
**ADDIS ABABA UNIVERSITY**

**SCHOOL OF GRADUATE STUDIES**

**ADDIS ABABA INSTITUTE OF TECHNOLOGY**

**SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING**

**(CONSTRUCTION TECHNOLOGY AND MANAGEMENT)**

# Cause and Effects of Delay on Educational Building Projects in Addis Ababa University

## Case Study

**By**

**Shewaferahu Tilahun**

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**Addis Ababa**

**Ethiopia**

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**By**

**Shewaferahu Tilahun**

**Approved by Board of Examiners:**

| | | | |
|---|---|---|---|
| 1. | Prof. Abebe Dinku (Dr.-Ing.)<br>Advisor | _____<br>Signature | _____<br>Date |
| 2. | Eng. Yibeltal Zewdu<br>Eternal Examiner | _____<br>Signature | _____<br>Date |
| 3. | _____<br>Chairman | _____<br>Signature | _____<br>Date |

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# Abbreviations

| | |
|---|---|
| **AAU** | Addis Ababa University |
| **ETB** | Ethiopian Birr |
| **IES** | Institute of Ethiopian Studies |
| **RII** | Relative Importance Index |
| **PERT** | Project Evaluation and Review Technique |
| **CPM** | Critical Path method |
| **HEB** | Higher Educational Building |
| **CDSCo** | Construction Design Share Company |
| **CD** | Calendar days |
| **LCB** | Library Complex Building |
| **LFLB** | Law Faculty Library Building |

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# ABSTRACT

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

However it is becoming more complex because of the sophistication of the construction process itself and the large number of parties involved in the construction process, i.e., clients, contractors, consultants, users, designers, subcontractors, regulators, and suppliers.

This eventually leads to delay in the completion of the project. Construction delay defined as "time over run either beyond completion date specified in a contract or beyond the date that parties agree upon for delivery of a project." It is slipping over its planned schedule and is considered as common problem in construction projects.

Delay in construction project completion is a global phenomenon that occurs in the construction industry and considered as one of the most common problems causing a multitude of negative effects on the project and its participating parties especially where the government projects are concerned and in the construction industry of Ethiopia is no exception.

The objective of this study is to identify the major causes and factors of construction delays, their effects on the successful completion of projects, and provide suggestions to minimize delays in the construction of Educational Building projects under Addis Ababa University.

This study uses a comprehensive literature review to design and conduct a survey to investigate delay causes and then filtered based on appropriateness to the Ethiopian Construction Industry as well as the Educational Building Projects at Addis Ababa University. A specific survey was conducted thru case study for selected projects to examine the most critical delay factors and their effects. A general survey was distributed thru questionnaire to examine the correlation of the most critical factors of delay and its relative effect on the project with respect to time, cost and quality. Data was collected and analyzed using the 'Relative Importance Index (RII)' whereby the score with the highest RII is one that mostly influences the delay.

**Key words:** *Educational building construction projects, Construction Delays, Causes of Delay, Effects of delay, Addis Ababa University*

# 1. INTRODUCTION

## 1.1. Background

Higher educational institutions are function to develop human resources that are able to adapt and compete in a society. The idea of the knowledge society is increasingly becoming widespread in the move towards globalization.

Modern construction projects are characterized by new standards, advanced technologies, multiparty participation, and frequent owner-desired changes. Coupled with this inherent uncertainties and complexities in the physical, financial, and economic environment in which most projects are performed. Such conditions have made completing projects on schedule and on budget a difficult task to accomplish, often leading to claims on cost compensations and/or time extensions. This eventually leads to delay in the completion of the project.

Delay is defined as the time over run either beyond completion date specified in a contract or beyond the date that the parties agree upon for delivery of a project. Delay in construction project is considered one of the most common problems causing a multitude negative effect on the project and its participating parties. Therefore, it is essential to identify the actual causes of delay in order to minimize and avoid the delays and their corresponding effects.

Delays in construction can cause a number of changes in a project such as late completion, lost productivity, acceleration, increased costs, and contract termination. A delay in an activity may not result in the same amount of project delay. A delay caused by a party may or may not affect the project completion date and may or may not cause damage to another party. A delay may occur concurrently with other delays and all of them may impact the project completion date.

Delays caused by the client such as failure to allocate sufficient fund, slow decision making coupled with delay caused by consultant such as late submission of drawings and specifications, frequent change orders, and inadequate site information generates claims from both the main contractors and subcontractors which many times entail lengthy court proceedings with huge impacts. Delays caused by contractors generally attributes to poor managerial skills, lack of effective planning and poor financial management have led to a contractor's downfall.

The effect of delay may include time overrun, cost overrun, disputes, litigation and total abandonment (Murali and Yau, 2006). Some studies directly examine delays, attempt to identify their causes and recommend ways to avoid them. Construction project delays have a weakening effect on parties (Owner, Contractor, and Consultant) to a contract in terms of a growth in

adversarial relationships, distrust, litigation, arbitration, cash-flow problems, and a general feeling of apprehension towards each other (Assaf and Al-hejji, 2002).

This thesis examines causes and effects of delay in an integrated manner and determine how critical delay causes are most influential in project performance. This will provide owners, Consultants and construction organizations involved in construction projects with the foundation on which such strategies – on how to avoid delays - can be developed in the future. This thesis focuses on Educational Building Construction Projects in Addis Ababa University, which were assessed for delay causes and examines the corresponding effects identified and provide recommendation based on the findings to improve project performance within the higher education building projects as well as the general public construction projects.

## 1.2. PROBLEM STATEMENT

Delays in a construction project is counted as a common problem and became a cause for projects completion with huge cost overrun (requiring higher budget than estimated), extended completion time, inferior quality deliverables and contract termination. In recent time it was an accepted phenomena to have delays in construction projects completion time. For the client, construction delay is a loss of revenue, lack of productivity, dependency on existing facilities, etc. For the contractor, construction delay is the higher costs, longer work duration, increased labor cost, higher material and equipment costs etc. Completion of construction projects on specified time or time agreed by the parties indicates their efficiency. The delays in construction projects happen because of various factors or causes. These causes lead to the delay in construction completion, and this delay ultimately leads to negative effects on the construction project.

In Ethiopian construction practice, it is very rare that construction projects are completed on the time specified or agreed upon. There are many educational building construction projects in Addis Ababa University, which suffered delay or in some cases suffered suspension or abandonment.

## 1.3. RESEARCH QUESTIONS

On the basis of the above stated facts, the following would be the research questions.

1. What are the real causes of project delays in the Addis Ababa University Educational Building Construction Projects?
2. How do construction project delay related to the project's successful completion?
3. What is the stakeholders' response for the effect of construction delays over successful completion?
4. How does construction delays influence projects' performance criteria and successful completion?

## 1.4. RESEARCH OBJECTIVES

### 1.4.1. General objectives

The general objective of this study is to assess the major causes of delays on building projects in the Ethiopian Construction Industry and its influence on the successful completion of the project. The primary objective is to identify the principal factors responsible for delays in the Addis Ababa University Educational Building Projects, their effect on the progress; as well as timely delivery.

### 1.4.2. Specific Objectives

1. To explore construction project delays related to project successful completion.
2. To identify the delay factors that currently exist in the construction of educational building projects by exposing the most common and fundamental problems affecting project delivery performance.
3. To briefly survey the construction project delays and their potential causes from different stakeholder's perspective.
4. To identify the success factors which are most influential in avoiding or preventing delay factors.

## 1.5. SCOPE OF THE STUDY

The scope of this research is limited to the construction of Educational Building Projects in Addis Ababa University. The data for this study has been gathered through detailed literature review, questionnaire survey, interview with key professionals and case studies.

## 1.6. RESEARCH METHODOLOGY

The methodology adopted for this research comprises three stages as follows:

**Stage 1.** Literature Review to determine the research focus. Local and International studies conducted particularly on related works and construction delays in general were reviewed.

**Stage 2.** Questionnaire Survey, this stage consists of two activities

**Activity 1.** General survey of stakeholders (Owners, Contractors, Consultants and Subcontractors) to examine the cause and effects of construction delays in the Ethiopian building construction projects.

**Activity 2.** Specific survey of stakeholders and participant professionals in the construction of higher educational building projects (Owners, Contractors, Consultants and Subcontractors) to identify the delay factors and their effect on the projects.

**Stage 3.** Case Study: a minimum of four sample projects of educational buildings in Addis Ababa University were analyzed. Projects were selected based on critical cases among completed and those under construction.

## 1.7. OUTLINE OF THE RESEARCH

This thesis format follows the logical steps of establishing the research questions, developing the methodology, gathering and analyzing data, and drawing conclusions. The Thesis is organized into six chapters as follows:

**Chapter 1** discusses the introduction of the research by highlighting the research problems, research purpose, research objectives, proposed methodology and research organization.

**Chapter 2** Presents a literature review in-depth understanding of definitions. It examines literatures, studies and journals about delay factors in the construction projects. Effects of construction delays on project delivery performance and prime measures of success i.e. time, cost and quality. The literature and studies on classification and causes of delays at different stages of project life cycle and allocation of responsibilities among parties in contract.

**Chapter 3** describes the data collection method, analysis techniques and statistics used to identify causes of delay on educational building projects in Addis Ababa. It also explains the analysis used to determine the correlation between critical delay causes and its effect on project delivery performance measures.

**Chapter 4** presents the findings and discussion based on the results obtained from questionnaire responses.

**Chapter 5** presents the case study selected from completed and ongoing building projects in Addis Ababa University which is believed to be significant to the study.

**Chapter 6** is the conclusion and recommendation chapter and discusses the research conclusions, limitations of the research, contribution to new knowledge, and provides recommendations based on the findings.

# 2. LITERATURE REVIEW

## 2.1 General

Increasing uncertainties in technology, budget and construction processes make the construction industry dynamic. Building projects are now much more complex and difficult and hence the building project team faces unprecedented challenges. The study on causes of construction delay and its effects on the project performance is a means of understanding and thus improving the effectiveness of construction projects.

The timely completion of a construction project is seen as a major criterion of project success by clients (Bowen, Hall, Edwards, Pearl & Cattell, 2002). The inability of a project to be completed in accordance with the proposed time schedule maybe as a result of delay. Stumpf (2000) viewed delay as an incident that extends the time required to perform the tasks under a contract. It usually shows up as additional days of work or as a delayed start of an activity (Sweis, Hammad & Shboul, 2008).

Delays in construction can cause a number of changes in a project such as late completion, lost productivity, acceleration, increased costs, and contract termination. The party experiencing damages and the parties responsible for them in order to recover time and cost. However, in general delay situations are complex in nature. A delay in an activity may not result in the same amount of project delay. A delay caused by a party may or may not affect the project completion date and may or may not cause damage to another party. A delay may occur concurrently with other delays and all of them may impact the project completion date.

One of the objectives of this research is to understand critical causes and effects of delays on the Addis Ababa University Building Construction Projects. This chapter defines and describes factors and causes of delay to construction projects as identified in the literature.

## 2.2 Construction Project Planning

Construction project planning and scheduling are often used interchangeably. According to (Trauner, 2009) project scheduling is a written or graphical representation of the Contractor's plan for completing a construction project that emphasizes the elements of time and sequence.

However, construction planning is a fundamental and challenging activity in the management and execution of construction projects. Construction planning involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any inter-relationship among the different work tasks (Chris 1998**)**. Construction project planning is a method of determining "What" is going to be done, "How" things are going to be done, "Who" will be doing activities and "How Much" activities will cost. In this sense planning does not cover scheduling, which addresses the "When" to do, but once planning is completed scheduling can be done (Fig. 2.1). A good project planning is a basis for developing a well-organized project schedule.

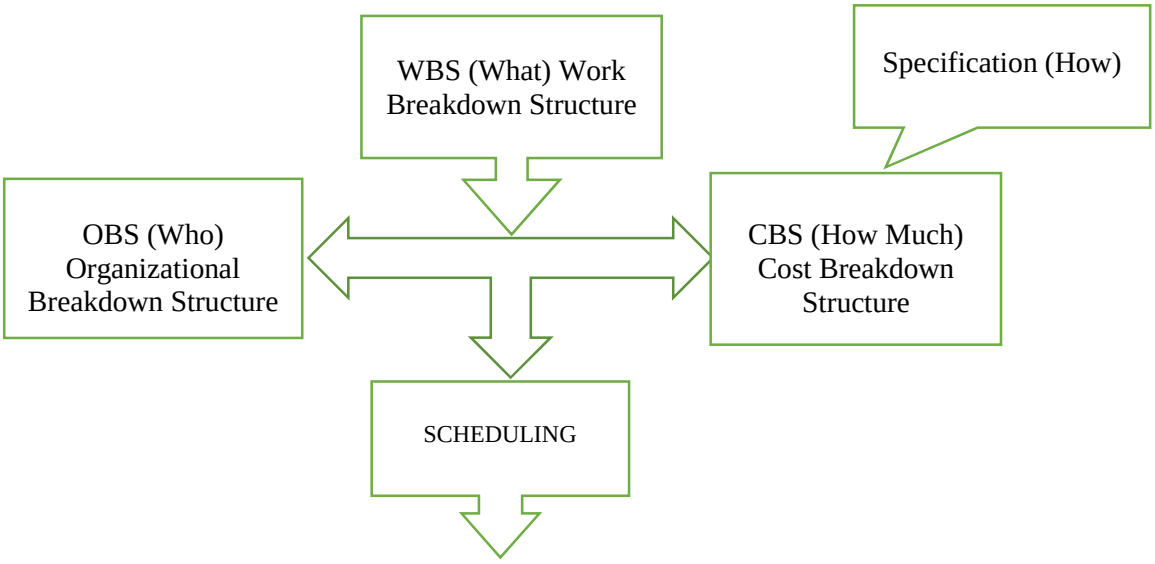


**Fig. 2.1 General Framework for the Planning Process (A. De Marco, 2011)**

The effective planning, scheduling and control of construction projects is necessary. The benefits of implementing and maintaining this set of three management systems are reduces delay, cost overrun and minimize disputes (Callahan et al. **1992**). These benefits accrue to the Contractor, Owner, suppliers and workers in the form of improvements in productivity, quality and resource utilization.

The objective of construction planning is to identify discrete activities or tasks that can be planned, estimated, scheduled, executed and controlled to ensure successful completion of construction projects. In addition, an effective planning must address the following questions like what is to be done, what are the activities, how it is to be done, when it is to be done, where it is to be done, what is needed to do it, who is to do it and how to ensure that it is done (Chitkrara **,2001**).

### 2.2.1. Stages of Planning

For efficient implementation of project activities, planning is essential at various stages.

Planning for construction may be done in the following two stages:

- Pre-Contract Stage
- Contract Stage

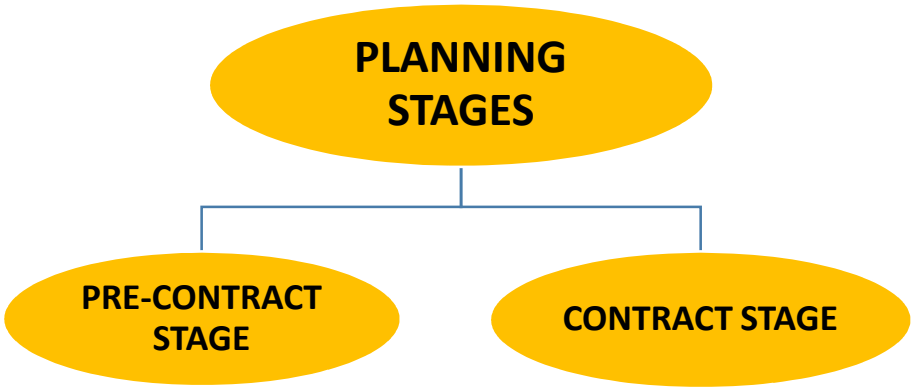


Figure 2.2: Classification of planning stages (Dhir et al., 1992)

#### 2.2.1.1. Pre-contract stage

It is the stage in which a Contractor has the best opportunity of planning the most likely method of construction for the future contract, establish strategies and prepare a realistic program for carrying out the work. At this stage the Contractor is enable to make a proper bid and preparation for completing the work in a stipulated time.

Pre-contract planning includes the following steps: - (Dhir et al., **1992**)

- Examining drawings and specifications to identify various items of work, its completeness and constructability
- Carrying out site investigation and market survey to assess the availability and rates of materials, manpower, machinery and other facilities
- Identifying alternative methods of executing the work for selecting the most suitable and economical method
- Checking the quantities of different items of work and estimating the time required for the completion of the different items of work
- Preparing a tentative construction work schedule with reference to the stipulated time of completion

- Deciding the overheads, and margin of profit and finalizing the tender price for completing the work within the stipulated time

#### 2.2.1.2. Contract stage

The contract stage is also called construction stage. This stage commences with the acceptance of the tender and extends till contract close out. After the pre-contract stage, the Contractor has to undertake detailed planning to organize activities of construction works and the required resources to accomplish the project with in the scheduled time.

In most cases, inadequate planning at this stage is noticed to result in delays leading to heavier expenditure than originally estimated.

Contract stage planning includes the following steps: - (Dhir et al., **1992**)

- Establishing a good communication system among the contractual parties for the smooth running of project work
- Evaluating and elaborate alternative construction methods identified during the pre-construction stage in order to select the most efficient and economical method
- Studying inter-relationships of various items of work and finalize proper sequential arrangement for operation
- Calculating the requirement of construction materials, time required to deliver and method of procurement
- Determining the requirement of plant and machinery including repair and maintenance facilities
- Preparing details of manpower requirement including managerial and technical staff for various stages of the work, skilled and non-skilled labor

## 2.3 Project Scheduling

Scheduling is the process of developing the work plan to a time frame, set date-wise in a logical sequence: it is a time table for action indicating the start and completion of each activity. Sidney **(2002)** defines scheduling as a tool that provides participants in the project with an orderly, time related sequence of events to follow in order to effect timely completion of the project.

### 2.2.1. Scheduling Techniques

The complex characteristics of construction projects have emphasized the need for improved scheduling techniques. Basically there are two types of project scheduling techniques which are used to plan, schedule and control construction projects.

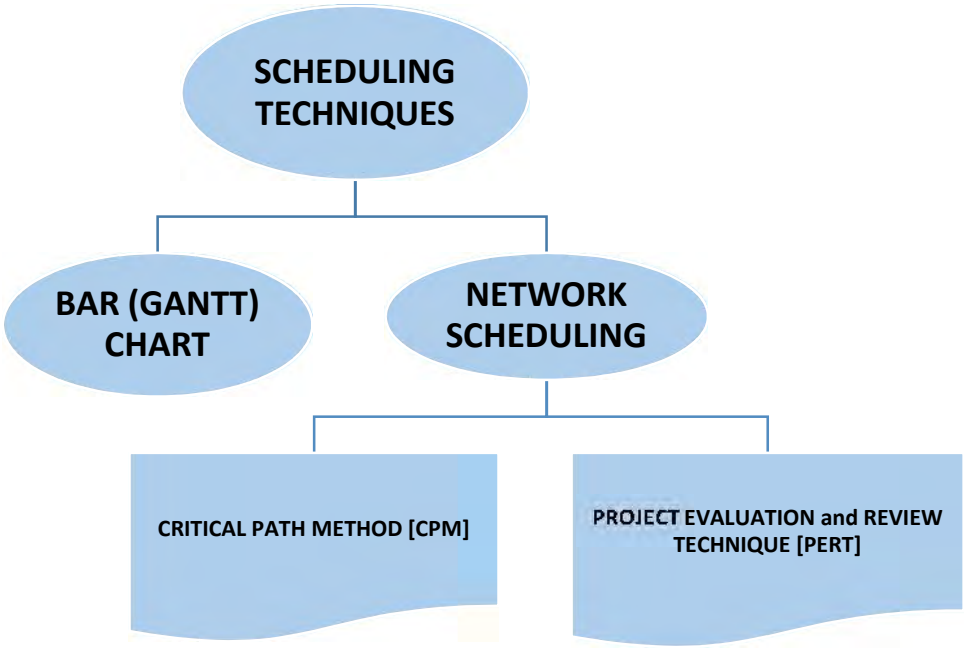


Figure 2.3: Classification of scheduling techniques (K. K. Chitkara, 2003)

#### 2.2.1.1. Bar (Gantt) Chart

Ahcom **(2004)** in his study presented that a Gantt charts are a project planning tool that can be used to represent the timing of tasks required to complete a project. It is a time-phased graphic display of activity durations. Activities are listed with other tabular information on the left side with time intervals over the bars. Activity durations are shown in the form of horizontal bars. Gantt charts are helpful for planning and guiding projects. They are most appropriate for small to medium -sized projects. Bar chart provides little information about the interrelationship of the voluminous interdependent tasks. These charts carry the risk of schedule slippages, time overrun, improper decision and contractual complications.

#### 2.2.1.2. Network scheduling

The advancement in technology and the speed of execution of modern projects, have made the traditional bar chart planning approach outdated and inadequate to cope with the complexity of modern construction. The Network Analysis Technique developed in the 1960's have now come

to be used as an effective management tool for planning, scheduling and controlling complex projects. The most common network analysis techniques used for planning, scheduling and controlling of projects are Critical Path Method (CPM) and Project Evaluation & Review Technique (PERT). Their common features are that they make use of the network model for depicting the time plan of the project: apply the critical path concept for determining the project duration and identifying critical activities and employ network analysis technique for controlling the project -time objectives [8]. When using network techniques, the interrelationship of all operations is clearly shown. The normal bar chart does not do this, and consequently requires the dependence of one operation on another to be remembered by the planner; this is extremely difficult with large projects, and in addition the technical staff assigned to carry out the work has to be informed how dependent one operation is on another. When a delay occurs, and networks are being used, critical operations will stand out as requiring particular attention [10]

#### 2.2.1.2.1. Critical Path Method (CPM)

The most widely used scheduling technique is the CPM often referred to as critical path scheduling. Frederic et al. **(2003)** states that a CPM schedule may record the actual daily activities at the site. They indicated the schedule often is placed on the wall of the job site trailer, where it is clearly visible to all the trades' people. Not only does the schedule record issues for the day, but it can help the manager anticipate future problems.

The critical path method (CPM) format is used to develop an as-built schedule. Delaying events are depicted as activities are linked to specific work activities. The critical path(s) are identified twice, firstly in the as-planned schedule and secondly at the end of the project. The difference between the as-planned completion date and the adjusted as-built completion date is the amount of time for which the claimant would request compensation. (Aibinu, **2001**)

Robert et al. **(2007)** have indicated that in the context of construction claims, an extension of time or additional compensation is justified for a delay only if it impacts the critical path or the actual end date of the project.

#### 2.2.1.2.2. Project Evaluation and Review Technique (PERT)

The Project Evaluation and Review Technique (PERT) is employed for planning, scheduling and controlling the projects involved uncertainties.

PERT is an event-oriented technique. Its basis is a network of events in which the activities are derived by connecting the events. It lays stress on measuring the uncertainty in activity times by

using three-time duration estimation method: Optimistic, most likely, and pessimistic. For computation of critical path, the PERT three-time probabilistic network is converted into a single-time deterministic CPM model. These estimates then are used to calculate the expected time for an activity.

Benjamin **(1976)** has identified some of the following advantages of PERT scheduling technique:

- PERT essentially forces the detailed definition of tasks, task sequences, and task interrelationships.
- PERT enables management and engineering to predict with some degree of certainty the probable time that it will take to achieve an objective.
- PERT enables the rapid assessment of progress and the detection of problems and delays.

## 2.4 Definition of Delay

Definition of delay stated by various scholars in different ways. Delays are defined as events or occurrences that affect the time required to complete a particular task. Assaf and Al-Hejji (2006) defined construction delay as the time over run either beyond completion date specified in a contract or beyond the date that parties agree upon for delivery of a project [1] It is slipping over its planned schedule and is considered as common problem in construction projects. Delay was also defined as an "act event which extends required time to perform or complete works of the contract manifests itself as additional days of work" by Zack (2003).

## 2.5 Classification of Delays

The type of delay has an impact on critical activities which need a more detailed analysis to determine whether additional time extension is warranted or not. Excusable delays can be further classified into excusable with compensation and excusable without compensation. Terry Williams (2003) revealed that there are four basic ways to classify delays: Excusable or non-excusable delay, Concurrent or non-concurrent delay, and Compensable or non-compensable delay. The types of delays mentioned above have internal or external sources on project process. Internal causes of delay include causes that come from the owner, designers, contractors, and consultants. External causes of delays are originated from outside of construction projects such as utility companies, government, subcontractors, suppliers, labor unions, nature, etc.

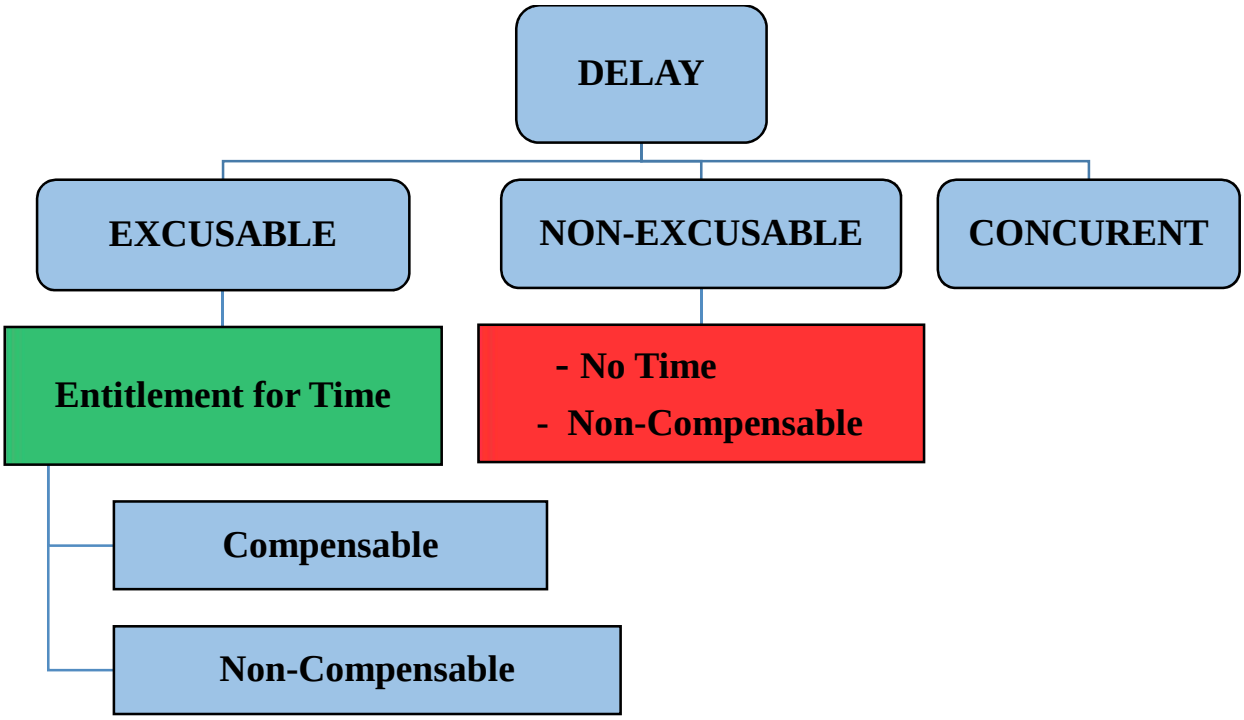


**Figure 2.4: Classification of Delays (Harry Kent, 1995)**

### 2.5.1. Excusable Delays

An excusable delay is a delay that is due to an unforeseeable event beyond the contractor's or the subcontractor's control. If the delay is considered compensable, then the contractor is entitled to additional financial compensation as well as extra project time. Under certain circumstances where non-compensated excusable delays occur, the contractor receives extra time but not compensation money for the additional completed work.

Excusable delays are known as "force majeure" delays, and commonly called "acts of God" because they are not the responsibility or fault of any particular party. Most contracts allow for the contractor to obtain an extension of time for excusable delays, but not additional money (Alaghbari et al 2007).

Delays resulting from the following events would be considered as excusable:

i. General labor strikes
ii. Fire
iii. Floods
iv. Acts of God
v. Owner-directed changes and extra works
vi. Differing site conditions

vii. Late possession of site
viii. Delayed advance or progressive payment
ix. Unusually severe weather
x. Intervention by outside agencies
xi. Lack of action by government bodies, such as building inspection

### 2.5.2. Excusable Compensable Delay

This type of delay is usually known as Owner-caused delay. If the delay is compensable, then the Contractor is entitled not only to an extension of time but also to adjustment for any increase in costs caused by the delay.

Molner **(2007)** discusses - here, the Owner is responsible for both the time and cost effect of the delay. Moreover, the author states that the Contractor may claim the Owner interfered with the work, did not deliver Owner-purchased equipment or supplies on site as promised, or that the Owner's actions or inactions caused other delays.

### 2.5.3. Excusable Non-compensable Delay

When a delay is caused by factors that are not foreseeable, beyond the Contractor's reasonable control and not attributable to the Contractor's fault or negligence, it may be "excusable". This term has indirect meaning that neither party is at fault under the terms of the contract and has agreed to share the risk and consequences when excusable events occur.

Harry **(1995)** found that examples of excusable, non-compensable delays include; unusually severe weather, fire, acts of God etc.

Therefore, it can be revealed that if such types of delays are encountered, the Contractor will not receive compensation for the cost of delay, but he will be entitled for an additional time to complete the work and is relieved from any contractually imposed liquidated damages for the period of delay.

### 2.5.4. Non-Excusable of Delays

Non-excusable delays are events that are within the contractor's control or that are foreseeable. Ahmed et al. **(2005)** indicated that these delays might be the results of underestimates of productivity, inadequate scheduling or mismanagement, construction mistakes, equipment breakdowns, staffing problems, or bad luck. Such delays are inherently the Contractor's responsibility and no relief is allowed

These are some examples of non-excusable delays (Al- Gahtani and Mohan 2007):

i. Late performance of contractor and/or sub-contractors
ii. Untimely performance by suppliers
iii. Faulty workmanship by the contractor or sub-contractors
iv. A project-specific labor strike caused by either the contractor's unwillingness to meet with labor representative or by unfair labor practices

### 2.5.5. Concurrent delays

If only one factor is delaying construction, it is usually fairly easy to calculate both the time and cost resulting from that single issue. A more complicated but also more typical situation is one in which more than one factor delays the project at the same time or in overlapping periods of time. These are called concurrent delays (Alaghbari et al 2007).

Concurrent delays occur when both owner and the contractor are responsible for the delay.

Generally, if the responsible parties of the delays are intertwined, neither the contractor can be held responsible for the delay (force to accelerate, or be liable for liquidated damages) nor can he recover the delay damages from the owner. Until the development of CPM schedule analysis, there was no reliable method to differentiate the impact of contractor caused delays from owner caused delays. (Alwi et al 2002).

Concurrent delays arise when one event causes a delay simultaneously with another event. For example, if an owner denies access to a project site for two weeks, and a severe storm prevents a contractor from working on the project for one of two weeks as well, there will be a concurrent delay of one week. The contractor will be able to recover for delay damages for one week, as a severe storm is not a cause of delay that is compensable and would have prevented the contractor from performing even if the owner did not deny access to the site.

Harry in his study **(1995)** show that the concurrent delay is considered an additional delay only to the extent it prolongs the delay to the contract completion time beyond the date that the one it is concurrent with had already delayed that date.

Concurrent delays are often more complex. Delays are categorized into 'excusable-compensable', 'excusable and non-compensable and non-excusable delays. More often, the excusable and non-excusable delays occur on separate but parallel chains of activities. When there are overlapping causes for the delay, the following principles usually are applied. (Yogeswaran et al, **1997**)

- 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 in 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 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, the dominant cause of delay should be the deciding factor.

For example, if two delays are concurrent, and one is five days long and the second is seven days long, the second concurrent delay will only extend the contract completion time by two days.

### 2.5.6. Compensable or non-compensable delays

A compensable delay is a delay where the contractor is entitled to a time extension and to additional financial compensation. Relating back to the excusable and non-excusable delays, only excusable delays can be compensable. Non-compensable delays mean that although an excusable delay may have occurred, the contractor is not entitled to any added compensation resulting from the excusable delay. Thus, the question of whether a delay is compensable must be answered. Additionally, a non-excusable delay warrants neither additional compensation money nor a time extension.

In addition to the compensable delays that result from contract changes by change notice, there are compensable delays that can arise in other ways. Such compensable delays are excusable delays, suspensions, or interruptions to all or part of the work caused by an act or failure to act by the owner resulting from owner's breach of an obligation, stated or implied, in the contract. If the delay is compensable, then the contractor is entitled not only to an extension of time but also to an adjustment for any increase in costs caused by the delay (Al-Gahtani and Mohan, 2007).

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

## 2.6 Causes of Delays

Construction delay is considered to be one of the most recurring problems in the construction industry and it has an adverse effect on project success in terms of cost, time, quality, and safety. There are several factors that cause delay in construction. Delay may be caused by Clients, Users, Consultants, Designers, Owners, Contractors and Suppliers.

In a study of the significant factors that cause delay of construction projects (Alaghbari, Kadir, Salim and Ernawati, 2007), classified the factors into four major groups, these are contractor factor, consultant factor, client factors and external factors. Financial problems, shortage of materials and poor site management practices were considered the top most factors. Client related factors included delayed payments, slow decision-making, frequent change orders, bid award for lowest price and contract scope changes. The most important factors by consultant were provision of incomplete design, poor supervision, slowness to give instructions and lack of experience. External causes identified included shortage of materials availability, poor site conditions and lack of equipment and tools in the market. In a related study of the causes and effects of delay in Malaysia construction industry Sambasivan & Soon (2007) found poor site management, inadequate experience' and poor subcontractors among the major causes of time delays on construction projects.

Projects can be delayed for a large number of reasons and usually impact on cost and time. Battaineh et al. **(2002)** studied causes of construction delay in Jordan. Results of the survey indicated Contractors and Consultants agreed that Owner interference, inadequate Contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and Sub-contractors are among the top ten significant factors.

Mansfield et al **(1994)** studied the causes of delay and cost overrun in construction projects in Nigeria. The results showed that the most important factors are financing and payments, poor contract management, changes in site conditions, shortage of material, and improper planning. Similarly, Aibinu et al **(2002)** made a research on effects of construction delays in Nigeria. The findings showed that time and cost overruns were frequent effects of delay. Delay had significant effect on completion cost and time of 61 building projects studied. Client-related delay is significant in Nigeria.

Assaf et al. **(2006)** conducted a survey on time performance of different types of construction projects in Saudi Arabia to determine the causes of delay and their importance according to each of the project participants, i.e., the Owner, Consultant and the Contractors. The survey included 23 Contractors, 19 Consultants, and 15 Owners. Seventy-three causes of delay were identified during the research. 76% of the Contractors and 56% of the Consultants indicated that Average of time overrun is between 10% and 30% of the original duration. The most common cause of delay identified by all the three parties is "change order". Surveys concluded that 70% of projects experienced time overrun and found that 45 out of 76 projects considered were delayed. Neal **(2007)** in his study showed that 40% of the projects studied in the UK have over-run their original contract period.

Ogunlana et al. **(1996)** studied the delays in building project in Thailand, as an example of developing economies. He concluded that the problems of the construction industry in developing economies could be nested in three layers: (1) problem of shortages or inadequacies in industry infrastructure, mainly supply of resources; (2) Problems caused by Clients and Consultants; and (3) Problems caused by incompetence of Contractors.

Sambasivan et al. **(2007)** surveyed causes and effects of delays in Malaysian construction industry. The study identified 10 most important causes of delay from a list of 28 different causes and 6 different effects of delay. Ten most important causes were: (1) Contractor's improper planning, (2) Contractor's poor site management, (3) inadequate Contractor experience, (4) inadequate Client's finance and payments for completed work, (5) problems with Sub-contractors, (6) shortage of material,(7) labor supply, (8) equipment availability and failure, (9) lack of communication between parties, and (10) mistakes during the construction stage.

Rizwan et al. **(2007)** conducted a research on delays in construction industry of Pakistan. A delay criticality index was used to identify the major delay causes in the industry which, in descending order of criticality, were found to be: change orders, labor productivity issues, poor site management and supervision, inspections/audits, poor cost estimation and control, inadequate project scheduling, defective design, inefficient construction methods, delayed payments, and incomplete construction drawings. In addition, the percentage allocation of responsibility for overall delay causes, according to Contractors' perceptions, was as follows: Contractors=48.75%, Consultants=17.5%, Owners=16.25 %, government=8.75%, and shared =8.75%.

Kumaraswamy et al. **(1997)** carried out a study on causes of time overruns in Hong Kong construction projects. He revealed that the five principal and common factors of delays are: (1)

poor risk management and supervision, (2) unforeseen site conditions, (3) slow decision making, (4) Client-initiated variations, and (5) necessary variations of works.

Shakeel et al. **(2006)** made an investigation of significant causes of delay in the UAE construction industry. In the study, they indicated that the effects of construction delays are not confined to the construction industry only, but influence the overall economy of a country like UAE, where construction plays a major role in its development and contributes 14% to the GDP. Thus, it is essential to define the most significant causes of delay in order to avoid or minimize their impact on construction projects. The research disclosed that 50% of the construction projects in UAE encounter delays and are not completed on time. The top 10 most significant causes of construction delays have been identified by this research. Approval of drawings, inadequate early planning and slowness of the Owners' decision-making process are the top causes of delay in the UAE construction industry.

Mezher et al. **(1998)** conducted a survey of the causes of delays in the construction industry in Lebanon from the view point of Owners, Contractors and architectural/engineering firms. It was found that Owners had more concerns with regard to financial issues; Contractors regarded contractual relationships the most important, while Consultants considered project management issues to be the most important causes for delays.

Ahmed et al. **(2005)** under his study of construction delays in Florida identified the six (6) most critical causes of delays in ascending order of criticality were found to be :( 1) changes in specifications, (2) inspections, (3) Incomplete drawings, (4) changes in drawings, (5) change order, (6) building permits approval.

Abdo **(2006)** made a survey on delays in public building construction projects in Ethiopia. The result of the research indicated that 94% of the 52 surveyed public building projects undertaken by local Contractors between the years 1995 to 2005 have encountered delays. Moreover, the time extension ranges from 10% to 367% and the Average delay is found to be 89.9%. The most frequent causes of delay which in descending order of criticality were found to be: (1) necessary variations, (2) delayed payments, (3) scarcity of materials, (4) late material supply, (5) less emphasis to planning, (6) sub-surface condition, (7) changes in design, (8) material and labor price escalation, (9)unrealistic time schedule, and (10) failure to update schedules on time.

Divya.R and S.Ramya (2015), mentioned the possible following factors causing delays in construction projects in Malaysia:

**Table 2.1: Categories and causes of delays in construction projects in Malaysia**

| Origin Agent | Causes of Delays |
|---|---|
| Owner related | Delay in progress payments |
| | Delay in delivering the site to the contractor |
| | Poor communication and coordination |
| | Change orders by owner during construction |
| | Late in revising and approving design documents |
| Contractor related | Rework due to errors during construction |
| | Poor communication and coordination |
| | Ineffective planning and scheduling of project |
| | Poor qualification of contractor's technical staff |
| | Delay in sub-contractor's work |
| Consultant related | Inadequate experience of consultant |
| | Poor communication and coordination |
| | Mistakes and discrepancies in design documents |
| | Unclear and inadequate details in drawings |
| | Un-use of advanced engineering design software |
| Materials related | Shortage of construction materials |
| | Delay in materials delivery |
| | Changes in material types during construction |
| | Late procurement of materials |
| Equipment related | Equipment breakdowns |
| | Shortage of equipment |
| | Low level of equipment operator's skill |
| | Low productivity and efficiency of equipment |
| Labor - relate | Shortage of labors |
| | Low skill of labors |
| | Personal conflicts among labors |
| External factors | Delay in obtaining permits from municipality |
| | Regulatory changes |
| | Weather effect on construction activities |
| | Accidents during construction |
| | Rise in prices of materials |
| | Delay in providing services from utilities (Such as water, electricity, etc.) |

## 2.7 Effects of Delays

The desire to finish a project on time, under the planned budget, and with the highest quality is common goals for all contracting parties, including the Owner, Contractor and Consultant. Delay usually result in losses of one form or another for everyone. Murali Sambasivam, et al (2007) studied the effects of construction delays on project construction industry. The six effects of delay identified were:

1) Cost overrun
2) time overrun
3) Dispute

4) Arbitration
5) Litigation and
6) Abandonment

B.P.Sunjka, et al stated that poor quality completed projects and bad public relations are also the effects caused due to delay in construction projects in addition to the above six effects.
Cost, time, and quality have proven their importance as the primary success factors of a project. According to Ahmed, et al delays on construction project is a universal phenomenon. They are usually accompanied by cost overruns. Delay has a negative effect on clients, contractors, and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration, and cash-flow problems. A project may be regarded as a successful endeavor until it satisfies the cost, time, and quality limitations applied to it. However, it is not uncommon to see a construction project failing to achieve its goal within the specified cost, time, and quality.
Aibinu and Jagboro (2002) studied the effects of construction delays on project delivery in Nigerian construction industry. The six effects of delay that were identified includes: time overrun, cost overrun, dispute, arbitration, total abandonment and litigation. Koushki and Kartam (2004) concluded that time and cost overrun were the impact of the material selection time, their availability in the local market and the presence of the supervising engineer. It is important to improve the estimated activity duration according to the actual skills levels, unexpected events, efficiency of work time, mistakes and misunderstanding (Lock, 1996). Delays influence negatively on the contractors performance and contribute to adverse impacts in construction projects such as contract disputes, low productivity and increase in construction costs that will also influence on the pre-determined of construction project objectives. From the comprehensive literature review, six major effects of delay in the construction projects were identified as follows:
Similarly, Sambasivan et al. **(2007)** identified six most frequently observed effects of delays in his survey on causes and effects of delays in Malaysian construction industry. These were: (1) time over-run, (2) cost overrun, (3) disputes, (4) arbitration, (5) litigation, and (6) total abandonment.

### 2.7.1 Time Overrun

Murali et al., (2007) argued that contractor related factors and client related factors such as inadequate contractor experience and owner interference have impact on time overrun. On the

other hand, Aibinu and Jagboro (2002) studied the effects of construction delays on project delivery in Nigerian construction industry. They identified time overrun as one of the major effects of delay.

### 2.7.2 Cost Overrun

Regarding cost overrun Koushki et al., (2005) identified three main causes that were contractor related problems, material-related problems, and owners$_6$ financial constraints, whereas Wiguna and Scott (2005) identified the most critical factors included: high inflation/increased material price; design change by client; defective design; weather conditions; delayed payment on contracts and defective construction work.

### 2.7.3 Disputes

Disputes are the effects of major causes of delays in construction projects such as causes of Client related, Contractor related, Consultant related and external related that may be arisen during the construction projects among the project parties. Lack of communication may also leads to misunderstandings, conflicts and disputes. Hence it necessitates the project managers to have effective communication skills which are one of the significant soft skills (People skills) with the project parties involving in construction projects. Based on Murali et al., (2007) the factors such as lack of communication between the various parties, problem with neighbors, unforeseen site conditions, delay in payments for completed work, improper construction method, delay caused by the subcontractor and discrepancies in contract documents will give rise to disputes between the various parties. Furthermore, if the disputes cannot be solved amicably or easily it can lead to arbitration or litigation.

### 2.7.4 Arbitration

According to Murali et al., (2007) delays caused by either client or contractor related factors such as change order, delayed progress payment, contractor's non-performance and lack of communication between parties which may rise disputes will be settled through arbitration process. For these circumstances, it is necessitate having a competent third party that can settle the disputes amicably or easily without going to court.

### 2.7.5 Litigation

Based on Murali et al., (2007) when the delays caused by client related, contract related, labor related and external related factors such as delay in payment for completed works, problems with site conditions and less labor supply where eventually rise the disputes to be settled by the litigation process. The parties involved in the construction projects use litigation as a last alternative to settle the disputes.

### 2.7.6 Total Abandonment

The most critical adverse effect of delays in construction projects is abandonment that could be temporary or in worse condition for permanent duration. The major causes of client related, consultant related, contractor related and external related may lead to project abandonment that will lead to delays in construction projects. Aibinu and Jagboro (2002) studied the effects of construction delays on project delivery in Nigerian construction industry. They identified total abandonment as one of the major effects of delay.

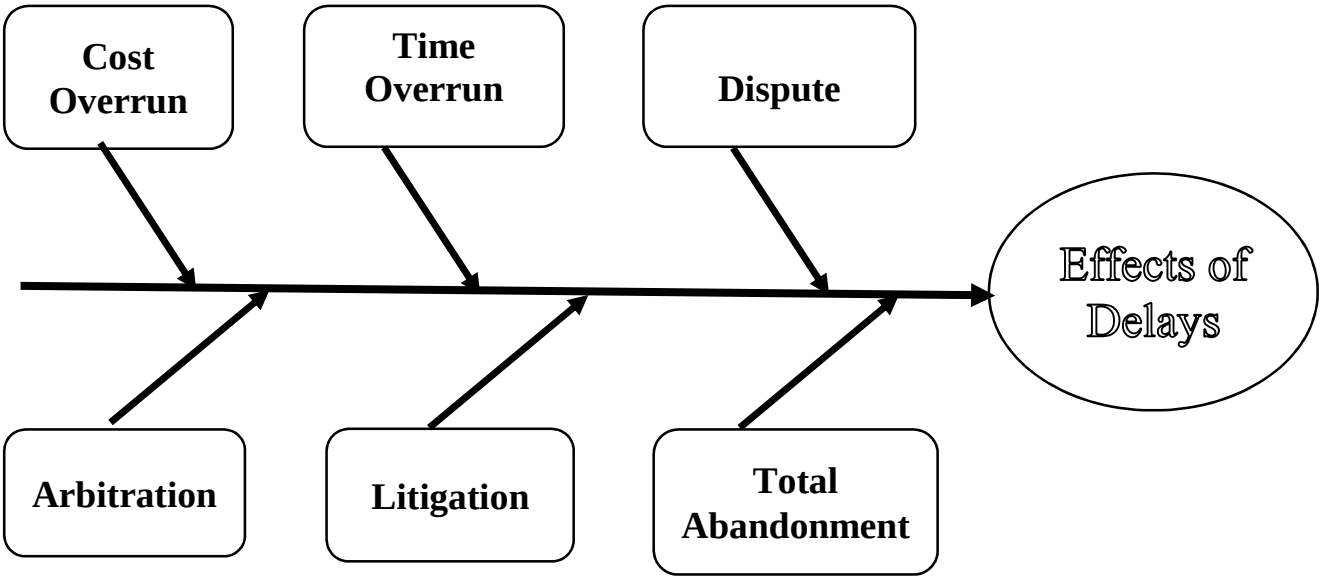


**Figure 2.5** Fish-Bone Diagram of six effects of the construction delays. (Abedi M. 2012)

# 3. RESEARCH METHODOLOGY

## 3.1. Study design

The methodology considered and adopted for this research work focus on literature review and, structured questionnaire survey was designed and employed to assess the knowledge and practice on the cause and effects of delays in the construction projects. It also uses a mixed research method (both quantitative and qualitative methods) in the data collection process. The quantifiable responses will be analyzed through a quantitative method as the name implies. The qualitative data gives more emphasis to the non-quantifiable responses and it is chosen due to its flexible nature. In recent time, the responses gathered through questionnaires are becoming less reliable as the respondents did not give due attention to the outcomes, it is essential to strengthen through interviews and face to face discussions. Therefore, the qualitative method used to support the quantitative data that was collected in the research. Finally, based on the obtained data and results of the analysis, conclusions and recommendations are provided.

## 3.2. Study area

The study area of this research is Addis Ababa. It is selected because the research title indicates the focus area of this research is higher education building construction projects located in the metropolis.

## 3.3. Target Participants

In this study determined numbers of volunteer participants are included. As this study is intended to get in-depth information about the knowledge and practice in the construction of building projects in general and higher education building projects particularly, it is good to have enough sample size. The participants that are included in this research were selected based on the following inclusion criteria's.

- The participant must be registered GC or BC of Grade 3 or above, Consultants and project Owners.
- Individual participants must be professional engineers/architects and willing to participate in the research.
- It is preferable that the participants should be those involved in the construction of Higher Educational Building projects
- The participant should have experience in contract management at any public building construction project

## 3.4. Data collection method

The required data were collected by using a well prepared and pretested questionnaire. A questionnaire was developed in order to assess the perceptions of different parties involved in the construction process in Ethiopia's construction sector, for the evaluation of frequency of occurrence and importance of the identified causes. Data gathering from large sample size participants is time consuming and require high budget. To overcome such challenges, I prefer to collect the required information by using questionnaire. The questionnaire was divided into three parts. The first part consisted of questions about the general profile, information and background of the respondents. The second part comprised of questions regarding the most frequent and important causes of construction delay were asked in two forms. The third part focused on the most important and frequent effects of construction delay. The questionnaire was designed to be a close ended questions including with few comment spaces. These type of questions had a number of choices of possible answers and the respondents selected whatever they feel was most appropriate. The reason for selecting a questionnaire method for my research is because it has a merit of giving adequate time for informants to respond, not easily approached respondents can be reached conveniently, large sample members can be addressed, and economically cheap. Similarly, the closed ended questions were also selected because they are easier to assess and answer considering how busy the respondents were.

In addition, unstructured one-to-one interview was conducted with selected individuals represented major contracting parties and actively participated at different responsibility levels in the construction of HEB projects. Meanwhile, contractual matters were reviewed by the researcher to verify participants' responses.

## 3.5. Data analysis

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

$$RII = \frac{1n_1+2n_2+3n_3+4n_4+5n_5}{AN} \quad \text{.....Equation 3.1.}$$

Where,

RII = Relative Importance Index,

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

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

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

N = total number of respondents.

The importance indices were calculated for all delay causes and the delay causes were ranked accordingly. In order to identify how project delay can be mitigated, it is important to identify the responsible party. Therefore, the responsibility of the delay causes is illustrated in the factor or category column.

Finally, the findings have been summarized and presented by using different diagrammatical tools plus supported with further descriptions.

In addition, analysis for case study were conducted for selected higher educational building projects those seriously hampered and affected by project delay. This helps the researcher to show the critical causes and effects of delay in the Ethiopian context.

# 4. FINDINGS AND DISCUSSION

## 4.1. Introduction

The findings and discussion below is devised in three parts corresponding to the research questions and also the sections of the questionnaire. The first part presents survey distribution and response rates by sector organization, respondents' designation and experience in the Ethiopian building construction industry. The second part of the results and discussion contains the findings of the questions directed towards identifying the importance of delay causes and raking in the level of their severity. 51 potential delay causes were selected from previous studies and grouped in category wise. These delay causes had a five point scale ranged from 1 to 5 in a level of importance from Non important to Extremely Important cause to project delays and the results are discussed. In the third part respondents were asked to identify the most important and frequent effect of construction delay. Similarly to the causes, nine potential effects were selected from previous studies. These effects of delay had also a five point scale ranged from 1 to 5 and the results of the questions are presented and discussed accordingly.

## 4.2. Survey Distribution and Response Statistics

### 4.2.1. Survey Response

A total of 52 questionnaires were distributed among the respondents of different backgrounds working on large construction projects. The distribution mainly focused to the people working in project owners, contractors and consultants.

Out of 52 questionnaires distributed, 44 (84.62%) were returned. There were 3 (100%) questionnaires from project owners and professionals from client side related to construction, 24 (80%) from contractors and their key staff, 2 (66.7%) from subcontractors, 15 (78.9%) from consultants and engineers.

### 4.2.2. Statistics of Respondents

The following tables, Table 4.1 and 4.2 show the distribution profile of the respondents' organization in terms of type and respondents designation respectively.

**Table 4.1- Respondents Organizational profile**

| Questionnaire Distributed and Returned | | | % of return Vs distribution |
|---|---|---|---|
| **Representing Organization** | **Questionnaire Distributed** | **Questionnaire Returned** | |
| Client (Project Owner) | 3 | 3 | 5.77 |
| Consultant (Engineer) | 17 | 15 | 28.85 |
| Contractor | 29 | 24 | 46.15 |
| Subcontractor | 3 | 2 | 3.85 |
| **Total** | **52** | **44** | **84.62** |

**Table 4.2 - Respondents Designation**

| Respondents Designation in the Company | | |
|---|---|---|
| **Designation** | **Number** | **%age** |
| Project Manager | 10 | 22.73 |
| Project Coordinator | 3 | 6.82 |
| Site Engineer | 9 | 20.45 |
| Office Engineer | 7 | 15.91 |
| RE (Resident Engineer) | 10 | 22.73 |
| Site Supervisor | 5 | 11.36 |
| **Total** | **44** | **100%** |

The designation of the respondents shows a relatively wider variety of professionals which are relevant to the construction delay analysis. The respondents have been assigned as senior project managers, quantity surveyors, contract administrators, planning engineer and construction supervisors.

Table 4.3 below shows respondents' general and specific work experience in the construction industry and building construction projects respectively.

**Table 4.3 - Respondents Experience**

| General and Specific Experiences | | | | |
|---|---|---|---|---|
| **Number of Years** | **General Experience** | **%age** | **Specific Experience** | **%age** |
| 0 to 5 years | 0 | 0 | 0 | 0 |
| 6 to 10 years | 6 | 13.64 | 12 | 27.27 |
| 11 to 15 years | 8 | 18.18 | 7 | 15.91 |
| 16 to 20 years | 11 | 25.00 | 9 | 20.45 |
| Above 20 years | 19 | 43.18 | 16 | 36.36 |

On the percentage of years of work experience of the respondents, (12) 27.27% of the respondents have 5-10 years of work experience, (7) 15.91% of the respondents have 11-15 years of work experience, (9) 20.46% of the respondents have 16-20 years of work experience, (16) 36.36% of the respondents have more than twenty (20) years of work experience in the building construction sector.

## 4.3. The importance and ranking of delay causes by respondents

The construction delay is universally evident reality and is counted as a common problem in construction projects. Delays in construction projects happen because of various factors and causes. These causes classified by seven factor groups.

- Clients related factors
- Contractors related factors
- Consultant related factors
- Material related factors
- Equipment related factors
- Labor related factors and
- External factors

In this respect the respondents were asked to rank the importance of delay causes using five points scale (most important, important, moderately important, less important and not important). Participants were also asked to add in the space provided for each factor group (Appendix B).The importance and ranking of delay causes resulted by the research methodology of questionnaire survey and evaluated by statistical formula for each factor group are shown below.

**Table 4.4- Importance and ranking of Client related delay causes**

| Importance and ranking of Client related delay causes by RII value | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Delay Causes** | **1** | **2** | **3** | **4** | **5** | **RII** | **Ranking** |
| Finance arrangement and inadequate fund allocation | 3 | 0 | 10 | 10 | 21 | 0.809 | 1 |
| Delay to effect progress payment | 0 | 4 | 4 | 26 | 10 | 0.791 | 3 |
| Slow Decision making | 0 | 3 | 7 | 30 | 4 | 0.759 | 5 |
| Unrealistic contract duration and imposed requirement | 3 | 0 | 7 | 24 | 10 | 0.773 | 4 |
| Change and variation order during construction | 0 | 4 | 10 | 11 | 19 | 0.805 | 2 |
| Incapability of Client's representative | 7 | 6 | 13 | 14 | 4 | 0.609 | 8 |
| Poor coordination and communication | 6 | 4 | 20 | 4 | 10 | 0.636 | 7 |
| Client interference | 7 | 3 | 23 | 4 | 7 | 0.605 | 9 |
| Delay in delivering the site to the Contractor | 4 | 8 | 11 | 4 | 17 | 0.700 | 6 |

The respondents also suggested to consider **bid award for lowest price** is also one of the potential cause of project delay, because the lowest bidders might be low qualified contractors. Consequently, poor performance will occur that will affect the project schedule.

From Table 4.4 the results show that the respondent ranked the most important client related delay causes in the construction of Addis Ababa Public projects were Financial arrangement and inadequate fund allocation (RII=0.809), change and variation order during construction (RII=0.805), Delay to effect progress payment (RII=0.791), unrealistic contract duration (RII=0.773) and Slow decision making (RII=0.759)

**Table 4.5 - Importance and ranking of Contractor related delay causes**

| Importance and ranking of Contractor related delay causes by RII value | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Delay Causes** | **1** | **2** | **3** | **4** | **5** | **RII** | **Ranking** |
| Inefficient planning and scheduling | 0 | 4 | 9 | 14 | 17 | 0.800 | 1 |
| Inadequate experience of contractor's technical staff | 0 | 4 | 26 | 14 | 0 | 0.645 | 6 |
| Poor coordination and communication | 5 | 4 | 10 | 17 | 8 | 0.686 | 4 |
| Rework due to error during construction | 3 | 16 | 11 | 8 | 6 | 0.591 | 8 |
| Delay in subcontractor's work | 0 | 9 | 20 | 15 | 0 | 0.627 | 7 |
| Poor site management | 2 | 8 | 9 | 19 | 6 | 0.686 | 4 |
| Inappropriate construction method | 0 | 8 | 13 | 13 | 10 | 0.714 | 3 |
| Inaccurate cost estimation | 4 | 0 | 14 | 17 | 9 | 0.723 | 2 |

As shown on the above table, the most important and highly ranked contractor related delay causes in the construction of HEB projects, are inefficient planning and scheduling (RII=0.800), Inaccurate cost estimation (RII=0.723), Inappropriate construction method (RII=0.714), poor site management (RII=0.686), poor coordination and communication (RII=0.686), Inadequate experience of contractor's technical staff (RII=0.645), delay in subcontractors' work (RII=0.627) and reworks due to errors during construction (RII=0.591).

**Table 4.6 - Importance and ranking of Consultant related delay causes**

| Importance and ranking of Consultant related delay causes by RII value | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Delay Causes** | **1** | **2** | **3** | **4** | **5** | **RII** | **Ranking** |
| Inadequate experience of consultant | 0 | 12 | 10 | 9 | 13 | 0.705 | 8 |
| Poor coordination and communication | 0 | 3 | 27 | 7 | 7 | 0.682 | 9 |
| Mistakes and discrepancies in design documents | 0 | 0 | 4 | 22 | 18 | 0.864 | 1 |
| Frequent change and variation order | 0 | 4 | 7 | 6 | 27 | 0.855 | 2 |
| Poor contract management | 0 | 0 | 14 | 20 | 10 | 0.782 | 6 |
| Change in material type and specification | 0 | 3 | 17 | 10 | 14 | 0.759 | 7 |
| Inaccurate site investigation | 0 | 0 | 9 | 24 | 11 | 0.809 | 5 |
| Unclear and inadequate details in drawings | 0 | 0 | 10 | 16 | 18 | 0.836 | 3 |
| Slow response and inspection | 0 | 0 | 9 | 21 | 14 | 0.823 | 4 |

The results of the questionnaire survey showed that, the most important and highly ranked Consultant related delay causes in the construction of HEB projects, are Mistakes and discrepancies in design documents (RII=0.864), frequent change and variation order (0.855), Unclear and inadequate details in drawings (RII=0.836), Slow response and inspection (RII=0.823), Inaccurate site investigation (RII=0.809), Poor contract management (RII=0.782) and change in material type and specification.

**Table 4.7 - Importance and ranking of Material related delay causes**

| Importance and ranking of Material related delay causes by RII value | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Delay Causes** | **1** | **2** | **3** | **4** | **5** | **RII** | **Ranking** |
| Shortage of construction materials | 4 | 7 | 0 | 14 | 23 | 0.859 | 2 |
| Delay in material delivery | 0 | 0 | 7 | 16 | 21 | 0.864 | 1 |
| Change in material type during construction | 0 | 4 | 10 | 13 | 17 | 0.795 | 3 |
| Late procurement of materials | 0 | 3 | 9 | 10 | 20 | 0.786 | 4 |
| Rise in material price | 0 | 7 | 10 | 17 | 10 | 0.736 | 5 |
| Quality of materials | 0 | 7 | 17 | 14 | 7 | 0.709 | 6 |
| Inadequate material | 0 | 14 | 10 | 6 | 14 | 0.691 | 7 |

The most important and highly ranked material related delay causes in the construction of HEB projects, are Delay in material delivery (RII=0.864), Shortage of construction materials (RII=0.859), Change in material type during construction (RII=0.795), Late procurement of materials (RII=0.786), Rise in material price (RII=0.736), quality of materials (0.709) and Inadequate material (RII=0.691)

**Table 4.8 - Importance and ranking of Equipment related delay causes**

| Importance and ranking of Equipment related delay causes by RII value | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Delay Causes** | **1** | **2** | **3** | **4** | **5** | **RII** | **Ranking** |
| Shortage of construction Equipment | 3 | 0 | 17 | 18 | 6 | 0.709 | 1 |
| Equipment breakdown | 3 | 10 | 14 | 10 | 7 | 0.636 | 2 |
| Low level of operator's skill | 10 | 3 | 20 | 7 | 4 | 0.564 | 4 |
| Low productivity and efficiency of equipment | 7 | 6 | 17 | 14 | 0 | 0.573 | 3 |
| Shortage of equipment parts | 10 | 7 | 14 | 9 | 4 | 0.555 | 5 |

The most important and highly ranked equipment related delay causes in the construction of HEB projects, are Shortage of construction Equipment (RII=0.709), Equipment breakdown (RII=0.636), Low productivity and efficiency of equipment (RII=0.573), Low level of operator's skill (RII=0.564) and Shortage of equipment parts (RII=0.555).

**Table 4.9 - Importance and ranking of Labor related delay causes**

| Importance and ranking of Labor related delay causes by RII value | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Delay Causes** | **1** | **2** | **3** | **4** | **5** | **RII** | **Ranking** |
| Shortage of labor | 0 | 4 | 23 | 10 | 7 | 0.691 | 2 |
| Personal conflict among laborers | 10 | 27 | 7 | 0 | 0 | 0.386 | 6 |
| Low labor productivity | 0 | 0 | 26 | 7 | 11 | 0.732 | 1 |
| Non attendance | 10 | 15 | 13 | 3 | 3 | 0.482 | 3 |
| Labor injuries | 9 | 10 | 25 | 0 | 0 | 0.473 | 4 |
| Labor strikes | 13 | 16 | 9 | 2 | 4 | 0.455 | 5 |

The most important and highly ranked labor related delay causes in the construction of HEB projects, are Low labor productivity (RII=0.732), Shortage of labor (RII=0.691), Non-attendance (RII=0.482), Labor injuries (RII=0.473), Labor strikes (RII=0.455) and personal conflict among laborers is (RII=0.386).

**Table 4.10 - Importance and ranking of External delay causes**

| Importance and ranking of External delay causes by RII value | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Delay Causes** | **1** | **2** | **3** | **4** | **5** | **RII** | **Ranking** |
| Delay in obtaining permit | 7 | 14 | 6 | 16 | 1 | 0.555 | 4 |
| Rise in price of material | 4 | 3 | 17 | 7 | 13 | 0.700 | 1 |
| Weather condition | 10 | 13 | 15 | 6 | 0 | 0.477 | 5 |
| Natural disasters | 21 | 18 | 2 | 1 | 2 | 0.350 | 8 |
| Regulatory changes | 9 | 19 | 8 | 7 | 1 | 0.473 | 6 |
| Unforeseen site condition | 3 | 6 | 15 | 18 | 2 | 0.645 | 2 |
| Delay in providing services from utilities (water, electricity, etc) | 8 | 7 | 14 | 12 | 3 | 0.577 | 3 |
| Government policies | 11 | 21 | 8 | 3 | 1 | 0.427 | 7 |

As shown on Table 4.10 above, the most important and highly ranked external factor of delay causes in the construction of HEB projects, are Rise in price of material (RII=0.700), Unforeseen site condition (RII=0.645), Delay in providing services from utilities (water, electricity, etc) (RII=0.577), Delay in obtaining permit (RII=0.555), Weather condition (RII=0.477), Regulatory changes (RII=0.473), Government policies (RII=0.427), and Natural disasters (RII=0.350).

**Table 4.11 - Importance Index for Most Important Factors from Overall Results**

| Rank | Delay Causes | RII | Factor (Category) |
|---|---|---|---|
| 1 | Mistakes and discrepancies in design documents | 0.864 | Consultant |
| 2 | Delay in material delivery | 0.864 | Material/ Contractor |
| 3 | Shortage of construction materials | 0.859 | External |
| 4 | Frequent change and variation order | 0.855 | Consultant |
| 5 | Unclear and inadequate details in drawings | 0.836 | Consultant |
| 6 | Slow response and inspection | 0.823 | Consultant |
| 7 | Finance arrangement and inadequate fund allocation | 0.809 | Client |
| 8 | Inaccurate site investigation | 0.809 | Consultant |
| 9 | Change and variation order during construction | 0.805 | Client |
| 10 | Inefficient planning and scheduling | 0.800 | Contractor |
| 11 | Delay to effect progress payment | 0.791 | Client |
| 12 | Late procurement of materials | 0.786 | Contractor |
| 13 | Poor contract management | 0.782 | Consultant |
| 14 | Unrealistic contract duration and imposed requirement | 0.773 | Client |
| 15 | Change in material type during construction | 0.759 | Consultant |
| 16 | Slow Decision making | 0.759 | Client |
| 17 | Rise in material price | 0.736 | External |
| 18 | Low labor productivity | 0.732 | Contractor |
| 19 | Inaccurate cost estimation | 0.723 | Contractor |
| 20 | Inappropriate construction method | 0.714 | Contractor |

As shown on Table 4.11, from the overall results obtained from the questionnaire response, delay causes that hamper the performance as well as timely delivery of the project are presented in the level of their severity.

## 4.4. Top Delay Causes

In Table 4.11 above, as ranked by the respondent, 20 most important factors causing delay in construction project are summarized and presented.

Mistakes and discrepancies in design documents by the Consultants and delay in material delivery by Contractors with RII=0.864 are suggested as the most important factor causing delay on building construction projects. This is closely followed by an external factor of shortage of construction materials in the market with RII=0.859. Frequent change and Variation Order, unclear and inadequate details in drawings and slow response and inspection with RII=0.855, 0.836 and 0.823 by the Consultants also ranked 4$^{th}$, 5$^{th}$ and 6$^{th}$ potential causes of delay respectively.

Furthermore financial arrangement and inadequate fund allocation by the Client and inaccurate site investigation by the Consultant are ranked 7$^{th}$ and 8$^{th}$ with RII=0.809. Change and variation order by the Client which is a potential cause for cost overrun ranked 9$^{th}$ with RII=0.805 and followed by Inefficient planning and scheduling by Contractor with RII=0.800 has lots of effects on construction projects..

There are many more causes, but we discussed the main and more important causes. These causes lead to the effects on the construction projects.

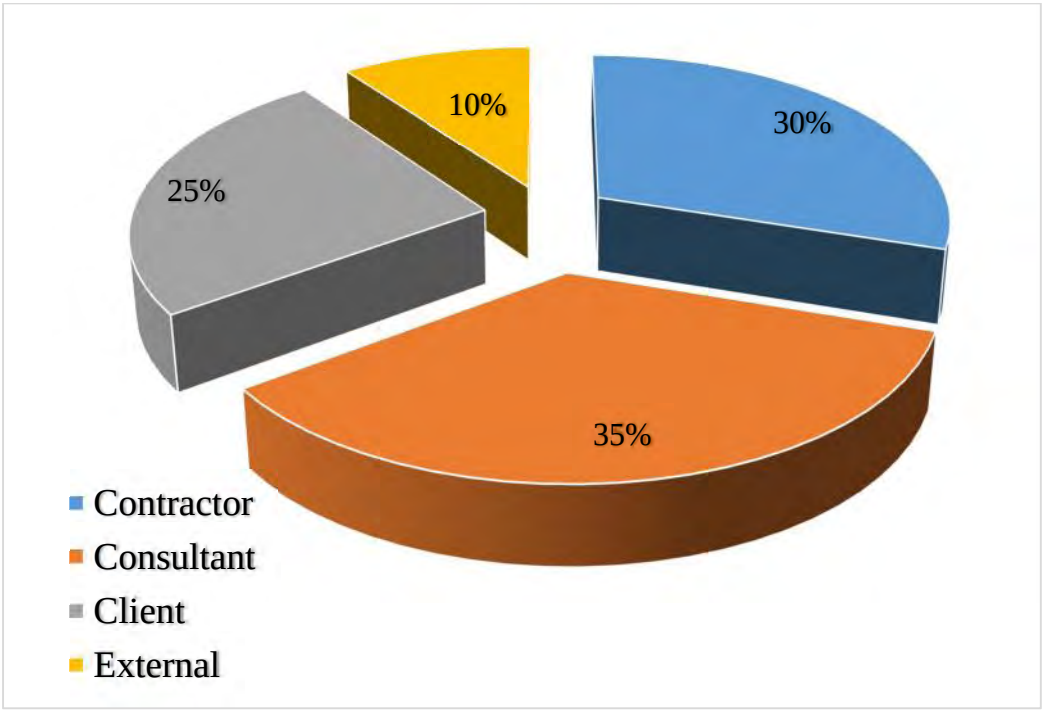


**Figure 4.1 Percentage distribution of delay causes by origin agents**

Figure 4.1 above shows, besides the influence of unbalanced questionnaire distribution among parties as shown in table 4.1 earlier, according to respondents' ranking, out of the top twenty most potential delay causes, 35% originated by the consultants, 30% originated by the contractors, 25% ranked as originated by clients and delay causes originated by external factors ranked least by 5%.

## 4.5. The Importance and Ranking of Effects of Delay by respondents

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

1) Time overrun
2) Cost overrun
3) Wastage and underutilization of resources
4) Tying down of Client's capital due to non-completion of the project
5) Abandonment of the project
6) Dispute between parties
7) Reduced profit or total lose
8) Arbitration
9) Litigation and court case

In this respect the respondents asked to rate their agreement on the effect of delay by correlating to delay causes using five points scale (Strongly disagree, disagree, slightly disagree, agree and strongly agree) having a score from 1 to 5 respectively. Participants were also asked to correlate the effects with causes of delay and space is provided to give their comment (Appendix B).The importance and ranking of effects of delay resulted by the research methodology of questionnaire survey and evaluated by statistical formula for each factor group are shown below.

**Table 4.12 - Importance and ranking of effects of delay**

| Importance and ranking of effects of delay by RII value | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Effects** | **Str. Disagree** | **Disagree** | **Sligh. Disagree** | **Agree** | **Str. Agree** | **RII** | **Ranking** |
| Time Overrun | 0 | 0 | 0 | 8 | 36 | 0.964 | 1 |
| Cost overrun | 0 | 0 | 0 | 24 | 20 | 0.891 | 2 |
| Wastage and underutilization of manpower & resources | 0 | 0 | 13 | 17 | 14 | 0.805 | 3 |
| Tying down of Clients' capital | 0 | 4 | 11 | 23 | 6 | 0.741 | 5 |
| Abandonment of the project | 6 | 8 | 17 | 11 | 2 | 0.577 | 7 |
| Dispute among parties | 0 | 6 | 3 | 27 | 8 | 0.768 | 4 |
| Arbitration | 0 | 10 | 16 | 18 | 0 | 0.636 | 6 |
| Litigation and Court case | 0 | 13 | 25 | 6 | 0 | 0.568 | 8 |

Results from Table 4.11 shows that Time overrun ranked the highest with RII of 0.964, while cost overrun or increase in final cost of the project is ranked second with RII of 0.891. Wastage and under- utilization of man-power and resources has RII value of 0.805. Time in every phase of project life is really essential, when a contract is done and the date is given, the effect of delay really affects time and money. Dispute among parties involved is ranked forth with RII value of 0.768. Time affects every other factor, the increase in final cost; more money has to be spent. Delay will also cause wastage and underutilization of man power and resource. Tying down of client capital due to non-completion of the project is ranked fifth with RII of 0.741 because; the client cannot get the intended service if the work is not completed on time. Abandonment of the project was ranked seventh with RII values and 0.577. Arbitration and litigation were ranked sixth and eighth with RII values of 0.636 and 0.568 respectively. There is a close interrelation among these three effect. Dispute among parties involved can induce litigation and arbitration and if the decision of the arbitration panel is not acceptable to either of the parties involved, this can lead to big time legal battle which can truncate the progress of the work..

The correlation between the causes and effects of delay shows that the time overrun refers to late completion or late delivery, from the time specified or agreed by all parties, of construction project. The main causes for the time overrun are financial problems, late payments for the completed work and ongoing work, change orders, inefficient planning and scheduling, poor site management, delay in material delivery, etc.

Cost overrun refers to the increased costs of labor, working force, materials and equipment etc. The main causes for the cost overrun are change orders, mistakes in the contract, changes in drawings, inaccurate cost estimation, etc.

Wastage and underutilization of resources refers to idle manpower, lower productivity of workers and equipment, etc. The main causes for the underutilization of resources are late procurement and material delivery, slow response and approval, change orders, inadequate material supply, changes in drawings, weather condition, unforeseen site condition, etc.

Disputes among parties refer to the disagreement between different parties in the construction project. The main causes for disputes are slow or late payments for completed or ongoing work, poor communication and coordination, client interference.

Litigation and court cases refers to a legal proceeding in a court to solve the problems and it takes a long time to solve the problems. The main causes of litigation and court cases are late or no payments for completed work, rise in material price, etc.

Abandonment refers to stopping every work or suspending the project for long time. The main causes for abandonment are regulatory changes, finances and payments, natural disasters etc.

## 4.6. Summary of Findings

The outcome of analysis from this study can be said to be of great relevance to the construction industry. Majority of the respondents are fully involved in the construction industry with at least 10 years of construction experience, meaning that the respondents have wealth of knowledge and could supply the necessary information on the question sent out in the questionnaires. The professionals represented were the Contractors having the highest percentage of 52.5% followed by the Consultants having 35% then the Clients having 7.5% and Subcontractors having the least percentage of 5%.

There are many factors that induce delay on construction projects, however in this study the factors are limited to 52 factors causing delay and they were ranked according to the Relative Importance Index. The factors includes: lack of funds to finance the project to completion, changes in drawings, lack of effective communication among the parties involved , lack of adequate information from consultants, slow decision making, unrealistic contract duration and variations. Also, project management problem, mistake and discrepancies in contract document, equipment availability and

failure, mistakes during construction, bad weather, fluctuation in prices of building materials, and ineffective planning and scheduling, low labor productivity and many more.

Analysis was also carried out on the effect of delay on the project work. Time overrun, increase in final cost of project, wastage and under-utilization of man-power and resources, tying down of client capital due to non-completion of the project, dispute among parties involved were ranked highest. Time is factor that is very essential in all activities that has to be carried out, in the contract document a specific time phase is given for delivery of project and if the time is being exceeded more money is often spent which could lead to increase in final cost of project and also wastage and under-utilization of man-power and resources. The client's capital has to be withheld due to non-completion of the project which could result into dispute, litigation and arbitration among the workers and management. Also delay can lead to reduced profit for Contractor and abandonment of building project by the client.

# 5. ANALYSIS OF CASE STUDIES

The AAU is building a total of 29 educational building projects since September 2004. Among these 16 were completed and the remaining 13 are under construction.

Since the title of this study directly related to Educational Building projects owned by the Addis Ababa University, the case study narrowed its focus on selected representative projects. Accordingly, five projects are selected to show the significance of this work. The selection criteria for these projects are accessibility of the required information for case studies and their exposure for excessive delays. The selected projects are comprises of the completed ones, ongoing projects and those critically suffering by abandonment and/or termination of the contract.

**Table 5.1- Selected projects for case study**

| S. No | Project Name | Contractor | Consultant |
|---|---|---|---|
| 1 | Black Lion Hospital Maintenance of Technical & HIK Wings | NKH Construction | CDSCo |
| 2 | Aklilu Lemma Institute of Pathobiology | Asmelash & Sons Construction PLC | CDSCo |
| 3 | AAU-IES New Library Building | MIDROC Construction | Fasil Giorghis Consulting Architect |
| 4 | Natural Science Faculty, Library Complex Building | MAGERCON Construction | CDSCo |

## 5.1. Black Lion Hospital, Maintenance of Technical & HIK Wing Project

The Maintenance of Technical & HIK Wing Project is located in the Black Lion Hospital Medical Faculty Compound. The project comprises of a maintenance of HIK Wing, which is under construction by a local contractor NKH construction. (See Appendix C-1 for project details and information). The project commenced on May 27, 2013 and supposed to be completed on May 26, 2014 with a contract period of 365 days. The initial contract amount of the project was ETB 89,001,607.88 but revised to ETB 111,132,773.14 including a supplementary works amounting to ETB 22,131,165.26. The amount of work executed until December 31, 2015 was ETB 81,730,815.50 which is 73.54% of the contract amount. The project is delayed by 582 days excluding the time required to complete the project in the future.

As per the data collected from the Consultant, Contractor and Employer, the major causes of delay on this project are originated by the Employer, Contractor and Consultant.

**Table 5.2- Particulars of Maintenance of Technical and HIK Wing Project**

| Project Particulars | |
|---|---|
| Client [Owner] | Addis Ababa University |
| Consultant | CDSCo |
| Contractor | NKH Construction |
| Specific Location | Black Lion Hospital |
| Contract Type | Admeasurement [Unit rate] |
| Initial Contract Amount | ETB 89,001,607.88 |
| Addition [Supplementary works] | ETB 22,131,165.26 |
| Revised Contract Amount | ETB 111,132,773.14 |
| Initial Contract Period | 365 Days |
| Total Amount of Work executed until Jan 2016 | 81,730,815.50 |
| Executed Vs Contract | 73.54% |
| Time elapsed up to Jan 2016 | 947 Days |
| Elapsed time Vs Contract | 176.35% |
| Total days delay beyond contract period | 582 Days |
| Time extension granted based on claim #1 & #2 | 172 Days |
| Unjustifiable delay | Days + Time for remaining works |

## 5.1.1. Causes of Delays at Black Lion Hospital, Maintenance of Technical & HIK Wing Project

### 5.1.1.1. Client Related Causes of Delays

#### 5.1.1.1.1. Delay to deliver the site to the Contractor

The Contractor has submitted his claim for extension of time due to the reason that Client's failure to give possession of the site (delay to release the rooms). In their claim the total days requested was 117 days (32% of the contract period). As the scope of the works is predominantly maintenance of the hospital building, the Client need to evacuate and made accessible the rooms to the Contractor within the mobilization period. The Contractor has commenced the work in the area where partially

released. The Consultant has evaluated the Contractor's claim and approved only 86 days (23.56% of the contract period).

The Contractor also submitted his 2nd claim for time extension after 79 days of the 1st one citing the same reason which is delay to give possession. In the 2nd time extension claim they requested a total of 115 days but similarly the Consultant granted only 86 days. As per the approved schedule the Contractor planned to execute 56.83% of the total contract amount between the periods February to May 2014 but the actual achievement was only 2.13%. In both claims the Contractor didn't accompanied any financial compensation claim.

#### 5.1.1.1.2. Unrealistic Contract Duration

As mentioned above the scope of works of the project is mainly maintenance and renovation of the hospital building. The Client is cognizant of the building situation and the level of their capacity to deliver all of the site to the Contractor.

### 5.1.1.2. Consultant Related Causes of Delays

#### 5.1.1.2.1. Inaccurate Site Investigation and inadequate details in drawings

The Consultant at his part act as the Owner's representative to carry out:

- site investigation,
- preparation of design documents, contract and technical specifications,
- estimate and advise the Client to determine contract durations and
- Administer the contract during construction.

The Contractor in his time extension claim requested an additional time 28 days for protection of electrical power cables, mechanical, water supply, gas and steam pipes, which are neither specified in the contract specification nor shown on the drawings. Besides, the additional works instructed to protect these utility lines, the Contractor also mentioned that he couldn't proceed the works as per the approved working schedule, as a consequence of the unforeseen site condition and subsequent variation orders.

### 5.1.1.3. Contractor Related Causes of Delays

#### 5.1.1.3.1. Ineffective Planning and Scheduling

As shown on Table 5.1 the project is extended by 582 days (159.4% of the contract time) beyond the contract period. According to Contractor time extension claims #1 and #2, the Consultant

approved 172 days out of the requested 231 days. Therefore, the Contractor is accountable for the remaining 410 days. This implies that the Contractor's ineffective planning (in terms of resource and work break down) coupled with failure to revise the schedule regularly in view of the project situation contributed for the delay.

#### 5.1.1.3.2. Poor site organization and Low performance

The other cause of delay that belongs to contractor's responsibility was low performance in the area where accessible to perform and poor site organization in accordance with the availability of the working area as it was understood that the whole of the area cannot be released at once in such type of maintenance works. Hence reasons mentioned in claim #1 couldn't support his claim. The Consultant stated under his comments on claim #1 and monthly progress report

> *"Though, most of the working area was released and accessible for the works, the contractor could not commence in full scale and perform as scheduled except minor activities."*

## 5.1.2. Observation at Maintenance of Technical & HIK Wing Project

- There has been a serious deficiency in site investigation and provision of sufficient information to the Contractor in relation to unforeseen utility lines.
- There has been a tendency to keep claims pending without addressing them timely. Therefore, it has been observed that there is a backlog of unsettled time extension claim.
- Both time extension claims were not accompanied by claim on cost compensation. Therefore, it has been observed that the Contractor has believed that financial compensations will not be accepted.
- There has been a deficiency in claim presentation and emphasizing with supporting documents.

## 5.2. Aklilu Lemma Institute of Pathobiology Project

The Aklilu Lemma Institute of Pathobiology Project is located in the compound of Samba Nekersa. The project is under construction by a local contractor Asmelash and Sons Construction PLC. The project commenced on January 01, 2012 and supposed to be completed on June 24, 2013 with a contract period of 540 days. The initial contract amount of the project was ETB 179,944,468.08 but revised to ETB 217,486,711.21 including a variation works amounting to ETB 37,542,243.13. The amount of work executed until December 31, 2015 was ETB 216,788,184.57 which is 120.48% of the contract amount. The total number of days elapsed until December 31, 2015 was 1426 days (264% of the initial contract period). The project is delayed by 886 days excluding the time required for remaining works.

As per the data collected from the Consultant, Contractor and Employer, the major causes of delay on this project are originated by the Employer, Contractor and Consultant.

**Table 5.3- Aklilu Lemma Institute of Pathobiology Project**

| Project Particulars | |
|---|---|
| Client [Owner] | Addis Ababa University |
| Consultant | CDSCo |
| Contractor | Asmelash and Sons Construction PLC |
| Specific Location | Samba Nekersa |
| Contract Type | Admeasurement [Unit rate] |
| Initial Contract Amount | ETB 179,944,468.08 |
| Addition [Supplementary works] | ETB 37,542,243.13 |
| Revised Contract Amount | ETB 217,486,711.21 |
| Initial Contract Period | 540 Days |
| Total Amount of Work executed until December 2015 | 216,788,184.57 |
| Executed Vs Contract | 120.48% |
| Time elapsed up to December 2015 | 1426 Days |
| Elapsed time Vs Contract | 264.07% |
| Total days delay beyond contract period | 886 Days |
| Time extension granted based on claim #1 & #2 | 508 Days |
| Unjustifiable delay | 378 days + Time for remaining works |

## 5.2.1. Client Related Causes of Delays

### 5.2.1.1. Delay to effect progress payment to the Contractor

After verified by the Consultant for the entitlement of progress payment the Client delayed to effect the total sum of payment amounting to ETB 15,237,455.26 for 35 days beyond the time stipulated in a contract.

### 5.2.1.2. Change and variation order during construction

The Client initiated a variation order for additional works which was not originally included in the design as well as the contract documents. The variation work amounts to ETB 37,542,243.13 accordingly the Contractor was granted a time extension of 196 days to be added on the contract period for the varied works.

## 5.2.2. Consultant Related Causes of Delays

#### 5.2.2.1.1. Poor Contract Management

The Consultant at his part act as the Owner's representative to manage the contract during the construction period, evaluate delay causes, evaluate delays as occurred and provide mitigation advice or take appropriate action as per the contract conditions and applicable standards, but due to failure to do accordingly the project suffered by extended delay.

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#### 5.2.2.1.2. Slow Response

As stated above, the Consultant took a responsibility to manage the contract as well as evaluate the performance in a periodic basis. This will enable them to see the delay events as it occurred. Accordingly the Consultant required to notify the contractor and the Employer as early as possible. But the Consultant could not act as required.

## 5.2.3. Contractor Related Causes of Delays

### 5.2.3.1. Ineffective Planning and Scheduling

As shown on Table 5.3 the project is extended by 886 days (164% of the initial contract time) beyond the contract period. According to Contractor time extension claims #1 and #2, the Consultant approved 508 days out of the requested 992 days. Therefore, the Contractor is accountable for the remaining 484 days. The main reasons contributing to the delay that couldn't

support his claim were Contractor's ineffective planning and failure to revise the master schedule regularly in view of the project situation.

#### 5.2.3.2. Low Labor Productivity

Besides the schedule deficiency to perform as planned, the contractor couldn't provide the required manpower and materials.

Furthermore, the productivity level of project workers also lower than the standard output used for performance evaluation.

## 5.3. Institute of Ethiopian Studies (IES) New Library Building Project

The IES New Library Building Project is located in the main campus of the Addis Ababa University. The project consisted of a three storey library building, intended to be used by local and international researchers. The Contract for the Construction of Addis Ababa University, Institute of Ethiopian Studies New Library Building Project was signed on August 19, 2009 between Addis Ababa University (The Employer) and MIDROC Construction Ethiopia P.L.C. (The Contractor). In addition to the main contracting parties, the Client and the Contractor, a financing entity took part in the contract as a Financer. The project commenced on 25 September 2009 and agreed to complete on March 21, 2011 with a contract period of 540 days. The initial contract amount of the project was ETB 33,199,268.65 (Thirty three Million One Hundred ninety nine Thousand two Hundred sixty eight and Cents 65/100) including 15% VAT. Until April 2011 the project performance was 71.7%. Since then the project caused to delay due to the reasons which will be shown under chapters 5.3.1 – 5.3.3. As the contracting parties failed to resolve the issues, the project remain vulnerable to delay and finally abandoned for nearly 66 months. Currently, the parties are in a process of amicable termination.

**Table 5.4 - Particulars of AAU-IES Library Building Project**

| Project Particulars | |
|---|---|
| Client [Owner] | Addis Ababa University |
| Financer | Sheik Dr. Mohammed Hussien Ali Al Amudi |
| Consultant | Fasil Ghiorgis Consulting Architects |
| Contractor | MIDROC Construction Ethiopia PLC |
| Specific Location | Addis Ababa University Main Campus |
| Contract Type | Admeasurement [Unit rate] |
| Initial Contract Amount | ETB 33,199,268.65 |
| Addition [Variation works] | ETB 2,291,362.86 |
| Revised Contract Amount | ETB 35,490,631.51 |
| Initial Contract Period | 540 Days |
| Total Amount of Work executed to date | 23,606,843.70 |
| Executed Vs Contract | 71.7% |
| Time elapsed up to January 2016 | 2317 Days |
| Elapsed time Vs Contract | 429.07% |
| Total days delay beyond contract period | 1777 Days |
| Time extension granted variation and claim #1 | 312 Days |
| Unjustifiable delay | 1465 days + Time for remaining works |

## 5.3.1. Causes of Delays at AAU-IES New Library Building Project

### 5.3.1.1. Client Related Causes of Delays

#### 5.3.1.1.1. Financial Arrangement and Inadequate Fund

As per the data collected from the Consultant, Contractor and Employer, the major causes of delay on this project originated by the Employer and the Consultant. The bid for the construction of IES library building project was conducted on January 2007 and suspended without decision until the contract signing date. Two years later, the contract document prepared with the same amount offered in the bid document. At signing of the agreement, the Contractor requested to adjust the unit prices based on the existing market price. By the time, the prices of major construction materials were inflated by 72% as detailed in Contractor's financial claim. The Client, on the other

way, insisted to commence the work in the meantime to work on price adjustment. The Consultant took the assignment to prepare a revised contract agreement for signing. Until the project abandoned on September 2011 the adjustment issue were not finalized.

#### 5.3.1.1.2. Slow Decision Making

The Contractor requested the Client to prepare the contract document based on the adjusted unit prices on September 2010, November 2010 and April 2011 but the Client failed to make decision and/or instruct the Consultant to fulfil his obligation until the third request was submitted.

### 5.3.1.2. Consultant Related Causes of Delays

#### 5.3.1.2.1. Mistakes and Discrepancies in Design Documents

At the beginning of the project the quantities of concrete, reinforcement bars and form work increased by 100% from the contract amount as a result of Consultant's error during preparation of bill of quantities. This error causes the project cost to increase by 11%.

#### 5.3.1.2.2. Poor Contract Management

The Consultant at his part act as the Owner's representative to administer the contract during construction, prepare variation and revised contract documents, but due to failure to do accordingly the project suffered by extended delay.

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#### 5.3.1.2.3. Slow Response

As stated above, the Consultant took a responsibility to prepare revised contract document based on the current market price as early as possible. But the Consultant could not prepare the document as required.

### 5.3.1.3. Contractor Related Causes of Delays

#### 5.3.1.3.1. Ineffective Planning and Scheduling

The monthly progress report prepared by the Consultant showed that Contractor's monthly performance for the last six months, November 2010 to April 2011, was much below the schedule.

#### 5.3.1.3.2. Low productivity and efficiency

Even for activities that the contractor could perform due to shortage of required skilled and non-skilled labor and very low companies wage, the contractor could not perform as a result low productivity and inefficiency.

#### 5.3.1.3.3. Very slow material delivery

According to the schedule prepared by the contractor and approved by the consultant, there are many activities which didn't related to a price adjustment and the contractor could perform. But a very slow material delivery or failure to deliver the required materials with the required quantity totally interrupts the project progress.

### 5.3.2. Effects of Delays on AAU-IES Library Building Project

All these causes of delays led the project to extended completion time, huge cost overrun (increase by 358%) the current estimate to complete the project is ETB 56,122,234.60, extra time to complete the project, abandonment of the project and furthermore, termination and financial compensation of ETB 7,938,932.81 based on cost compensation claim during termination.

## 5.4. Natural Science Faculty Library Complex Building Project

The Library Complex Building (LCB) Project is located at the Science Faculty campus of the Addis Ababa University. The project consisted of a seven storey building with one basement. The Contract for the Construction of LCB Project was signed on November 12, 2009 between Addis Ababa University (The Employer) and MAGERCON Construction (The Contractor). The project commenced on 26 November 2009 and agreed to complete on May 10, 2011 with a contract period of 530 days. The initial contract amount of the project was ETB 62,127,694.98 (Sixty Two Million One Hundred Twenty Seven Thousand Six Hundred Ninety Four and Cents 98/100) excluding VAT. Until April 9, 2014, when the contract termination came in to effect, the contractor could perform only ETB 21,388,645.19 which was 34.4% accomplishment with an elapsed time of 1595 days (301%) of the contract period. At the initial period of construction the contractor requested a time extension of 65days through time extension claim No. 1 for delayed possession of site. Accordingly, 62 days were granted for the reasons evidenced by the contractor. Since commencement of the works the project exhibited progressive delays every month due to the reasons which will be shown under chapters 5.4.1 – 5.4.3. The contractor was notified by successive

notices to improve its performance but no action had been taken until the contract termination came in to effect on April 2014 after the total abandonment for 941 days. Currently, the project was awarded to another contractor with a contract amount of ETB 61,918,466.00 to complete the remaining works.

**Table 5.5- Particulars of Science Faculty Library Complex Building Project**

| | |
|---|---|
| Client [Owner] | Addis Ababa University |
| Consultant | CDSCo |
| Contractor | MAGERCON Construction |
| Specific Location | Science Faculty Campus |
| Contract Type | Admeasurement [Unit rate] |
| Initial Contract Amount | ETB 62,127,694.98 |
| Addition [Variation works] | None |
| Revised Contract Amount | ETB 62,127,694.98 |
| Initial Contract Period | 530 Days |
| Total Amount of Work executed until April 2014 | 21,388,645.19 |
| Executed Vs Contract | 34.4% |
| Time elapsed up to April 2014 | 1595 Days |
| Elapsed time Vs Contract | 301% |
| Total days of delay beyond contract period | 1065 Days |
| Time extension granted variation and claim #1 | 62 Days |
| Unjustifiable delay | 1003days |

## 5.4.1. Causes of Delays at Science Faculty Library Complex Building Project

### 5.4.1.1. Client Related Causes of Delays

#### 5.4.1.1.1. Unclear Criteria to Assign Consultants

Majority of the AAU projects are designed, supervised and managed by a single government owned consulting firm, CDSCo, without any bid or competition. This resulted the service expected from the consultant declined from time to time.

### 5.4.1.2. Consultant Related Causes of Delays

#### 5.4.1.2.1. Poor Contract Management

The Consultant at his part act as the Owner's representative to manage the contract during the construction period, evaluate delay causes, evaluate delays as occurred and provide mitigation advice or take appropriate action as per the contract conditions and applicable standards, but due to failure to do accordingly the project suffered by extended delay.

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#### 5.4.1.2.2. Slow Response

As stated above, the Consultant took a responsibility to manage the contract as well as evaluate the performance in a periodic basis. This will enable them to see the delay events as it occurred. Accordingly the Consultant required to notify the contractor and the Employer as early as possible. But the Consultant could not act as required.

### 5.4.1.3. Contractor Related Causes of Delays

#### 5.4.1.3.1. Ineffective Planning and Scheduling

The monthly progress report prepared by the Consultant showed that Contractor's monthly performance and Net cash flow of the last nine months indicates a negative result. This indicates that i) the contractor performance is nil and ii) the cash outflow is higher than that of the inflow. No inflow is a result on nonperformance.

#### 5.4.1.3.2. Inadequate Cost Estimation

Though the tender evaluation procedure for the selection of the contractor followed two stages assessment process, Contractors mostly provide a lowest price to win a bid and secure the work. A danger of "bid award for lowest price" significantly affected this project.

After collection of the required information from the consultant, interview has been conducted with the contractor technical personnel. The main reason for the delay as well as the abandonment of the project was foreign currency devaluation that occurred in the year 2010. The contractor had 17 projects during the time when exchange rate was changed and most of them were awarded with a very marginal and fragile contract prices.

### 5.4.1.4. External Causes of Delays

#### 5.4.1.4.1. Regulatory Changes

In 2010 the foreign currency exchange rate devaluated significantly. The influence of the devaluation rate by 33% on construction inputs. As a regulation, the government couldn't allow to consider for ongoing projects. Contractors, who took projects with a very marginal price, became a victim of the incidence.

## 5.4.2. Effects of Delays at Science Faculty Library Complex Building Project

All these causes of delays led the project to abandon for ten years and finally the Contractor was terminated as a result of nonperformance.

The followings were the effects of the delays as Library Complex Building project at the Natural science Campus:

- Abandonment for extended time resulting the client failed to provide the required services
- Termination of contract
- Cost overrun. As a result of termination the new contract was signed with other contractor with an amount of ETB 61,918,466.00 for the remaining work to complete.
- Time overrun

# 6. CONCLUSIONS and RECOMMENDATIONS

This chapter includes the conclusions and recommendations that would help in solving the occurrence of delay and its effects at the construction of educational building projects in Addis Ababa University. The first objective of this study was to identify the existence of delays and explore its relationship with project's successful completion. The second objective was to identify the causes and principal factors responsible for the occurrence of delays in Addis Ababa University educational building construction projects. Discussing the effect of delays on the construction of higher educational building projects in Addis Ababa was the third objective and the last one was to formulate recommendations to avoid or minimize delays and its consequential effects.

## 6.1. Conclusions

Based on the literature reviews, the results of questionnaire responses and case studies the following conclusions are drawn.

A. The following causes are identified as a potential delay causes on the projects

1. Mistakes and discrepancies in design documents, frequent design change and variation order during construction, unclear and inadequate details in drawings, slow response and inspection, poor contract management, inaccurate site investigation and change in material type during construction as consultants' responsibility;
2. Delay in material delivery, inefficient planning and scheduling, late procurement of materials, low labor productivity, inappropriate cost estimation and improper construction method as contractor's responsibility;
3. Finance arrangement and inadequate fund allocation, change and variation order during construction, delays to effect progress payment, unrealistic project duration and slow decision making as client's responsibility
4. Shortage of construction materials and rise in material prices as external causes.
5. Unanticipated Government regulation change in exchange rate devaluation
6. Consultant's inability and failure to manage the contract as per the conditions and standards of the specification.

7. Findings of the case study witnessed none of the projects completed within the contract period. The total delay ranges from 200% to 329% of the initial contract times excluding the time required to complete the projects.
8. The AAU hired CDSCo for many of its projects to provide consultancy and supervision services. In fact CDSCo is a well experienced leading grade 1 consultancy firm in the country. But the quality of the service they are providing as well as the frequency and level of mistakes they are doing is apparent to their experience, particularly in design, document preparation and level of accuracy and contract management of educational building projects.

B. Time overrun, cost overrun, Inferior quality deliverables, loss of unutilized (idle) resources and tying down of client's capital, abandonment and contract termination are the effects of the delay encountered so far.

C. Besides all, other non-quantifiable delay damages that cannot be stated in terms of money such as inferior quality end product, inability to provide service and/or loss of client opportunities.

## 6.2. Recommendations

These delays are badly affecting the construction of the Addis Ababa University educational building projects and it is needed to find a solution for countering the delays. The solution to avoid and/or to counter delays is to avoid and lessen the causes related with delays, and in result there will be lesser effects of delays on the educational building projects.

It is suggested to deal with the causes and find a solution so that these causes not happen or happen very less. Based on the findings of the research, the following recommendations were proposed.

### 6.2.1. Expectations from Contractors

- Contractors should prepare proper plan and achievable schedule using the appropriate scheduling techniques and revise as appropriate.
- Contractors should apply effective site management system for different activities of the project so as to avoid rework of activities and low labor productivity that will result time and cost overruns.

- To avoid time and cost overruns, Contractors should setup sufficient storage area or prepare procurement plan to properly utilize advance payments and secure required construction materials especially that are scarce in the local markets.
- Contractors should give due attention for time value of money.
- Contractors should carefully estimate the costs during pricing and proper working methodology to be adopted.

### 6.2.2. Expectations from Consultants

The survey results indicated that the majority of delay factors are relevant to Consultants. Therefore, the following corrective measures are expected from consultants

- Consultants should produce a clear, conclusive and adequately detailed design and working drawings as early as possible (prior to tender preparation).
- The consultant for most of the AAU projects, CDSCo, should be able to produce a refined product and provide a quality service as they are a leading Grade 1 consulting firm.
- In order to avoid delays caused by change orders and design changes during construction, all changes should be done before the start of construction and client should clearly define its demand.
- Consultants should have clear and all-inclusive understanding on client necessities and complete project information to avoid unnecessary suspension and delay to project activities.
- Consultants should manage the contract impartially and in accordance to the contract conditions and requirements.
- Consultants should respond as quickly as possible to contractor and client questions and requests for clarification to avoid associated delays

### 6.2.3. Expectations from Clients

- The client should determine the required duration of project and impose realistic duration to avoid time and cost overruns.
- Clients must have strong economical ability and financial arrangement for project, effect progress payments on time

- Client must give proper time and priority on its construction project and tacking appropriately time verdict.
- The Client should minimize change orders and make timely decisions as much as possible to avoid cost and time overruns.
- The communication and coordination between the stake holders also have to be improved.
- The Client should exercise to work with various consultancy firms, this will provide them competitive consultancy fee, adequate consultancy service and better achievement.

### 6.2.4. Expectations from Regulatory Bodies

- The government should consider a cost compensation at least for ongoing projects.
- Regulatory bodies require to set measures against to non-performance, delay damages and default of consultants.
- Regulatory changes to be discussed among all concerned stakeholders prior to implementation.

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# APPENDIXES

# Appendix A

# Research Proposal

# *1.* ABSTRACT

Delay in construction project completion is a global phenomenon that occurs in the construction industry and considered as one of the most common problems causing a multitude of negative effects on the project and its participating parties especially where the government projects are concerned.

Construction projects are characterized by advanced technologies, multiparty participation, and frequent owner-desired changes. Coupled with uncertainties and complexities in the physical, financial, and economic environment in which most projects are performed. Such conditions have made completing projects on schedule and on budget a difficult task to accomplish, often leading to claims on cost compensations and time extensions.

The construction activities in Ethiopia are increasing, most of public projects are facing problems related to delays in completion time, requiring higher budget than estimated, the final deliverables become inferior in quality, detrimental variations and reworks and dissatisfaction by other party lead to disputes.

Therefore, it is found important to assess the critical cause and effects of delay on projects' successful completion and healthy relationship among the stakeholders.

The research work will address the following research questions

1. What are the real causes of project delays in the Higher Educational Building Construction Projects?
2. How do construction project delay related to the project's successful completion?
3. What is the stakeholders' response for the effect of construction delays over successful completion?
4. How does construction delays influence projects' performance criteria and successful completion?

So, this thesis will examine delay factors in an integrated manner and to determine how critical delay causes are most influential in project performance. This will provide owners, Consultants and construction organizations involved in construction projects with the foundation on which such strategies – on how to avoid delays - can be developed in the future.

This thesis focuses on Higher Educational Building Construction Projects in Addis Ababa, which were assessed for delay causes and examines the corresponding effects identified and provide

recommendation based on the findings to improve project performance within the higher education building projects as well as the general public construction projects.

**Key words:** *Educational building construction projects, Construction Delays, Causes of Delay, Effects of delay, Addis Ababa University*

# *2.* BACKGROUND

Construction delay defined as the time over run either beyond completion date specified in a contract or beyond the date that parties agree upon for delivery of a project [1]. Delay in construction involves during different stages of the construction process (Pre-Construction and Construction phases). It can be caused by different parties in a contract and also be internal or external. N. Hamzah et al., (2011) under his study on Factors Contributing to delay Project Construction in Higher Learning Education, identified 22 factors of delay and out of which seven of them categorized as critical factors for delay in his study.

Critical causes of delays classified:

- Insufficient capital
- Late progress payment
- Delay in work approval and Slow decision making
- Contractor's management failure
- Scarce construction materials
- Design change, New instruction and additional works

Delay in Construction projects results:

- Delay in completion of the project (time overrun)
- Cost overrun due to failure to complete the project timely
- Delivery of inferior quality products (works)
- Rework and variation
- Dispute among stakeholders

# *3.* PROBLEM STATEMENT

Delays in a construction project is counted as a common problem and became a cause for projects to be completed with huge cost overrun (requiring higher budget than estimated), extended completion time, the final deliverables are inferior in quality and contract termination.

In the recent time it was an accepted to have delays in construction projects completion time. For the client, construction delay is a loss of revenue, lack of productivity, dependency on existing facilities, etc. For the contractor, construction delay is the higher costs, longer work duration, increased labor cost, higher material and equipment costs etc. Completion of construction projects on specified time or time agreed by the parties indicates their efficiency. The delays in construction projects happen because of various factors or causes. These causes lead to the delay in construction completion, and this delay leads to negative effects on the construction project.

In Ethiopian construction projects, it is very rare that construction projects are completed on the time specified or agreed upon. There are many higher educational building construction projects in Addis Ababa, which suffered delay or in some cases suffered suspension or abandonment.

# 4. RESEARCH QUESTION

On the basis of the above stated facts, the following would be the research questions.

1. What are the real causes of project delays in the Higher Educational Building Construction Projects?
2. How do construction project delay related to the project's successful completion?
3. What is the stakeholders' response for the effect of construction delays over successful completion?
4. How does construction delays influence projects' performance criteria and successful completion?

# 5. RESEARCH OBJECTIVE

## *5.1.* General objectives

The general objective of this study is to assess the major causes of delays on building projects in the Ethiopian Construction Industry and its influence on the successful completion of the project. The primary objective is to identify the principal factors responsible for delays in the Addis Ababa Higher Educational Building Projects, their effect on the progress as well as timely delivery.

### 5.2. Specific Objectives

1. To explore construction project delays related to project successful completion.
2. To identify the delay factors that currently exist in the construction of higher educational building projects by exposing the most common fundamental problems affecting project delivery performance.
3. To briefly survey the construction project delays and their potential causes from different stakeholder's perspective.
4. To identify the success factors which are most influential in avoiding or preventing delay factors.

# *6.* LITERATURE REVIEW

## *6.1* Contract

Contract is a written agreement between or among two or more parties whereby each party promises to do or not to do something and agrees to terms (conditions and Warranties) set out in the contract. Conditions of Contract are terms in which parties in the contract are governed / administered with. That is, it is an administrative law which is the legally binding part of the contract. These promises and terms shall be enforceable by law and incorporates the rights, obligations and Remedial rights of each contracting parties.

## 6.2 Project Planning and Scheduling

Project scheduling is a written or graphical representation of the Contractor's plan for completing a construction project that emphasizes the elements of time and sequence. However, construction planning is a fundamental and challenging activity in the management and execution of construction projects. Construction planning involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any inter-relationship among the different work tasks [1]

Construction project planning is a method of determining "What" is going to be done, "How" things are going to be done, "Who" will be doing activities and "How Much" activities will cost. In this sense planning does not cover scheduling, which addresses the "When" to do, but once planning is completed scheduling can be done.

## 6.3 Construction Project Delay

Construction delay defined as the time overrun either beyond the contract date or beyond the date that the parties agreed upon for delivery of a project. This involves some cost consequences and may cause adversarial construction relationship between parties involved [2].

## 6.4 Classification of Delay

Different researchers classified delay in different ways. The most common and comprehensive classification of construction delays are: [3]

- Excusable and non-excusable delays
- Compensable and non-compensable delays
- Concurrent delays

## 6.5 Significant Factors that Cause Delay

In a study of the significant factors that cause delay of construction projects, Alaghbari, Kadir, Salim and Ernawati (2007) classified the factors into four major factors, namely, contractor factor, consultant factor, client factors and external factors.

## 6.6 Effects of Delay in Construction Projects

The timely completion of a construction project is seen as a major criterion of project success. While on the contrary, the inability of a project to be completed in accordance with the proposed time schedule maybe as a result of delay.

Unmet responsibility by either party or failure to manage contractual matters in a standard way hampers the project successful progress and completion.

The most common effects of delay in a project are:

1. Delay in completion of the project and extension of time (delay damages)
2. Project cost overrun due to failure to complete the project timely
3. Delivery of inferior quality products (works)
4. Dispute among stakeholders and adverse relationship
5. Termination and abandonment of projects
6. Liquidated damage for delays in construction projects

# 7. RESEARCH METHODOLOGY

## 7.1 Study design

The methodology considered and adopted for this research work focus on literature review and, structured questionnaire survey was designed and employed to assess the knowledge and practice on the cause and effects of delays in the construction projects. It also uses a mixed research method (both quantitative and qualitative methods) in the data collection process. The quantifiable responses will be analyzed through a quantitative method as the name implies. The qualitative data gives more emphasis to the non-quantifiable responses and it is chosen due to its flexible nature. In recent time, the responses gathered through questionnaires are becoming less reliable as the respondents did not give due attention to the outcomes, it is essential to strengthen through interviews and face to face discussions. Therefore, the qualitative method used to support the quantitative data that was collected in the research. Finally, based on the obtained data and results of the analysis, conclusions and recommendations are provided.

## 7.2 Study area

The study area of this research will be Addis Ababa. It is selected because the research title indicates the focus area of this research is higher education building construction projects located in the metropolis.

## 7.3 Target Participants

In this study determined numbers of volunteer participants are expected to be included. As this study is intended to get in-depth information about the knowledge and practice of construction contract administration, it is good to have enough sample size. The participants that are going to be included in this research will be selected based on the following inclusion criteria's.

- The participant must be registered GC or BC of Grade 3 or above, Consultants and project Owners.
- Individual participants must be professional engineers/architects and to be willing to participate in the research
- It is preferable that the participants should be those involved in the construction of Higher Educational Building projects

- The participant should have experience in contract management at any public building construction project

## 7.4 Data collection method

The required data will be collected by using a well prepared and pretested questionnaire. Data gathering from large sample size participants is time consuming and require high budget. To overcome such challenges, I prefer to collect the required information by using questionnaire. The items that would be included in the questionnaire are developed by the researcher, collected from different resources and modified for the sake of this research. The reason for selecting a questionnaire method for my research is because of different reasons. It has a merit of giving adequate time for informants to respond, not easily approached respondents can be reached conveniently, large sample members can be addressed, and economically cheap.

In addition, a one-to-one interview will be conducted with selected individuals representing Construction firms, Consultants, Clients, Individual professionals and subcontractors who involved in the construction of Higher Educational Building Projects in Addis Ababa. Similarly to the survey questionnaire, interview questions will be prepared and developed by the researcher. Meanwhile, the researcher will review contractual matters to verify participants' responses.

## 7.5 Method of data analysis

During the data collection period, I will make the preparation, clearing, and checking for completeness of the collected data through questionnaires and in-depth interviews. The collected data by using in-depth interview will be first transcribed in to a written form. After the transcription and editing process, the participants' responses will be arranged and organized based on their similarities. And then, the researcher will make the content analysis process mainly by considering the research questions.

Finally, the findings will be summarized and presented by using different diagrammatical tools plus supported with further descriptions.

In addition, analysis for case study will be conducted for selected higher educational building projects those seriously hampered and affected by project delay. This will help the researcher to show the critical causes and effects of delay in the Ethiopian context.

# *8.* SIGNIFICANCE OF THE STUDY

Project planning and scheduling is a basis for smooth execution and successful completion of the project. Proper planning, execution and monitoring will save the life of the project and reduces the risks associated with delay, cost overrun and quality issues. Failure to manage delay causes and their factors accordingly hamper the project completion and the stakeholders' relationship. So, this research will give good picture about the causes and effects of project delays.

Second, in most cases, public construction project are vulnerable for cost overrun, delay to complete as scheduled, inferior quality products and disputes caused by unmet responsibilities by either party. All these and other unstated conditions are aggravated by poor time management and improper planning besides from other causes. So, this research will contribute to fill the gap in the construction practice.

Third, based on the output of this study, the researcher will provide practical mitigation strategy in controlling delays in the higher educational building project and helps all contracting parties to consider its effects during design stage. Therefore, this research will contribute to fill the gap related to project delays in the industry.

Finally, this research will contribute in the field of construction management. It will add more information on the most frequent and critical causes of delay and to tackle the problems as early as possible.

# *9.* Time Table

| Activities | Time in Days | Day No. |
|---|---|---|
| Planning and Proposal writing | 5 | 1-5 |
| Getting approval | 2 | 7 |
| Literature Review | Always | 1-40 |
| Preparation of questionnaires and distribution | 5-15 | 20 |
| Data collection | 7-10 | 31 |
| Data Analysis | 5 | 36 |
| Writing the first draft of the report | 5 | 40 |
| Writing the final draft of the research document and submission | 7 | 45 |

# *10.* Budget

| Items/Activities | Amount in Birr |
|---|---|
| Advisor consultation | 10,000 |
| Secretarial Work | 3,000 |
| Stationeries, photocopy and duplication | 1,500 |
| Expense for Participants | 2,000 |
| Telephone Expense | 1,500 |
| Internet Expense | 500 |
| Transportation | 1,500 |
| Other expenses | 500 |
| **Total** | **20,500** |

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# Appendix B

# Questionnaire Survey

# Questionnaire

## "Cause and Effects of Delay on Addis Ababa University Educational Building Projects"

To the respondents,

This survey is part of academic research that aim to assess the major causes of delays on building projects in the Ethiopian Construction Industry and its influence on the successful completion of the project. The primary objective is to identify the principal factors responsible for delays in the Addis Ababa Higher Educational Building Projects, their effect on the progress as well as timely delivery.

With this survey, I would like to investigate the critical delay factors that currently exist in the construction of higher educational building projects in order to improve the building construction delivery process. In the long term, this research could help the contracting parties to complete projects on time, within budget and highest quality. All the information you provide will kept in strict confidentiality and it will be only used for academic research. Please answer each questions carefully. There is no right or wrong answer. If you are unsure of an answer, please respond with your best estimate. I value your participation and thank you for the commitment of time, energy and effort. If you have any further questions, I can be reached at the address below.

Sincerely,

Shewaferahu Tilahun
Post Graduate Candidate, Construction Technology and Management
School of Civil and Environmental Engineering
Addis Ababa Institute of Technology (AAiT)
Addis Ababa University
Tel.: +251 911 219 129
Email: tshewaferahu@yahoo.com

## Part 1: Information and Experience

1) Name: (Optional) _____

2) Company Name _____

3) Email: _____

4) Which organization do you represent?

Client [Owner] ☐

Consultant ☐

Contractor ☐

Others

5) Respondent Designation in the Company

| | | | | | |
|---|---|---|---|---|---|
| Owner | ☐ | Project Manager | ☐ | Site Engineer | ☐ |
| Resident Engineer | ☐ | Site Supervisor | ☐ | Others | ☐ |

6) Years of Work Experience ***(General)***

| | | | | | |
|---|---|---|---|---|---|
| 0 to 5 years | ☐ | 6 to 10 years | ☐ | 11 to 15 years | ☐ |
| 16 to 20 years | ☐ | Above 20 years | ☐ | | |

7) Years of Work Experience ***(building Construction projects)***

| | | | | |
|---|---|---|---|---|
| 0 to 5 years | ☐ | 6 to 10 years | ☐ | 11 to 15 years |
| 16 to 20 years | ☐ | Above 20 years | ☐ | |

8) Project Size

| | | | | | |
|---|---|---|---|---|---|
| 1 to 100 Million | ☐ | 101 to 200 Million | ☐ | 201 to 300 Million | ☐ |
| 301 to 400 Million | ☐ | 401 to 500 Million | ☐ | Above 500 Million | ☐ |

| **Delay Causes** | | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|
| Consultant Related | Inadequate experience of Consultant | | | | | |
| | Poor Communication and coordination | | | | | |
| | Mistakes and discrepancies in design documents | | | | | |
| | Poor contract management | | | | | |
| | Frequent chang and varaion orders | | | | | |
| | Inaccurate site investigation | | | | | |
| | Unclear and inadequate details in drawings | | | | | |
| | Slow response and inspection | | | | | |
| Material Related | Shortage of construction materials | | | | | |
| | Delay in material delivery | | | | | |
| | Change in material type during construction | | | | | |
| | Late procurement of materials | | | | | |
| | Rise in material prices | | | | | |
| | Quality of material | | | | | |
| | Inadequate material | | | | | |
| Equipment Related | Shortage of equipment | | | | | |
| | Equipment breakdown | | | | | |
| | Low level of operator's skill | | | | | |
| | Low productivity and efficiency of equipment | | | | | |
| | Shortage of equipment parts | | | | | |
| Labor Related | Shortage of labors | | | | | |
| | Personal conflict among labors | | | | | |
| | Low labor productivity | | | | | |
| | Non attendance | | | | | |
| | Labor injuries | | | | | |
| | Labor strikes | | | | | |
| External Factors | Delay in obtaining permit | | | | | |
| | Rise in price of materials | | | | | |
| | Weather Condition | | | | | |
| | Natural Disasters | | | | | |
| | Regulatory changes | | | | | |
| | Unforeseen site conditions | | | | | |
| | Delay in providing services from utilities (such as water, electricity, etc) | | | | | |
| | Government Policies | | | | | |

If you have comments regarding the causes of delay and/or their importance, please specify here:

# Part 3: Effects of Delay in Construction projects

Please rank effects of delay below in what you consider to be the most influential effect of delay. The five point scale ranged from 1 to 5.

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

**Importance and Ranking of Delay**

3.1) **Effects**

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Effects** | **S. Disagree** | **Disagree** | **Sl. Disagree** | **Agree** | **Str. Agree** |
| Time Overrun | | | | | |
| Cost Overrun | | | | | |
| Wastage and underutilization of manpower and resources | | | | | |
| Tying down of Client's capital due to non-completion of the project | | | | | |
| Abandonment of building project | | | | | |
| Dispute between parties involved | | | | | |
| Reduced profit or total loss | | | | | |
| Arbitration | | | | | |
| Litigation and court case | | | | | |

3.2) If you have comments regarding delay effects, please specify here:

3.3) What is your general comment regarding causes of delays and their effect on the building construction project: