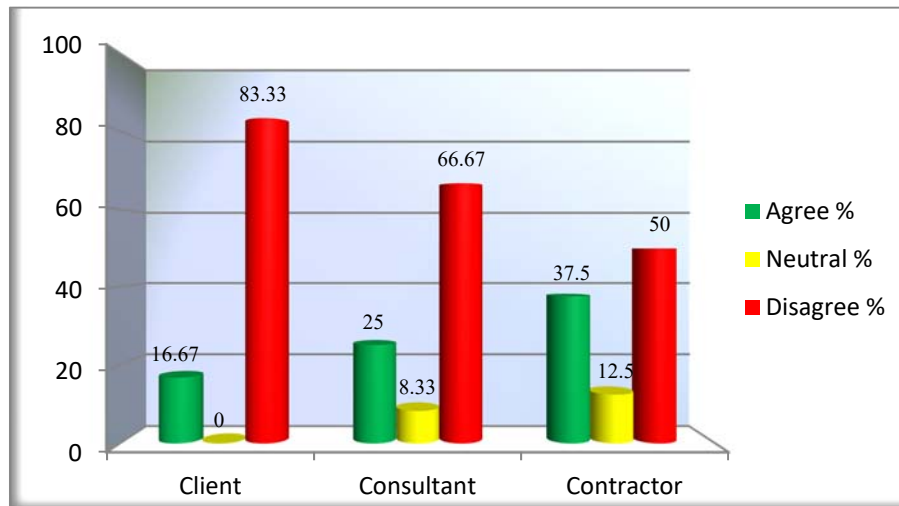
## Question # 3

*The removal and/or relocation of obstructions within the right of way are being carried out reasonably and without causing delays on the contractor's operations.*

As depicted in Figure 6.3 below, the client, consultants and contractors disagreement to the above hypothesis is 83.33%, 66.67% and 50% respectively. Looking into the higher level of disagreement, it is possible to conclude that the client has critical problems in timely clearing and/or relocation of obstructions that is causing delays.

This problem is aggravated because the client is giving possession of site without full removal of obstructions within the right of way, causing disruption to contractors' progress. The client also

lacks coordination with local and government authorities to facilitate relocation of obstructing utility lines such as electric and telephone poles, water supply lines etc.

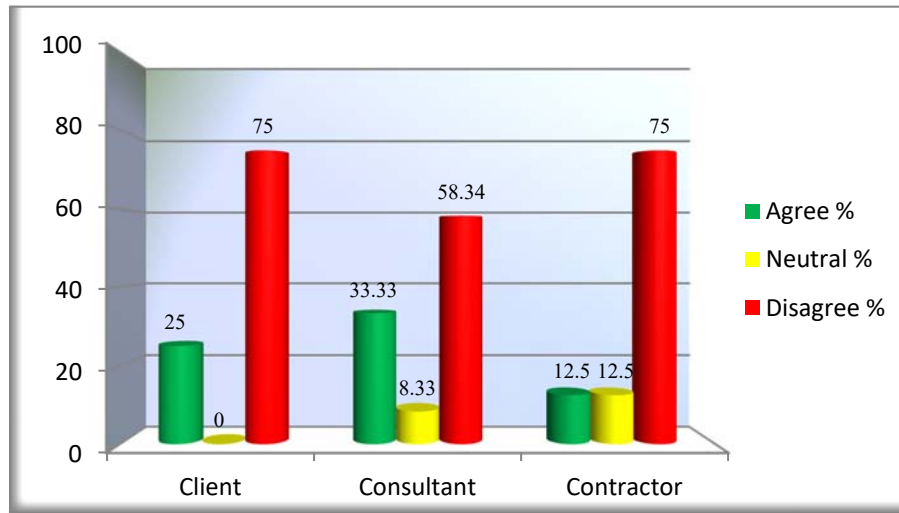


*Figure 6.3: Comparison for hypothesized question #3.*

#### *Question # 4*

*The client mostly does not propose design changes after the start of construction.*

For this hypothesis 75% of the client, 58.33% of the consultant and 75% of the contractors have expressed their disagreement. Hence, the responses indicate that the rate of the design change issued by the client after the commencement of the construction works is very high. The main reasons for proposing such changes are unclear client's objectives during the design phase due to lack of proper communication with the stakeholders, ambiguities or lack of sufficient details in designs, changes for financial reasons, etc. Mostly, the reasons are to the larger extent under the control of the client.

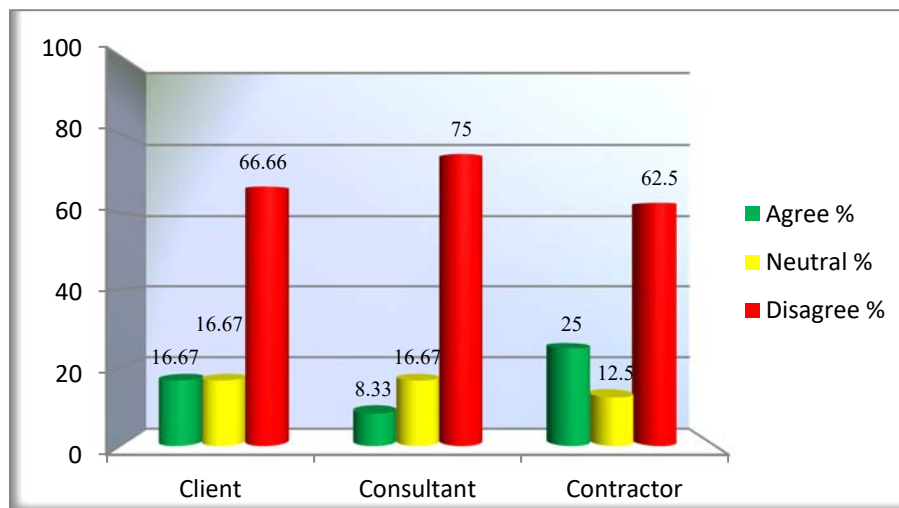


**Figure 6.4: Comparison for hypothesized question #4.**

**Question # 5**

*Performance of most contractors is good and they have the capacity to avail resources (Labor, equipment, material, finance) as required to achieve the targeted time for completion.*

The three parties have disagreed with the above hypothesis with 66.67%, 75% and 62.5%, which shows that larger portion from the contractors’ respondents acknowledged problems in performance capacity and in availing necessary resources, leading to delays in time for completion. Detailed comparison is presented in Figure 6.5 below

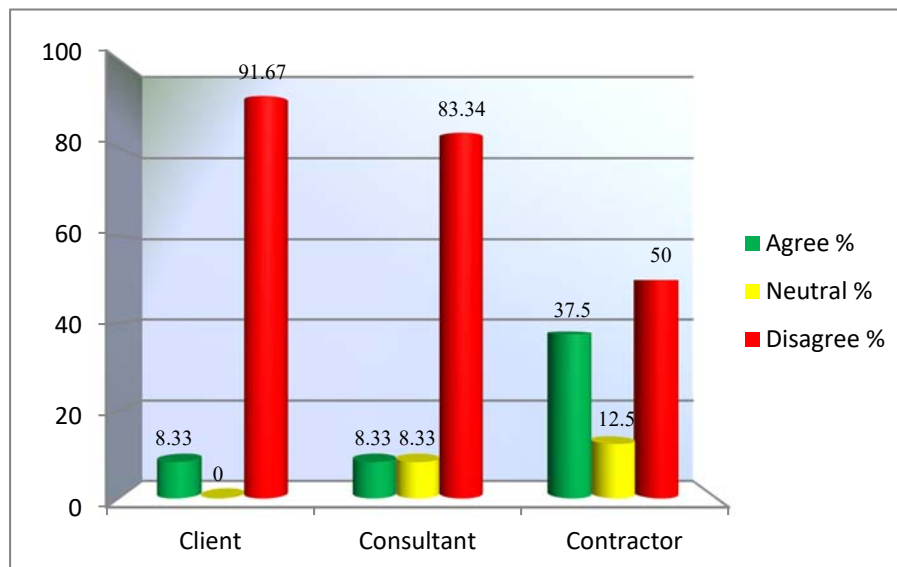


**Figure 6.5: Comparison for hypothesized question #5.**

### Question # 6

*Most contractors are good at preparation of realistic work program and monitoring of same as construction progresses.*

As shown in Figure 6.6, the responses from the client and consultants emphasize the problem on contractors' poor performance in preparation and monitoring of work program. The respondents from the client disagreed with the above hypothesis with 91.67% and consultants with 83.33%. Though the proportion seems lower, majority of respondents from contractors also disagreed with the hypothesis. This indicates the prevalence of scheduling problems in contractors' organizations, and with such drawback it is inevitable to encounter project delays.

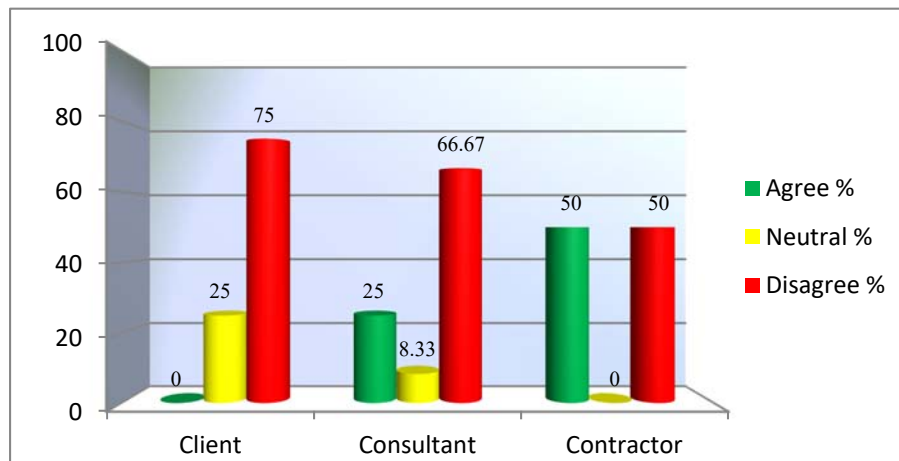


**Figure 6.6: Comparison for hypothesized question #6.**

### Question # 7

*Performance of most supervision consultants in administration of contracts is good.*

The responses given for the above hypothesis indicates that 75% and 50 % of the respondents from the client and contractors are of the opinion that consultants' performance in administration of contracts is not good. On top of that, 66.67% of the consultants' are disagreeing to the hypothesis. In general, the comparison for the hypothesis question shown in Figure 6.7 demonstrates the significance of problems of contract administration by consultants.

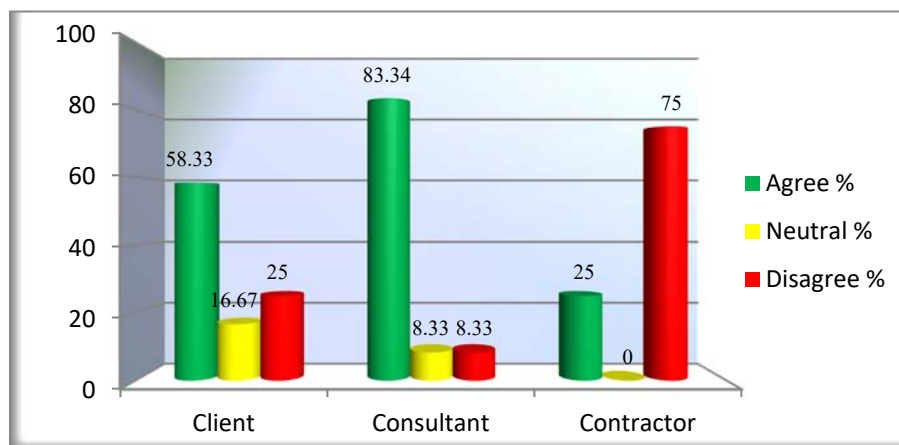


**Figure 6.7: Comparison for hypothesized question #7**

**Question # 8**

Generally client's performance in contract administration and making decisions timely is reasonable.

This hypothesis is aimed to examine the overall capacity of the client towards contracts administration and decision-making process. The perception of majority of the respondents on this hypothesis as depicted in Figure 6.8 indicates the non-existence of capacity problems; however, the result obtained on importance of delay causes, the consultant rank clients slowness in decision making number 3 which greatly contradicts with their answer given here. In addition, the 75% disagreement of the respondents from the contractor side shows the incapacity of the client which majorly affects them. In general, we can see that contractor's and client's response is not genuine.

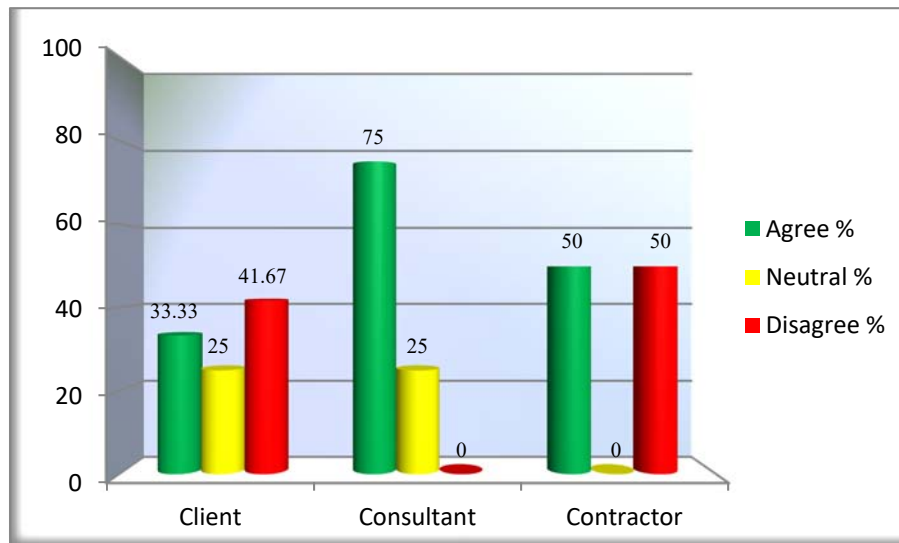


**Figure 6.8: Comparison for hypothesized question #8**

### Question # 9

*Financiers do **not** interfere with administration of contract and construction operations.*

Through this hypothesis it was intended to know the extent of interference imposed by financiers on the contract administration of the client and contractors' operations. The comparison shown in Figure 6.9 reveals that there is certain level of interference by financiers which is recognized by the three parties, though not significant as the other problems raised so far.

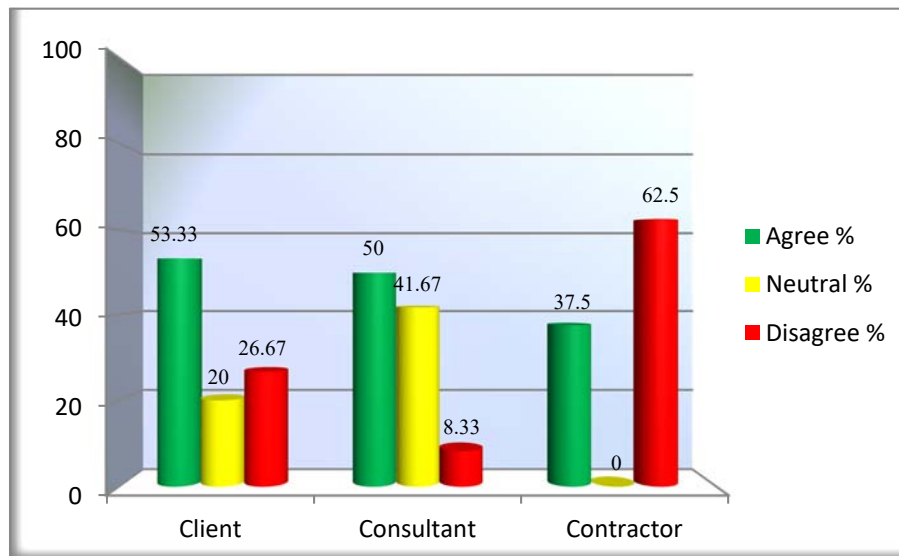


**Figure 6.9: Comparison for hypothesized question #9**

### Question # 10

*Contractor's Interim Payment Certificates are released timely.*

Through this hypothesis it was intended to know the extent of delay in effecting the contractor's payment. The comparison shown in Figure 6.10 reveals 62.5% of the contractor's confirm the prolonged time taken by the client to effect the contractor's payment. However, the respondent's from the Client and Consultant side disagrees with the delay to effect the payment.



*Figure 6.10: Comparison for hypothesized question #10*

## 6.11. Summary

In this chapter we can clearly see that the major causes for late completion of road construction projects are easily identified and are common on almost all road construction projects. However despite the fact that the causes are always the same and known, the problem has never been solved. The main responsibility lies on the client in following the performance of the contractor, supervision consultant and design consultant while performing their contractual obligation and take action when it is found necessary to do so. However, due to the fact that the client also has its problem in fulfilling its contractual duties as described on the hypothesized questions and the literature review most cases are tried to be solved administratively rather than penalizing the liable party, which in the end affect the construction project by extending the contractual time and money.

In general, based on the findings through the questionnaire and the case study the suggested remedial measures on each group of delay causes are discussed in detail on chapter eight.

## Chapter Seven

### Conclusion

Road construction projects in Ethiopia are severely suffering from over extended delays, affecting the implementation of the country's road sector development program towards improving the existing poor road network, and, properly utilizing major portion of the allocated budget for the sector.

There are many causes of delays in construction projects and several studies have pointed out various factors based on the underlying conditions that the specific study is concerned. Therefore, this research attempted to investigate the problems particularly for road construction projects in Ethiopia.

The research has been achieved by undertaking a review of literature, which was used to identify the possible variables causing delays in construction projects as a whole. Then the variables have been scrutinized in line with the road sector development program and applicable procurement regulations in the country.

Furthermore, cases on some of road projects were demonstrated to highlight the extent of the existing problem. Accordingly, it was noted that for some of the projects the additional time required was even more than the original contract period.

Ninety variables for delay have then been identified. The variables for delay have been categorized in eight major groups based on the sources of delay. These variables were then used in a questionnaire, which was designed to consist three major sections. It basically aimed to acquire data on the general background information of the respondents and their organization; degree of impact and frequency of occurrence of the identified variables/factors; and also on assessment of controlling mechanisms of time problems.

After distributing the questionnaire for professionals who have experience in road construction projects in Ethiopia, responses were collected with a response rate of more than 76%, which was well above the minimum required value for conducting the analysis. The data has been classified into three groups according to the type of respondents; i.e., client, contractor or consultant. From the data of each of the groups; severity, frequency and importance indices have been calculated. Based on the respective importance indices the variables were ranked. The agreement among the rankings has been checked using Kendall coefficient of concordance, which resulted in high values of the coefficient confirming strong agreement among the rankings. Besides, significance levels for the null hypothesis to be true were found out to be less than 0.01, confirming that the

alternative hypothesis; there is agreement among the sets of rankings by the parties is verified with more than 99% of confidence. Among the identified variables the most 25 important factors have been identified for each sets of ranks. Out of these most important delay variables, seventeen were found to be common for each set of the rankings. The result shows that the numbers of factors identified by all the groups were 34. Finally, recommendations were made to substantially minimize the impacts of these critical factors causing delays, which are discussed on the last chapter. The outcome of the analysis indicated that all of the parties are deeply involved in causing the problems, and a lot of work is expected to be done by each of the parties in order for road construction projects to be completed as per the stipulated contract period.

## Chapter Eight:

# Recommended Remedial Measures and Conclusion

### 8.1. Introduction

This chapter focuses on answering the second underlying research question: how reasons for late completion of projects could be substantially minimized in road construction projects in Ethiopia. The critical factors have already been identified in Chapter 6, and it is deemed that mitigating these factors would substantially minimize the problems of delays in road construction projects of Ethiopia. Accordingly, the recommended remedial measures have been dealt with under the respective major categories.

While analyzing the data from the questionnaire response the following steps have been followed to rank the factors and sort out the critical ones.

1. Severity, frequency and importance indices have been determined using statistical methods for three groups according to the responses from the client, consultants and contractors.
2. Variables have been ranked in the order of their importance for each group.
3. Out of the twenty-five most important delay variables, seventeen are found to be common for each set of the rankings.
4. The agreement among the rankings has been checked using Kendal coefficient of concordance, and the value for delay variables was found to be 0.829247. These higher values indicate the strength of agreement among the sets of rankings.
5. The levels of significance of the agreement among the sets of rankings for delay variables have been tested. Accordingly, the significance levels for the null hypothesis to be true were found out to be less than 0.01, confirming that the alternative hypothesis is verified with more than 99% of confidence.
6. Importance indices have also been determined for each of the eight major causes of delays by taking the average of the importance indices of the factors under each group.
7. The major groups of delay causes have also been ranked and the degree of agreement and significance level of the sets of rankings were determined.

## 8.2. Remedial measures

By following the above discussed steps, the computed Kendall coefficient of concordance was ( $W$ ) 0.989 and the significance level ( $p$ ) for the null hypothesis to be true was less than 0.01; again confirming that the alternative hypothesis is verified with more than 99% of confidence. Responses for ten hypothesized questions were also been analyzed and the comparisons made were presented with charts. The assessment was conducted to examine the general level of performances of the client, consultants and contractors in the design and construction processes. It was observed that the critical problems that require closer attention are client's problems related to incomplete design and clearance of obstructions; and contractors' problems related to capacity of availing the necessary resources for a project and preparation and monitoring of realistic work programs. The responses for these questions offer a broader view for recommending solutions for the critical problems.

### 8.2.1. Client related causes of delays

This major category includes the first twenty causes. Both the Contractor and Engineer ranked four of the variables in the most 25 delay causes. These are: *Type of project bidding and award (selection based on least evaluated bidder)*, *Poor Assessment of original contract duration*, *Delay in effecting payments by the owner*, *Delay in site possession by the owner*, *Delay in settlement of Right of way issues by the owner*. To mitigate this problem the client shall give special attention on the following issues.

- Selection of contractors based on the least evaluated bidder basically focuses on financial offer of the bidders. Also performances are examined based on documents submitted by bidders. Such method mostly does not give clear picture of performance of the bidders at the time of bidding. As capacity of contractors is highly dependent on the number of projects at hand, selection based on the least evaluated bidder shall be made in conjunction with performance evaluation of bidders. Currently, the client is using performance of bidders on projects at hand. However, due to lack of proper documentation and communication gap within the Clients organization, the information obtained on the performance of Contractor's could be misleading. Hence, in order to mitigate this problem and obtain correct information the Client should set follow up mechanisms which will be made from commencement of projects and can easily be accessed.
- Identification and removal of obstructions within the right of way shall be part and parcel of the design phase to avoid any sort of obstruction after the start of construction.

- The client should take responsibility for campsite and material site identification and clearance of any obstruction on such sites before the start of construction; instead of leaving the responsibility of selection of these sites to the contractor after the commencement of the construction works.
- The client shall establish coordination with other government authorities involved directly or indirectly in the process of removal of obstructions.

Poor assessment of original contract duration is basically a problem of lack of proper follow up of the Client on the design Engineer's studies and lack of strong actions taken on their default. All most all design documents submitted by design consultant's takes 36 months of contract period by default without detail investigation on the nature of the work and availability resources. This could be obtained by giving sufficient period for design projects and setting proper penalization for defaults during design phase.

Delay in effecting payments by the owner mainly depends on shortage of allocated budget for the work within the fiscal year and also, unbudgeted cost of other projects administered by the same client due to Variation Orders and Quantity increments which will utilize other projects budget. In order to solve this problem properly planned budget request has to be provided by the client. Moreover, the Client's decision on approving Variation Orders should mainly be based on the allocated budget the specific project has for the fiscal year.

### **8.2.2. Contractor related causes of delays**

This major category includes causes 21-42. Out of the 22 variables 7 are identified in the most 25 delay causes of all the three sets of rankings. These are *Poor Management of finance by the contractor, Poor site management and supervision by the contractor, Ineffective planning and scheduling of work by the contractor, Weakness in following the planned work schedule by the contractor, Delay in site mobilization, Lack of field survey by the contractor before commencement of the work, Ineffective contractors head office involvement in the project.*

To substantially reduce the occurrences of the aforementioned factors in projects it is recommended that:

- The client shall improve the method of evaluation of bids to guarantee selection of well performing contractors with sound financial capacity and human resource.
- The client needs to limit the number of projects to be awarded to a contractor to avoid cash flow problems during construction.

- In pre-qualification stage, contractors' ability to avail the minimum requirement for provision of resources shall be considered as major criteria.
- During the course of construction, contractor's deployment of resources shall be periodically reviewed in line with the approved work program.
- Contractors should assign experienced personnel dedicated to preparation plan and schedule of the works and subsequent revision of work program.
- Contractor's use of appropriate planning techniques shall be assessed during the bid evaluation process.
- Contractor's quality assurance manual shall be reviewed before the award of contract and during construction there has to be close follow-up by the consultant/engineer towards its implementation.
- The client shall ensure that contractors' are utilizing advance payment for the intended purpose and mobilization of resource is properly done within the programmed period.
- The client shall allow longer bidding period in order for contractor's get sufficient time for detailed technical study. This will help contractors to estimate their bid and devise their work program with a better certainty.
- The Client has to properly monitor the Contractor's head office direct involvement on the project works without jeopardizing the decision making process.

### 8.2.3. Supervision Consultant related causes of delays

This major category includes causes 43-51. Out of the 9 variables 2 are identified in the most 25 delay causes by the client and Consultant. These are *Poor qualification of consultant / engineer's staff assigned to the project and Delay in the approval of contractor's submissions by the engineer*. The identified critical factor is highly dependent on quality and performances of consulting firms assigned for a project. To mitigate such problem the following points are recommended.

- The client shall improve the method of evaluation of proposals to allow participation of potentially good consultants.
- The client should introduce a system of evaluating the performance of consulting firms and individuals for possible award of other project and approval of Curriculum Vita without any provisional acceptance or blacklisting.

#### 8.2.4. Design related causes of delays

This major category includes causes 52-59. Out of the 8 variables 3 are identified in the most 25 delay causes of all the three sets of rankings. These are *Poor Assessment of original contract duration, Lack of communication of the design engineer with local administration (Assessment of their requirement and inadequate investigations by the designer during the design phase.* The design related problems as can be seen here and in the case studies in chapter four are occurring in almost all of the projects and require special attention by the client. The following points will help to alleviate the problem.

- The client need to institute a mechanism whereby design consultants are held accountable and penalizing even during construction stage and blacklisting poor performing design consultants,
- As the current design period is too short to conduct detailed investigation and produce complete and sound design, allowing more time for the design phase would assist in reducing the problems related to design,
- It is also crucial for the client to improve its selection process for design consultants by increasing the requested requirements to guarantee assignment of qualified consultants,
- The client needs to have qualified and well experienced personnel and conduct detailed review of documents produced by design consultants, rather than assigning inexperienced Engineers on design projects.
- Appointing same supervision and design consultant on a specific project, so that the discrepancies seen during construction stage can easily be mitigated.

#### 8.2.5. Material related causes of delays

This major category includes causes 60-64. Out of the 5 variables 4 are identified in the most 25 delay causes by all the parties. These are *Change in material prices, Shortage of construction materials required, delay in material delivery and late procurement of materials by the contractor.* In all of the projects there is a provision for price adjustment for compensating the change in material prices. However, contractors are still suffering from cash flow problem due to considerable change in prices, especially on imported materials. Generally, contractors shall exercise risk analysis for the possible uncertainties before submitting their bids. The following measures are also recommended.

- During design phase detailed investigation of construction materials shall be conducted with reliable estimation of quantities and reasonable cost.

- Contractor's has to have proper material consumption schedule and accordingly has to order and deliver material on site before the need arises.
- The site supervision team shall also follow up status of material procurement starting from the day of ordering until time of delivery in line with the work program of the contractor.

### **8.2.6. Equipment related causes of delays**

This major category includes causes 65-68. Out of the 4 variables 3 of them are identified in the most 25 delay causes by all the three sets of rankings. These are *Equipment breakdowns, Shortage of equipment required and Low productivity and efficiency of equipment*. In this regard, during bidding stage, in addition to checking the ability of the Contractor to avail the minimum requirements of major equipment, contractors' ability of acquiring sufficient stock of spare parts and/or access to replace equipment in cases of breakdown of major equipment shall be assessed.

Moreover, during construction phase the supervision team shall assess the average productivity of contractors' major equipment in line with the approved work program and take action on low efficiency equipment.

### **8.2.7. Labor related causes of delays**

This major category includes causes 69-76. One of the variables is identified in the most 25 delay causes by the Consultant. This is *Poor qualification of the contractor's technical staff assigned to the project*. With respect of quality of contractors' personnel assigned to a project, the client need to assess both qualifications and number of technical professionals during bidding stage and same has to be carefully monitored during construction. Any proposal for replacement of these personnel shall also consider better or equivalent qualifications. Moreover, depending on the project location bidders are required to assess the availability of manpower within the locality.

### **8.2.8. External causes of delays**

This major category includes causes 77-90. Out of the 14 variables 3 of them are identified in the most 25 delay causes by all the Client and Contractor. These are *severe weather conditions on the work site, government tendering system requirement of selecting the lowest bidder and bureaucracy of local administrative offices to settle right of way issues*.

External delay causes are those, which are beyond the control of none of the parties but still the impacts on project will affect at least one of the parties. Hence, it is the responsibility of the client to clearly indicate the risk allocation through the contract documents. In addition, both

parties shall execute risk assessment and need to prepare themselves to manage same depending on the allocation of risks stipulated in the contract.

### **8.3. Conclusion**

The main objective of this thesis was to identify causes which leads to untimely completion of road projects, and about 90 causes of delay categorized in eight groups were identified, questionnaire based on the identified variables was distributed and responses were analyzed, selected case studies were studied and finally remedial measures for all cause of late completion of road projects under the Eight groups were suggested.

From the overall suggested remedial measure the most important recommendations given on the major categories of delay which are Contractor related, Client related and External causes are listed here under;

- Bid evaluation method has to be improved and guarantee selection of best performing Contractor and Consultant (for both design and supervision).
- Banning contractors to involve in other bids who have more than two projects at hand with less than 70% progress.
- During the course of construction, contractor's deployment of resources shall be periodically reviewed in line with the approved work program and action has to be taken on noncompliance.
- Contractors should assign experienced personnel dedicated to preparation plan and schedule of the works and subsequent revision of work program.
- Contractor's use of appropriate planning techniques shall be assessed during the bid evaluation process.
- Contractor's quality assurance manual shall be reviewed before the award of contract and during construction there has to be close follow-up by the consultant/engineer towards its implementation.
- The client shall ensure that contractors' are utilizing advance payment for the intended purpose and mobilization of resource is properly done within the programmed period.
- The client shall allow longer bidding period in order for contractor's get sufficient time for detailed technical study.

- 
- The Client has to properly monitor the Contractor's head office direct involvement on the project works without jeopardizing the decision making process.
  - Identification and removal of obstructions within the right of way shall be part and parcel of the design phase to avoid any sort of obstruction after the start of construction.
  - Contract duration has to be properly assessed during design stage.
  - The Client has to effect payment on time.

### *Recommendation for further studies*

Further studies can be conducted on how to implement the recommended remedial measures by each of the parties. Moreover, similar study could be carried out on the contributions of these variables to claims and disputes between the client and contractors.

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# **Appendix A**

## **Questionnaire**

## Appendix B

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## Appendix D

Table D1 - Computation of Kendall Coefficient of Concordance ( $w$ ) and Level of Significance ( $P$ )

Table D2 - Computation of Kendall Coefficient of Concordance ( $w$ ) and Level of Significance ( $P$ ) for the eight major groups

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## Abstract

Road is the biggest infrastructure of any country be it developed or developing, due to the fact that it requires huge investment for its construction and that the end result serves a great deal and eases human day to day life. With the advent of the liberalization of the economy and availability of funds from international financiers, there has been a surge of large-scale civil engineering construction in the Ethiopian construction industry. This is particularly evident in the road sector, where the Ethiopian government, has been investing a substantial amount of money with the assistance of International financiers like the World Bank and so on. Nevertheless, the construction sector is suffering greatly because of the many difficult encounters; among this late completion of road projects is one and being the major cause of additional cost, as per the current data more than 20% of road construction projects have extended time period than the originally anticipated completion date. Whether in local or International contract projects, the issue of delay remains the same.

In this regard therefore, the objectives of this thesis are to investigate the causes of these late completions of road projects and to propose a possible remedy as to the handling of similar incidents in the future. Similar studies have been previously conducted different recommendations has been given. However, because the problem still exists and is harming the sector, it is still necessary to look through the previous studies and recommendations and conduct further studies based on recent information.

In view of the above, Ninety variables for delay were identified through review of literature and personal experience. Towards identification of critical factors and possible solutions, questionnaire had been distributed to professionals who have experience in road construction projects in Ethiopia. The variables are then ranked in their order of importance in three sets based on the responses from the client, consultants and contractors.

Moreover, case studies of ten road projects under the Federal Government which can be taken as an example for delayed projects has also been studied in order to investigate their major reason for the extension of their contract period. And these causes are correlated with the findings of the questionnaire and finally remedial measures have been given.

As a result, from the case studies and collected questionnaire it can be concluded that there is strong agreement in ranking of variables. From each set of the three rankings the top twenty-five are selected to be critical ones. Hence, for these critical factors possible solutions have also been recommended.

## **Key Words**

Contract Duration, Delay Variables and Claim, Late Completion (delay) and Road.