St. MARY'S UNIVERSITY SCHOOL OF GRADUATE STUDIES MASTER OF ART PROGRAM

DEPARTMENT OF PROJECT MANAGEMENT

ASSESSMENT ON THE CAUSES OF PROJECT DELAY IN BUILDING CONSTRUCTION PROJECTS; THE CASE FOR ETHIOPIAN CONSTRUCTION WORKS CORPORATION

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JULY 2021

ADDIS ABABA, ETHIOPIA

St. MARY'S UNIVERSITY SCHOOL OF GRADUATE STUDIES MA PROGRAM

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DECLARATION

I hereby declare that this thesis entitled “Study on assessment on the causes of project delay in building construction projects; the case for Ethiopian construction works corporation” was prepared by me, with the guidance of my advisor. The word contained herein is my own except where explicitly stated otherwise in the text and that this work has not been submitted, in whole or in part, for any other degree or professional qualification.

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YONAS GIZAW  July 18, 2021

LETTER OF CERTIFICATION

This is to certify that Yonas Gizaw has conducted this research work entitled “Assessment on the causes of project delay in building construction projects; the case for Ethiopian construction works corporation” is original work and suitable for the submission for the award of Master of Art Degree in Project Management.

Muluadam Alemu (Ph.D.) _____

Date and Signature

ACKNOWLEDGMENT

The compilation of this study would have not been realized without the help of others and I would like to take this opportunity to thank everyone who helped me with this thesis. First, I would like to express my thanks and appreciation to my Advisor, **Muluadam Alemu (Ph.D.)** for his guidance, continual advice, patience, vast knowledge, and critical review of the thesis. It has helped me to improve the quality of the report and compilation of my thesis work. Also, I would like to express my gratitude for my parents for their courage and motivation to do the work. Having said this, the work I accomplished was successful with helpful assistant of the respondents who were willingly filled all the questioners. So, I do like to thank them for their assistant.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATION & ACRONYMS

APM: Association of Project Managers

BCP: Building Construction Project

CPM: Critical Path Method

ECWC: Ethiopian Construction Works Corporation

IPMA: International Project Management Association

PMBOK: Project Management Body of Knowledge

SPSS: Statistical Package for the Social Sciences

ABSTRACT

In the construction industry the main issue is delay or time limitation to fully accomplish the work without any defect in the project. Generally, delay is a condition that work does not complete in an estimated time. Construction delay is a common problem in construction projects in Ethiopia and occurring in every type and phase of a construction projects. Therefore, this study was carried out to identify the major causes of delay and the mechanism to minimize delay in Ethiopia construction Work Corporation. Thirty-nine (39) project delay attributes on Cause of building projects delay and Four (4) Mechanisms to minimize delays in building projects were identified through detailed literature review and expert's support. The study adopts quantitative methods with the help of primary data. Primary data was collected using self-administered questionnaires on 109 selected respondents from clients, consultants and contractor. This research categorized the causes of delay under four main groups of clients related, consultant related, contractor related, and external related and then assessed their impacts on cause and minimization of delay using relative importance index (RII) as a basis for analysis. The RII for all delay factors and group of categories was computed to rank the factors. The topmost influential causes and minimization of delay on Ethiopia construction work corporation project the study concluded that causes of delays under owners related delay in building construction projects. "Delays in revising and approving design document" (RII=0.73) this result shows Important 0.6 < 0.73 =0.8, causes of delays under consultants related delay in building construction projects. "Delay in approval of submittals, design drawings, and sample materials" (RII=0.71) the result shows modernly Important 0.6 < 0.71 =0.8,), causes of delays under contractors related delay in building construction projects.), "Rework due to errors during construction" (RII=0.80) this result shows Highly Important 0.6<0.86 =0.8, Causes of delays under external related delay in building construction projects. "Unforeseen site conditions" (RII=0.86)" this result shows Highly Important 0.6 < 0.86 =0.8 and "Managing ineffective planning and scheduling" is appeared to have very high impact on minimizing delays in building construction projects with (RII=0.63). results show between 0.6 < RII = 0.8 and Scale Level of Importance RII result is important in which more priorities must be given to this points to avoid delays that are caused in building construction projects.

Key Words: *Cause, Minimization of Delay, Project Management, Building construction project.*

CHAPTER ONE

Introduction

1.1 Background of the Study

The construction industry is one among the most sectors that provide important ingredient for the event of an economy. However, many projects experience extensive delays, and thereby exceed initial time and price estimates (Tawana, 2015). In construction, delay might be defined because the time overrun either beyond completion date laid out in a contract, or beyond the date that the parties prescribed for delivery of a project (Assaf, *et al.*, 2006). The success of a project depends on the foremost efficient programming, scheduling and control of obtainable resources and project activities by keeping its time, cost and utility values at the highest. However, alongside cost and quality, project schedule is considered the foremost important aspect of the development management life cycle and together of the most drivers of the project success (Durdyev, *et al.*, 2017).

Delays in construction projects are considered one among the foremost common problems causing a mess of negative effects on the project and its participating parties. Alongside delay, the frequently faced consequences are project failure, reduction of margin of profit, and loss of belief of citizen in government-funded projects, etc. When delays do occur, they are either accelerated or have their duration extended beyond the scheduled completion date. These are not without some cost consequences. Delays also produce to disruption of labor and loss of productivity, late completion of project increased time related costs, third party claims, abandonment and termination of contract (Abdul-Rahman, 2006).

In the literature, there are many studies that examine the causes and effects of delays within the construction sector. Accordingly, financial problems, inflation, late payments etc. are the foremost common causes of delay in developing countries, while change orders by the client, planning and programming errors, slowness within the decision by the client etc. are the foremost common causes within the developed countries (Assaf and Al-Hejji 2006, Pourrostam, *et al.,* 2011, Kumar 2016). Furthermore, time overrun and price overrun are the foremost common delay effects seen altogether countries no matter development level (Sarıkaya 2010, Sunjka and Jacob 2013, Kuşakçı, *et al.,* 2017). However, there also are delays within the sector that are shaped by different internal and external influences on the local scale. For this reason, it is important to look at the causes and effects of the delay in construction

activities. During this context, Ethiopian Construction Works Corporation project located in Addis Ababa has been chosen because the case of this study.

The aim of this study is to investigate the factors which will cause delays within the building construction projects within the case for the Ethiopian construction works corporation. Also, the consequences of delays are evaluated in the study. For this purpose, a survey is going to be conducted with the clients, consultants and contractors operating in Addis Ababa at ECWC and recommend effective strategies to attenuate delays of building projects. This study seeks to fill this yawning gap, as various research findings have suggested that problems within construction project in reference to delays are often reduced drastically by effective implementation of the project management concepts (Frame, 2002).

1.2 Statement of the Problem

Construction industry contains large number of parties as clients, contractors and consultants. This makes the industry complex and the success of construction project depends on its performance, and measured based on timely completion, within the budget, required quality standards and customer's satisfaction (Omran 2012). The research focused on the delay in Ethiopian construction works corporation projects because projects that are constructed by the ECWC have finished their construction beyond the given time. For this reason, I tried to identify the issues that caused and the effect of the delay on the company. I also tried to show the mechanism to minimize the delay.

Because the completion of projects beyond their budgets and scheduled times is one of the biggest problems faced by many infrastructure projects today (Simushi, 2017). According to Haseeb (2011), inaccurate time estimation, weak economy, lack of managerial skills, low labor productivity, improper planning, and slow decision making by owners, unrealistic imposed contract duration, contractor subcontracting, increasing prices of materials, environment and others are main factors of delay in construction projects. Most construction projects in Ethiopia suffer from delay (Nega, 2008). Although efforts of the organization are visible, construction delay remains the main problem and there are various factors, which affect the accomplishment of projects as planned in this case in terms of time requirement. The problem of project delay still not solved even today when the technology is advanced and project management practices are more common than before (Yang, *et al.,* 2013).

Werku and Jha (2016), in their study investigating Causes of Construction Delay in Ethiopian Construction Industries the ranking of groups based on their order of importance as: (1) Contractors related factors, (2) Material related factors, (3) Labour related factors, (4) Designers related factors, (5) Consultants/supervisors related factors, (6) Client related factors and (7) External related factors. (Alade, *et al.*, 2016) explained effects of delay as time overrun which refers to the late completion or late delivery, from the time specified or agreed by all parties in the construction project and cost overrun which refers to increased costs of labor, working force, materials and equipment, etc. The other effect of delay is dispute which refers to the minor problems between different parties in the construction project in which the other effects of delay followed as litigation, arbitration and abandonment.

This research examined the factors that cause delays to building construction project and determine how critical delay causes are most influential in project performance. This would provide stakeholders responsibilities that results delay to the project performance with the foundation on which such strategies on how to avoid delays. Therefore, the present study is intended to avoid causes those results delays in the construction project and would have a valuable advantage for the stakeholders and engineers regarding to a proper project management. This has been done by identifying the main causes and suggesting ways of addressing the problems in meeting the research objectives.

1.3 Research Objectives

1.3.1 General Objective

The general objective of this study is to examine the Causes of Project Delay in Building Construction Projects; The Case for Ethiopian Construction Works Corporation.

1.3.2 Specific Objectives

- To identify factors that cause building projects delay in Ethiopian construction Works Corporation.
- To identify the mechanism to minimize delay in building projects.

1.4 Research Question

Based on the above problem statement, the research is going to be guided by the following research questions.

- What are the factors that cause building projects delay in Ethiopian construction works corporation?
- What are the mechanisms to minimize delays in building projects?

1.5 Significance of the Study

Basically, this study explains the answer or result for some of the irregular issues that exist in construction industry such as issues that related to delays in building construction projects. Normally, the purpose why these issues arise in the event of delay is due to the parties who are unclear and not alert to the causes of delay. Thus, by identifying the causes of delay in construction project, this study can be a guideline to the certain parties involved, so that it avoids any causes that would happen in their project and carrying out the works within the time, budget and quality as in the contract.

In addition to that, it can be as a basic guidance for those who are involved in construction industry for instance, developers, architects, engineers, quantity surveyors and others in relation to the issue of delay. Finally, it assists in avoiding unnecessary disputes while assuring project success and better relationship among the contractual parties.

1.6 Delimitation/Scope of the Study

This study assessed the causes of project delay in the case of Ethiopian construction works corporation building projects from the perspectives of the three major parties in construction project that are owner, contractor and consultants to identify the most common and frequently occurring causes of delay in building construction projects. This study also evaluated the effects of delay on building projects and identify mechanisms to minimize delay in Ethiopian Construction Woks Corporation. This study also covers only the building projects that are currently being constructed by the Ethiopian construction works corporation.

1.7 Limitation of the study

The major challenge of this study was on the data collection from respondents which took so much time because the respondents were busy on filling the questioners. Due to limitation of time this study all the respondents were not participated in the questioner and also took time to analyze the given data by the respondents.

1.8 Organization of the Paper

This research paper is organized into five chapters. The first chapter presents the introduction where the background of the study, statement of the problem, research questions, and research objectives both general and specific, significance of the study, scope and Limitation are clearly described. The second chapter deals with review of related literature on the delay of building construction projects. In this chapter, previously conducted studies are reviewed to explore basic concepts and main practical activities on the causes of project delay in building construction projects and in the second chapter there is conceptual framework which shows dependent variable and independent variable. The third chapter presents the research design and methodology that will be administered in the research where the intended research approach, study area, design, population, sampling technique, data source and analysis methods and ethical consideration are stated and the fourth chapter presents the overall finding of the study which prevails about the most important occurring causes of delay from the perspectives of the three main groups (clients/ owner, contractors and consultants). The last chapter, chapter five encompasses the conclusion and recommendation part of the study.

CHAPTER TWO

Literature Review

This chapter reviews published data and research findings relevant to the topic under the subheadings of four-dimensional frameworks of theoretical, empirical, conceptual and analytical perspectives.

2.1 Theoretical Review

2.1.1 Project

A project is a transient undertaking conducted to produce a new good, service, or outcome, according to the Project Management Body of Information (PMBOK, 2013). Projects' transient existence means that they have a clear beginning and end. When the project's goals have been met, or when the project is cancelled because its objectives would not or cannot be met, the project has come to an end, or when the need for the project no longer exists. Projects may have far-reaching social, economic, and environmental effects that outlast the project itself (PMI, 2013).

According to the Project Management Body of Knowledge (PMBOK, 2013), a project is a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates that a project has a definite beginning and end. The end is reached when the project objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists. Projects can also have social, economic, and environmental impacts that far outlive the projects themselves.

According to Robert K. Wysocki (2014) definition Project is a sequence of unique, complex, and connected activities that have one goal or purpose and that must be completed by a specific time, within budget, and according to specification. A Business-focused definition of a Project by the same author (Wysocki, 2014) is a sequence of finite dependent activities whose successful completion results in the delivery of the expected business value that validated doing the project.

2.1.2 Project Management & Process Groups

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (PMI, 2013). This application of knowledge requires the effective management of the project management processes. As David M. (2009) cited Project management is defined in BS 6079 as ‗the planning, monitoring and control of all aspects of a project and the motivation of all those involved to achieve the project objectives on time and to cost, quality and performance. The purpose of project management was described by Lock as a system for foreseeing or predicting as many risks and problems as possible in relation to a project and then planning, organizing and controlling the activities required to overcome such risks and problems so that the project is completed successfully.

According to (PMBOK, 2013), Project Management Process Group is a logical grouping of project management processes to achieve specific project objectives. Process Groups are independent of project phases. Project management processes are grouped into the following five Project Management Process Groups:

- **Initiating Process Group:** Those processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase.
- **Planning Process Group**: Those processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve.
- **Executing Process Group:** Those processes performed to complete the work defined in the project management plan to satisfy the project requirements.
- **Monitoring and Controlling Process Group**: Those processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes.
- **Closing Process Group**: Those processes performed to formally complete or close the project, phase, or contract.

2.1.3 Project Management Knowledge Areas

A Knowledge Area represents a complete set of concepts, terms, and activities that make up a professional field, project management field, or area of specialization. These ten Knowledge Areas are used on most projects most of the time. Project teams should utilize these ten knowledge Areas and other Knowledge Areas, as appropriate, for their specific project. The

Knowledge Areas are Project Integration Management, Project Scope Management, Project Time Management, Project Quality Management, Project Human Resource Management, Project Communications Management, Project Risk Management, Project Procurement Management and Project Stakeholder Management (PMI, 2013).

- **Project Integration Management:** This Knowledge Area addresses the glue that links all the deliverables from the Process Groups into a unified whole (Robert K. Wysocki, 2014). It describes the process required to ensure that the various elements of project are properly coordinated (PMI, 2013).
- **Project Scope Management:** The major focus of the Project Scope Management Knowledge Area is the identification and documentation of client requirements. Many ways exist to approach requirements gathering and documentation (Robert K. Wysocki, 2014). Project scope management is what we make sure that our project includes all the relevant to achieving the projects objectives. The process includes planning scope management, collecting requirements, defining scope, creating work breakdown structure, validating the scope and controlling the scope (PMI, 2013).
- **Project Schedule Management:** Project time management includes the processes required to manage the timely completion of the project (PMI, 2013). It includes both a planning and a control component. The planning component provides time estimates for both the duration of a project task (that is, how long will it take in terms of clock time to complete thess task) and the actual effort or labor time required to complete the task. The duration is used to estimate the total time needed to complete the project. The labor time is used to estimate the total labor cost of the project. The control component is part of the Monitoring and Controlling Process Group and involves comparing estimated times to actual times as well as managing the schedule and cost variances (Robert K. Wysocki, 2014).
- **Project Cost Management:** The planning component includes building the project budget and mapping those costs into the project schedule. This provides a means of controlling the consumption of budget dollars across time. Variance reports and earned value reports are used in the Monitoring and Controlling Process Group (Robert K. Wysocki, 2014).

- **Project Quality Management**: Includes the processes for incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements, to meet stakeholders' expectations.
- **Project Resource Management:** Includes the processes to identify, acquire, and manage the resources needed for the successful completion of the project.
- **Project Communications Management:** Includes the processes required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and ultimatsse disposition of project information.
- **Project Risk Management:** Includes the processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project.
- **Project Procurement Management:** Includes the processes necessary to purchase or acquire products, services, or results needed from outside the project team.
- **Project Stakeholder Management:** Includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution.

2.1.4 Project Schedules

A project schedule is a written or graphical description of a contractor's strategy for finishing a building project that stresses time and series elements. Usually, the proposal would define the main task objects (activities) and represent the order (logic) in which they will be assembled to complete the project. A project timeline, at the most simplistic form, would physically depict the planned sequencing of the major work items used to show how and where the contractor will design the project (Trauner, *et al.*, 2009). From the start of the project to the end, the project timeline should contain any part of the project in a sequential order. In addition, each operation in the schedule should have its own time defined in the schedule. The total project timeline will be determined by the sequencing and summarization of the individual time components.

The amount of detail displayed in a building schedule varies based on a variety of variables. These considerations include, but are not limited to, the type of scheduling used, contract conditions, job design, contractor activities, etc. Overall, the project plan should clearly show

the construction tasks that must be completed, the time allotted to each task, and the order in which the tasks must be completed (*Ibid*). In a project environment, the scheduling function is more important than it would be in an ongoing operation because projects lack the continuity of day to-day operations and often present much more complex problems of coordination. Indeed, project scheduling is so important that a detailed schedule is sometimes a customer-specified requirement. Properly designed, detailed schedule can also serve as a key input in establishing the monitoring and control systems for the project (Jack R. M., Samuel J. M. 2009).

2.1.5 Project Success

Projects are being viewed as part of a business for the purpose of providing value to both the ultimate customer and the parent corporation. Project managers are expected to understand business operations more so today than in the past. Some companies are even developing internal training programs on business processes for their project managers. And, as project managers become more business oriented, the definition of success on a project now includes a business component (Kernzer, 2014). Projects are unique, this is the reason why project success criteria differ from one project to another (Muller and Turner, 2007). Since projects are temporary in nature, the success of the project should be measured in terms of completing the project within the constraints of scope, time, cost, quality, resources, and risk as approved between the project managers and senior management (PMBOK 5th edition).

2.1.6 Project Delay

Delay (Delay overrun) occurs when real testing does not finish within the expected time frame. A delay, also known as a time overrun, occurs when a construction project takes longer than expected to finish. It occurs when a contract's work is not completed within the specified time frame. Time overrun is a typical occurrence that happens in almost any project in the building industry. In developing countries, time delays are important where a project's construction time approaches 100 percent of the expected time (Muhammad, *et al.,* 2017). Government development delays, especially in the road sector, have had a major effect on the country's economic activities. Several road buildings projects have been started by the government but have yet to be completed throughout the country (Twana, 2015).

According to Assaf et al (2006) in construction, delay could be defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed

upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and due to labour cost increases. Time, cost and quality are the basic of successful construction which include also the safety and it environment. Time and cost had parallel relationship which the increasing of the time will make the increasing of the cost. Then, the controlled of time is important for avoid any loss to the contractor. The time that already discuss is the period which is the schedule for the activities from beginning until finish the process of planning.

Construction delays are more likely to happen in almost all projects due to the miscommunication between contractors, subcontractors, property owners or any other reasons. In many cases, construction projects are delayed because of inaccurate estimate of time and project cost that was initially presented to the clients or project owners. Delays and cost overruns are the most common problems causing delay in the construction industry in both developed and developing countries (Enshassi et al, 2009).

2.1.7 Types of Delay

Each of these concepts can be used to define a time delay in a work schedule. It is unusual for delays to occur on building sites, as well as other projects where a schedule is used to prepare work. It is what is being delayed that determines if a project, or some other deadline such as a milestone, will be completed late. Most importantly, delays can be seen in terms of four major categories as explained by (Trauner, *et al.,* 2009):

1. Critical versus Non-Critical
2. Excusable versus Non-Excusable
3. Compensable versus Non-Compensable
4. Concurrent versus Non-Concurrent

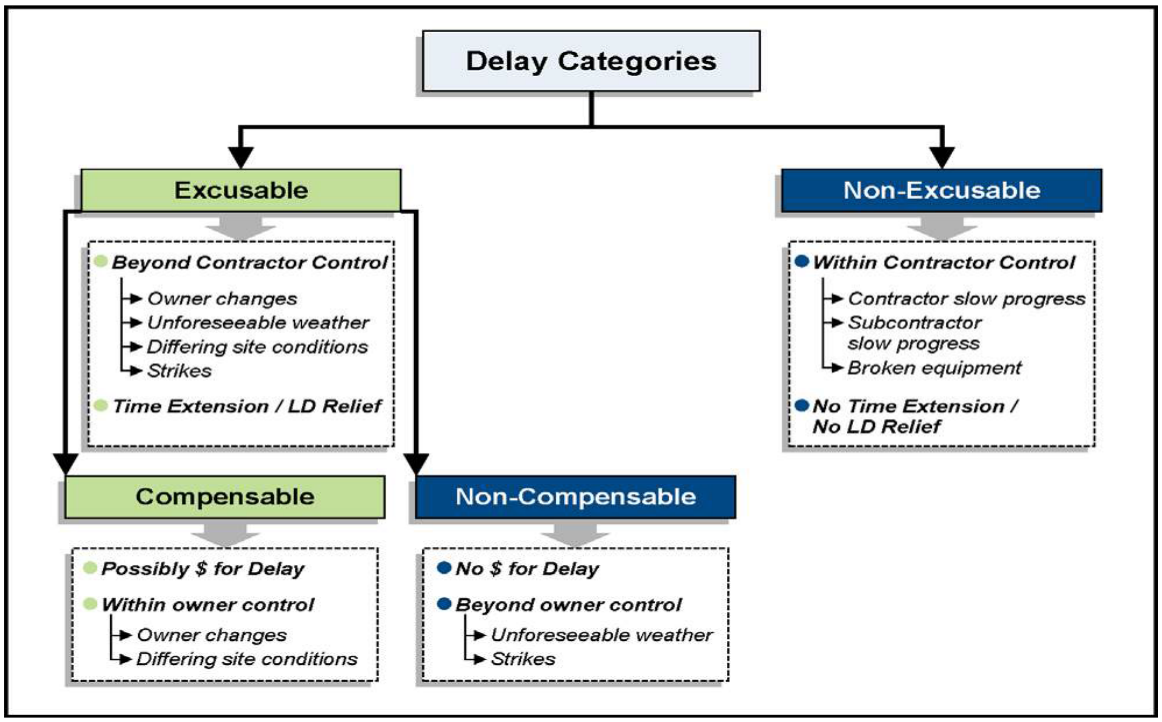

Figure 2.1 Delay Categories (Trauner, *et al.*, 2009)

Critical versus Non-Critical Delay

Jomah Mohammed Al-Najjar (2008) highlighted those Critical delays are delays which prevent the contractor from finishing the work on the scheduled completion date as agreed upon in the contract whereas the noncritical delays do not affect the completion date of the project. This indicates that non-critical delays can be seen as those delays that do not impact the completion date of the project but in a way, affect the progress of the work. It can, therefore, be said that both excusable and non-excusable delays are all critical delays.

Delays that affect the project completion or in some cases a milestone date are considered as critical delays and delays that do not affect the project completion or a milestone date are considered as noncritical delays. If these activities are delayed, the project completion date or a milestone later will be delayed. The determining which activities truly control the project completion date depends on the following: The project itself, the contractor`s plan and schedule (particularly the critical path), the requirement of the contract for sequence and phasing, the physical constraint of the project, i.e., how to build the job from a practical perspective (Dinakar 2014).

Excusable Delays: Excusable Delays are delays caused by unforeseeable events outside the control of the contractors or subcontractors. Normally, delays caused by the following incidents

will be deemed excusable depending on common general requirements of public agency specifications: General labor strikes, fires, floods, acts of God, owner- directed changes, plan and specification errors and omissions, differing site conditions or concealed conditions, usually sever weathers, intervention by outside agencies and inaction on the part of government agencies, such as building inspection.

Before concluding that a delay is excused solely based on the preceding description, the analyst must consult the building contract papers. Delays must be decided upon within the framework of the particular contract. The contract should explicitly specify what constitutes legitimate project delays that warrant contract delivery date extensions. For example, certain contracts do not qualify for any time extensions due to environmental conditions, no matter how rare, unpredictable, or severe they are (Trauner, *et al.*, 2009).

Non-Excusable Delays: Non-excusable delays are those that are outside the contractor's reach or that are anticipated. The following are few examples of inexcusable delays which are Late performance of subcontractors, Untimely performance by suppliers, Faulty workmanship by the contractor and subcontractors and a project specific labor strike caused by either the contractor’s unwillingness to meet with labor representatives or by unfair labor practices (Trauner, *et al.*, 2009). Contractor or its suppliers are responsible for inexcusable delay and they are entitled to accelerate their work done in estimated time are to pay compensation to the owner. The contractor compensates on the basis either on liquidated damages or actual damages. Liquated damages base on the daily rate of estimated costs which is likely to incur in the delay of construction projects the owner by the contractor (Muhammad A. et al., (2017).

Compensable versus Non-Compensable Delays

Inadequate drawings and specifications are the most prevalent source of compensable delay, but compensable delays may also result from the owner's inability to respond quickly to demands for details or shop drawings, owner's changes in design or materials, and owner's interruption and/or alteration in the job series (Al-Najjar, 2008). On the other hand, a non-compensable delay means that although an excusable delay may have occurred, the contractor is not entitled to any added compensation resulting from the excusable delay. Therefore, the issue of whether a delay should be covered must be resolved. A non-excusable delay also would not entitle you to extra credit or a time extension. Whether or not a delay is compensable is largely decided by the contract terms. In most cases, a contract outlines the types of delays that

are non-compensable and for which the contractor does not receive any additional money but may be allowed a time extension (Al-Gahtani & Mohan, 2007).

Concurrent versus Non-Concurrent: Concurrent delays are precisely described as different delays to the critical path that exist at the same time, according to (Trauner, *et al.,* 2009). Concurrent delays are also known as simultaneous delays, commingled delays, and entangled delays (Nguyen, 2008). Concurrent delays are also known as overlapping delays (Levy, 2006).

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

2.1.8 Causes of Delay in Construction Projects in Ethiopia

Werku, Koshe and Jha (2016) noted that the key crucial factors that cause construction delays in Ethiopia, according to their report "Investigating Causes of Construction Delay in Ethiopian Construction Industries," are: (1) Difficulties in a contractor's funding of a project; (2) Material price increases; (3) Ineffective project planning; (4) Scheduling or budget control; (5) Delay in progress compensation for finished works; (6) Lack of qualified workers in the area of construction management in the organization; and (7) Seasonal labor demand.

Neway (2018) in the study the findings show that the top ten factors that cause construction delays in the public building construction projects in Addis Ababa are: (1) Difficulty in project financing; (2) Poor Project management system;(3) Delay in issuance of designs and working drawings; (4) Shortage of availability of imported construction materials; (5) Design errors and complexity of designs;(6)Delay in progress payments for completed works; (7) Late start & resource mobilization to site; (8) Financing problems; (9) Inaccurate Site investigation Report;(10) Price Inflation.

Siraw Y. (2014), in his study on analysis of factors contributing to time overruns on road construction projects under Addis Ababa City Administration in Ethiopia, he concluded that slow site clearance, Inflation, progress payments delay by owner, contractor's financial problems, inaccurate cost estimation, and delay in commencement were the major causes of time overrun in Addis Ababa Road construction.

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

2.1.9 Delay Factors in Construction Projects

Several studies have been conducted about delays in construction projects for decades with scholars advancing various factors and groups of factors that contribute to causing delays. Researchers in project management in the building industry have found many reasons or explanations for delays. Client-based Schedule factors, contractor related Schedule factors, Consultant-related Schedule factors, and others/External related Schedule factors were all used to analyze some of the study results (Alaghbari, *et al.*, 2007).

Moreover a study by Shibani, Dr Abdussalam (2015) on a study topic "Time and Cost Overrun in Construction Projects in Egypt" conclude that the most five (5) factors affecting schedule delay (time overruns) in construction projects from the perspective of importance were: (1) "low productivity of labours", (2) "poor communication and coordination between parties", (3) "different ways of bribes", (4) "financing delay of the project", (5) "change orders during work" and "unskilled labours". The result also indicates that the most five (5) factors affecting cost overrun (increasing of the cost) include additional works by the owner, inaccurate review of the plans and contract document, poor feasibility planning and cost control during work, resources constraints such as (financial budget, lack of reserved resources for the contractors and fluctuation of materials prices. His study also recommends that the owners, contractors, and consultants were advised to be more responsible about their work and their responsibility to prevent any schedule delay or cost increases which could be achieved by encouraging the labours by giving rewards to increase their productivity, good management, improve the communication and coordination among them.

2.1.9.1 Contractor Related Delay Factors

Another recent critical literature review on main factors of delay in Construction projects by Daba and Pitroda (2018) indicated that the contractor-related schedule delay factors are "dishonesty/problems in funding by contractor, ineffective site supervision, ineffective

scheduling, revise due to mistakes during work, sub-contractors work related delay, poor experience of the contractor, delay in site arrangement, delay in preparation of working drawing and sample of material, delay in payment of executed work for a contractor by the owner, slow decision-making, late approving design documents, variation by owner, delay in procurement of materials, mistakes in design documents, recurrent changing of subcontractors, poor methods of construction, unskilled project crew, poor technology, poor coordination and communication between them, ineffective contractor's policies, unskilled subcontractors, ineffective economic control on site, inadequate procurement of construction materials, improper equipment, frequent equipment breakdowns, shortage of equipment, subcontractor turn-over, lack of labour, slow mobilization of labour, ineffective equipment, slow equipment deliver, materials damage, conflict between labor and client".

A more recent study on cost overruns by Enshassi et al., (2010) on the topic "Significant Factors Causing Time and Cost Overruns in Construction Projects in the Gaza Strip" factors related to contractor-related Schedule delay are: financial problems; delay in delivery of materials to site; shortage of materials on site; construction mistakes and defective work; poor skills and experience of labour; low productivity of labour; coordination problems with others; lack of subcontractor's skills; lack of site contractor's staff; poor site management; shortage of site labour; and equipment and tool shortages on site. Aibinu and Odeyinka (2006) identified several factors as the main contributors to contractor-related factors for Schedule delay. These include planning and scheduling problems, financial shortage problems, equipment fault, shortage of equipment and materials, slow mobilization, equipment maintenance problems and a shortage of labors.

2.1.9.2 Client Related Delay Factors

A recent critical literature review on main factors of delay in construction projects by Daba and Pitroda (2018) indicated that the client/owner-related schedule delay factors include corruption, intermittent termination of variation while project is ongoing, less on-time payment for developers, variation of specifications and material type during construction work, delay in checking contract document, variation of project scope, poor coordination with other stakeholders, slow decision making, inadequate information during project feasibility study ,delay in site delivery, lack of motivations for contractor to finish ahead of schedule ,ineffective representative, poor experience, interference during actual project work, joint-owners disagreement, improper feasibility study ,poor coordination and communication, interruption

of work ,slow document approve ,nature bidding and award ,impractical contract duration ,and unrealistic delay penalties.

Contract modifications (replacement and addition of new work to the project and change in specifications); lack of working knowledge; lack of coordination with contractors; delayed decisions; and financial problems (delayed payments, financial difficulties, and economic problems) are also client-related Schedule delay factors (Enshassi, *et al.,* 2010). Furthermore, Assaf and Al-Hejji (2006) carried out a similar study on the topic "Causes of delay in large construction projects". The researchers found out that Client-related Schedule delay factors affecting schedule delay are: Lack of incentives for contractor for finishing ahead of schedule and suspension of work by owner, delay in payment for the work, delay to deliver the site to the contractor, changing and modify orders during work, delay in revising and approving design documents, bad communication and coordination between the client and the other parties, slowness in decision making, suspension of the work and conflicts between joint-ownership of the project. The study by Aibinu and Odeyinka (2006) identified Client-related Schedule delay factors which include the owner's cash flow problems, variation orders and slowness and delay in decision making.

2.1.9.3 Consultant Related Delay Factors

Performing inspection and testing, poor communication and coordination with other parties, and conflicts between consultant and design engineer are the most significant in causing delays (Gündüz, *et al.,* 2013). Al-Kharashi and Skitmore (2009) identified delays in approving major changes in the scope of works, inadequate experience of the consultant and late in reviewing design documents as critical. (Enshassi, *et al.,* 2010) found that the consultant's lack of expertise, the absence of the consultant's site workers, the consultant's site staff's lack of administrative and supervisory experience, insufficient records, prolonged and inefficient monitoring in making decisions, and delayed orders are all causes. Olawale and Sun (2010) identified the factors of inadequate evaluation of project's duration, discrepancies in contract documentation and contract and specification interpretation disagreement as causes of delay under consultant related.

Furthermore, Daba and Pitroda (2018) found that the consultant-related Schedule delay factors are "lack of experience, disagreement with a design engineer, delay in approving project scope, delay in performing inspection and testing, poor site investigation, unskilled project

management assistance, delay in approving and checking design documents, inadequate coordination and communication between project holders and developers, recurrent change of contractors and sub-contractors, kind of project award and bidding ,variation during construction by owners, unfavorable weather condition during construction work, poor experience of consultant and contractors, delay in checking working drawing, error in design documents and discrepancies, less brief specifications in drawings ,quality pledge".

2.1.9.4 Others/External Related Schedule Delay Factors

A study by Assaf and Al-Hejji (2006) on the topic "Causes of delay in large construction projects". Their findings indicated that the external/ others related delay factors as; unfavorable weather conditions, delay in obtaining permits from municipality; effects of subsurface conditions (e.g. soil, high water table, etc.), hot weather effect on construction activities, rain effect on construction activities, unavailability of utilities in site (such as, water, electricity, telephone, etc.), Social and cultural considerations, traffic management and restrictions on the work site, building accidents, varying site (ground) conditions, improvements in government regulations and laws, utility supply delays (such as water and electricity), and a third-party final review and registration are all things to consider.

Findings from a recent study done by Aziz (2013) of Egypt in his study also showed that the main and highest factor affecting delays in construction projects in Egypt is a financial problem (funding problem) and identified the top ten factors include different type of bribes, shortage of equipment Ineffective project planning and scheduling, poor site management and supervision, poor financial control on site, rework due to errors, selecting inappropriate contractors, sudden failures actions and inadequate planning.

Various researchers have identified others/external -related Schedule delay factors category as one of the groups of factors affecting schedule delays in construction project management. These include price escalation, inclement weather, labour disputes and strikes, government regulations, slow permit by the government, civil disturbances and acts of God (Aibinu and Odeyinka, 2006). In a separate studies by several authors have concluded that poor procurement of material topped, shortage of materials in the market as a factor causing delay, poor quality of materials, escalation of material prices, and late delivery of materials, lack of equipment and tools on the market; adverse weather conditions; poor site conditions (location, ground, etc.); poor economic conditions (currency, inflation rate, etc.); changes in laws and

regulations; equipment breakdowns, shortage of equipment; transportation delays; and external work due to public agencies (roads, utilities, and public services are external -related Schedule delay factors Assaf and Al-Hejji (2006); Alghbari, *et al.,* (2007).

2.2 Effects of Delay

There are numerous elements bringing about deferment, some of them are inside the contractual worker's obligation and some are inside proprietor's risk. The consequences of delay are different for different project participants which also depend on the type of project. The general consequences are cost overrun and time overrun etc. For the owner/client delay is the loss of money, loss of time, loss of other facilities etc. For the contractor, delay means the loss of wealth for more expenditure on equipment's, other materials and for hiring the skilled labour (Tushar, *et al.,* 2016). Divya and Ramya (2015) also explained effects of delay as time overrun, cost overrun, dispute, total abandonment, arbitration, and litigation. The consequences of delay are different for different parties. The general consequences are the loss of wealth, time and capacity. For owner, delay means the loss of income and unavailability of facilities. For contractor, delay means the loss of money for extra spending on equipment and materials and hiring the labor and loss of time (Haseeb, Xinhai-Lu, Bibi & Maloof-ud-Dyian2011).

The study by Kikwasi, (2012) also revealed that disruption and delays in construction project create the following consequences: negative social impact, misunderstanding causing dispute, time overrun, resources wasting in relation to equipment as well as labour, and work going beyond budget. According to (Li, *et al.,* 2000) when delay happens there exist conceivable conditions that a manager of project might face the challenge of extra money to finish the task conceding the quality of the project by reducing specification and standard as well as rework consequently to amend the project.

The effect of delays on projects can cause confrontational relationship, general sense of trepidation, lawsuit, project rejection, disbelief, and cash flow problems (Ahmed et al., 2000). Ahmed et al. (2000) further identified wrong project appraisal and price fluctuation to be among the causes of construction project delay. Nwachukwa (2009) adopted a systematic strategy to analyse the effect material constraints to the success of managing projects in construction industry of Nigeria. He established that the attitude of a project client together with the management team towards the management of material resources is significant as it influences achieving the objectives of the project. Particularly, materials procurement delays can affect negatively the construction programme and this could cause delays in achieving the

set time for the project. A research carried out by Kikwasi (2012) indicates that disruption as well as delays in projects lead to time overrun, disagreement resulting in dispute, work exceeding budget, wasting of labour and equipment resources, and negative social impact.

2.3 Methods of Minimizing Delay

Extensive and Robust Project Management Plan

Suggestion on how to manage construction delays based on empirical evidence are generally inadequate. Nonetheless, some researchers have suggested that one of the possible ways of reducing delays during the implementation phase of construction project is to have an extensive and robust, project management plan (Abdelnaser, *et al.*, 2005).

Project Management Principles

Previous studies suggests that key factors contributing to delays may be managed through project management principles. The key factors causing construction delays that have been identified across the literature are, ineffectual scheduling and planning of the construction project by a contractor, delay in progress payment by the client, changing order by the project's client, skills as well as experience of the staff of the contractor, delay in granting key alterations in the work scope by consultants. Lack of capacity to manage these factors may be linked to the poor implementation of project management principles across publicly executed construction project (Almobarak, *et al.,* 2013).

Managing ineffective planning and scheduling

There exist some tools and techniques of project management that can be applied to enhance planning and scheduling of projects. They include Critical Path Method (CPM), Work Breakdown Structures (WBS), Critical Chain Method (CCM), Precedence Diagram Method (PDM), Program Evaluation Review Technique (PERT) and Gantt Chart (PMI, 2013). Work breakdown structure helps in the allocation of time to various tasks that are embedded in a construction project (Burke, 2013). The approach of CPM includes dissecting the project into logical sequence of undertakings that are to be accomplished, calculating the time frame for each undertaking (PMI, 2013). CPM promote good planning and communication for effective management of time, help in the assessment and calculation of time to complete the project, indicate critical activities that may influence project duration, and indicate float times for all activities. Also, CPM communicates interdependency and thus gives a more effective time management technique for large and complex projects (Kallantzis et al, 2007).

Managing poor qualifications, skills and experience of the contractors' staff

The potential staff should be examined for the needed experience for the successful implementation of the project. Also, each team member may be screened to be sure they all possess requisite competencies needed to complete tasks or activities allocated to them within the system (Crawford, 2005). Staff knowledge on project stakeholders experience executing similar projects and awareness of nuances of the project environment must be evaluated. Again, regular training can be provided for the project team members to build their capacity and soft skills (PMI, 2013). Also, it is important to 27 acknowledge that the lack of qualified and experienced manpower can be blamed, partly, on the current boom in the construction sector, especially with respect to large and more complex construction projects as suggested by Al Kharashi and Skitmore (2009).

Managing Delay in Progress Payment by the Client

The managing of delay in headway imbursement by the project's client (basically government) may be done by exploring the use of project management principles. A robust cost management plan can be applied to solve the issue of delay in headway imbursement by the project's client. By adopting to the use of effective cost management plan, policies, procedures and documentation for planning, managing and controlling project cost including cash flows needed for the project can be determined from the outset of the project (PMI, 2013).

Managing change order during construction

Taking into consideration the importance of change order in project management, it is always necessary to inform all parties about the implication of change order and its potential effect on the project progress. To minimize this issue causing unwanted delay in construction projects, change order proposed by the client may be managed by using project management principle like expert judgment, meetings and change control tools based on the project organization and environmental constraints (PMI, 2013). Quick approval of key alterations in relation to the work scope by consultant is paramount to avoid project delays. The reason is that such changes may impact project management plan, project documents or deliverable (PMI, 2013). This problem can be avoided by engaging the services of competent consultant who understands the implications of certain action on the performance of project (Berggren et al., 2001).

Delay rectification

A study by Rahman et al., (2006) found that approximately 29.2 percent of the participants recommend the upsurge in productivity through overtime working or work by shift, 24 percent of the participants chose the request for time extension; this can be done on the condition that delay was compensable or justifiable (Mobarak et al, 2008). According to Rahman et al., (2006), the ten ways he suggested ought to be done in order to get a failing construction project back on track were: Double check all dependencies, improve process, Prevent all scope change, Fast track it, Reallocate resources, Check time constraint activities, Crash the schedule, Scale back the scope of work, Swap resource and Work overtime

Proper cash flow forecasting

The significance of this pursues to identify and understand the cash flow characteristics of an organization, including its strength and weakness, create cash flow forecasts and the use of related tools to enhance cash flow planning as well as management. Cash flow is improved through the implementation of germane strategies and the use of cash flow information for enhancing the entire operations of the project.According to the Project Management Institute (PMI, 2013), project defines the art of coordinating and directing resources (i.e., human and material resources) through the various phases of project to achieve a pre-set cost, quality, objectives of scope, time, and participating objectives. The management aspect of construction project includes planning, coordination, and controlling of the various operations inside the project.

Further documents that are included at the planning phase of construction are;

- Scope statement and the scope documentation: this document defines the benefits, deliverables, need, key milestone and objectives of the business.
- Work breakdown structure (WBS): this is a visual representation which split the project scope into chunks that are manageable.
- Communication plan: the communication plan gives an outline or a guide to the communication goals as well as the communication objectives. It does the same for communication tools and methods and communication roles.
- Risk management plan: risk management plan assists projects managers in identifying predictable risk, like changing requirements, unrealistic cost and time estimates etc.

- Execution: execution comes in as soon as the work commences. Here the project team starts in assigning the resources of the project, implements projects management plans, set up systems tracking the project, implement tasks, keep posted the projects plan, and adjust the plan of the project.
- Closure: this forms the last phase of the project. Here project managers from time to time hold inquest meetings to assess what went well during the execution of the project and thus ascertain failures. The team then creates what is called a project punch list which contains all the tasks that could not be

2.4 Empirical Review

Ramya et al., (2015) studied the delay factors and their impact on project completion in Malaysian construction industry. The study result indicated ten (10) most important causes of delay from a list of twenty-eight (28) different causes. The ten most important causes of delay were (i) contractor ‘s improper planning (2) contractors poor site management (3) incomplete (4) client ‘s inadequate financial resources and payments for complemented work (5) problems with subcontractors (6) shortage of material (7) labor supply (8) equipment availability and failure, (9) Lack of communication between parties and (10) mistake during the construction stage.

Prakash and Joseph (2014) identified eight categories as leading to construction delays, six factors that effects delays, and fifteen methods for mitigating construction delays in their analysis of the causes of delays in construction projects. Late revision and acceptance of design plans, delays in subcontractor operation, and inadequate contact and coordination change orders by the owner during construction were the top three most significant reasons that led to the causes of delays. Contractor-related delays were ranked as the most important cause of delays, followed by client related delays, and consultant-related delays. The top three important ways of reducing construction delays have been identified: site control and monitoring, effective strategic planning, and consistent knowledge and contact channels.

In a study of delay analysis in construction project (Dinakar, 2014), classified delay causing factors into seven major groups, these are owner contributed factors, contractor contributed factors, consultant contributed factors, material contributed factors, equipment contributed factors, labor contributed factors and external factors. The contribution of Contractor in delay of the construction project is more than the client and consultant side. External causes, on the

other hand, have the least impact on building project delays. Improper communication between the involved parties is found as the major problem while external reasons like lack of qualified labor, equipment and material when needed comes next in row.

The study carried out by Sunjka and Jacob (2013) revealed that the ten (10) most common causes of project delays in the Niger Delta region in Nigeria includes youth commotion, communal catastrophes, lack of proper planning, poor contract management, late identification and resolution of drawing and specification errors. Ibrahim (2006) worked on finding out the causes of delay in construction projects and their severity according to contractors and consultants and stated that cost, time and quality have proven their importance as the main measures for construction project success.

Aedwin and Shibi (2015) identified causes of delay related to owners, consultants, contractors, Labour, Equipment, and external factors. Owner-related factors, according to their report, include (slow decision-making, delay in delivering the site, payment delays, incorrect preparation and scheduling, owner intervention, change of orders, interruption of operation, lack of communication, late decision making, conflicts among partners); Consultant (Inadequate experience, delay in approving drawings and samples, inadequate detailing and clarity in drawings, quality assurance control, mistakes & discrepancies in design documents); Contractor (delay in payment, delays in sub-contractor work, poor site management and supervision, rework due to errors, inexperience, poor qualification of staff, in effective planning, frequent change of subcontractor); Labour & Equipment (shortage of labour, low productivity level of labours, in-experienced work force, delay in material delivery, shortage of materials, shortage of equipment, equipment break down, low productivity & efficiency, poor operator skill, lack of communication); and External factors (change in government, poor soil conditions regulations, delay in obtaining permits, climatic factors, accidents during construction, delay in commissioning).

Srdić et al (2015) studied causes of delay in construction industry of Slovenia. They categorized the causes in to 11 groups and conducted a research. The results show that the causes of most delays can be attributed to the legal issues, slow decisions of the owner or his representative, and to design that lacks details important for the contractor. Many of the issues within these categories appear in the very beginning of the project, and can be mitigated (partially or fully) by the owner; while their costs are far away from being excessive.

According Ashraf and Ghanim (2016) the top ten factors causing delays for public sector projects in Jordan are: (1) inadequate management and supervision by the contractor, (2) client's changes of the design, (3) inadequate planning and control by the contractor, (4) using lowest bid that lead to low performance, (5) changes in the extent of the project, (6) errors in design and contract documents , (7) progress payments are not made in time by the client, (8) Rework due to mistakes during construction, (9) Changes in the original design and (10)Low level productivity.

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

Muhammad, *et al.,* (2017) on their study on Time Overrun in Public Sector Construction Projects in Pakistan as an example of developing countries: summarized their findings based on average index the topmost factors of time overrun in the form of non-excusable, non-compensable and compensable delay found on construction industry site as follows. Non-Excusable Delay: (1) Delay in shop drawings and sample materials; (2) Poor communication and coordination between parties; (3) Slowness in decision making process; (4) Suspension of work. Non-Compensable Delay: (1) Fire (2) Natural changing in environment; (3) Wind; (4) Snow fall. Compensable: (1) Poor site management and supervision by contractor (2) Poor communication and coordination by contractor with other parties; (3) Delays in sub-contractor’s work; (4) Delays in sub-contractor’s work.

Another recent study by Tsegay and Hanbin (2017) found that corruption is the leading cause of construction delays in Ethiopia. In addition, there is a lack of resources (utilities) at the site, inflation, lower-quality materials, late planning and design documentation, slower material delivery, late contract agreement and delivery of finished project work, and poor site management and performance, late release budget/ funds, and unsuccessful project preparation and scheduling. According to their findings, the essential consequences of delay examined are cost overruns, time overruns, contract termination, arbitration, and lawsuits in that order.

In the case of Wolkite Town, Nesru and Tadele (2020) investigated The Causes and Effects of Building Construction Delays in Ethiopia, Southern Nation Nationalities of People Region in Gurage Zone. Economic conditions (inflation, currency, and LC), fluctuation in commodity prices, project time overruns, poor decision making, insufficient preparation, lack of finance to support project completion, preparing incomplete bill of quantity, delay in payment acceptance, scarcity of material, change in drawing and design were listed as the top ten causes of BCP delay in importance index. In terms of significance, the top five effects of BCP delays were a rise in project financial costs (budget overrun), project time overrun, low quality of finished project, termination of construction sites, and wastage and underutilization of human capital and materials.

Fugar and Agyakwah-Baah (2010) indicated that delay in construction projects is still a major problem in Ghana in spite of the numerous studies conducted by researchers. They identified a total number of thirty-two factors that causes delays in projects which the respondents of the research (client, professional contractors and consultant) ranked according to the order off significance. The study results revealed top ten (10) factors concerned with delays in construction projects in Ghana are: Delay in honouring payment certificate for work done, cost underestimation, underestimation of project complexity, problem with credit accessibility especially with banks, inadequate or poor supervision, underestimation of time for completion of projects by contractors, materials shortage, poor management by professional, site management problem, price fluctuation/high interest rate: The respondents agreed that the top three of the groups off financial delay were the finance, the material and finally the scheduling and control.

A study conducted by Arya A. and Kansal R. (2016) on their study Analyzing causes and effects of delays of construction projects in India. Late progress payment, financial problems of owner and improper study of design and three project-related factors {poor qualification of

the contractor technical staff and project team, poor site arrangement, management, and poor terrain condition, and supervision} were in the top-10 lists of combined consultants and contractors. This indicates that concerns related to the project and external factors were taken equally into account by combined contractors and consultants.

A study done in the Kingdom of Saudi Arabia by Albogamy et al., (2012) on resolving construction delays found the 20 top ten (10) key causes generating delays: inadequate qualification, poor performance of the lowest bidder contractor in the government tendering procedure, technical staff skills and expertise, delays in subcontractors work, poor planningand scheduling of the project by the contractor, delay in progress payments by the owner, shortage of qualified engineers, delay in preparation of shop drawings cash flow problem faced by the contractor, inadequate early planning of the project and nonutilitarian of professional construction contractual management.

2.5 Knowledge Gap

Construction projects have been increasingly growing in Ethiopia. However, few studies were conducted as country and project level and as per the knowledge of the researcher in study, so this shows that as per the researcher's awareness there is no research which was conducted in the study area. According to the monthly project performance evaluation of ECWC (2020) showed that only 24.75% of the projects were completed based on the agreed time schedule which shows poor project performance. So, delay of construction projects is critical and serious problem in Ethiopian Construction Works Corporation.

2.6 Conceptual Framework

Construction delays exist at any stage of a project and are a frequent occurrence in Ethiopian construction projects. Furthermore, it is well recognized that building project delays are one of the leading causes of project failure. If the delay is not identified and the corrective project management decision is not taken in time a project may incur extra cost and extension of project time, which gives rise to dissatisfaction to all the parties involved and nowadays it is becoming a major obstruction for their development for developing countries like Ethiopia (Werku, 2016). However, (Muhwezi, *et al.,* 2014) they grouped in to four broad categories of causes of schedule delays in construction projects as clients related, consultant related, contractors related and external factors related. Therefore, this study classified these factors into four broad categories of client related, consultant related, contractor related, and external related factors.

The causes of delays in the construction projects were grouped in to four broad categories of causes of schedule delays in construction projects as clients related, consultant related, contractors related and external factors related. This study therefore, re-clustered these factors into four (4) broad categories of client related, consultant related, contractor related, and external related factors L. Muhwezi et al (2014).

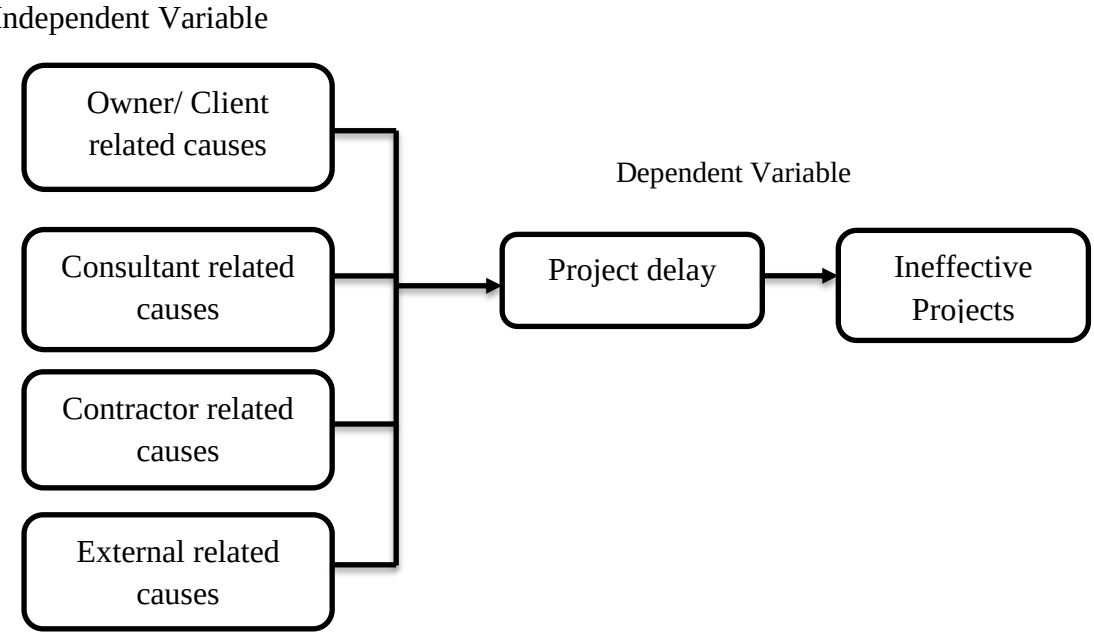

Figure 2.2 Conceptual Framework of the Study Abdella, *et al.*, (2002).

CHAPTER THREE

Research Methodology

3.1 Introduction

The techniques and procedures used to evaluate the style and methods of gathering knowledge and data from the sample population through field sources are discussed in this chapter. The aim of this research is to identify the most common causes of delays in building construction projects from the viewpoints of the owner, contractor, and consultant. The chapter involves a detailed discussion of data sources, population, sampling procedure, sample size, research instruments and data analysis.

3.2 Research Design

Research design is a model for meeting research goals and addressing research question. In other words, it is a master plan that lays out the processes and protocols for gathering and analyzing data. Furthermore, it must ensure that the data gathered is relevant to the issue at hand. The researcher must also have a good understanding of the sources of information, the design procedure, such as the sample or experiment, the sampling methodology and the timeline, as well as the costs involved (Adams, *et al.*, 2007).

This research used a descriptive survey design. Descriptive research characterizes the universe or phenomena by defining data patterns to address questions about who, when, where, why, and to what degree. It's a simplification of results. Whether the purpose is to define and explain patterns and variations in populations, to develop new measures for key phenomena, or to describe samples in studies aimed at determining causal effects, description plays a key role in the experimental method in general and in education science (Loeb, *et al.*, 2017).

Regarding to the research approach a quantitative data collection was used to identify the causes of project delay in building construction projects. According to (Adams, *et al.*, 2007), quantitative analysis applies to the style of research that is focused on the empirical concepts of positivism and neo-positiveness and adheres to the strict research design criteria established prior to actual research.

3.3 Population and Sampling procedure

Purposive or decision sampling was found to be suitable for a questioner of the study, according to (Saunders, *et al.,* 2009), which is a sampling method that allows the researcher to use his judgment to select cases that would better help the researcher to address the research questions and meet the research objectives. When dealing with very small samples, such as in case study research, or when you want to find cases that are especially insightful, this type of sample is often used (Saunders, *et al.,* 2009).

The population of the study includes the main parties of Building construction projects which are PM, office engineers, site engineers & supervisors who are involved in the construction projects. The study population only covers employees with engineering educational background and engaged in Building construction projects at ECWC. The total building construction projects currently being built by ECWC are found to be 20. Of three different parties namely clients, contractors and consultants involving in the construction projects 109 available participants out of 10 project sites was selected (41 from contractors, 34 from clients, 34 from consultants) and taken as a sample. To determine sample size of the study, the researcher used a method developed by Yamane (1967:886) in which having 95% confidence level and an assumption for the margin of error to be 5%.

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

$$n = \frac{150}{1 + 150(0.05)^2}$$

$$n = \frac{150}{1 + 0.375}$$

$$n = \frac{110}{1.375}$$

$$n = 109.09 \approx 109$$

3.4 Types and Sources of Data

Both primary and secondary data were used in relation to the topic under discussion. Various data collection methods may be used in studies, and they are likely to be used in conjunction. Interviews, observation, documentary analysis, and questionnaires are only a few examples. The tools and sources used to gather data are determined by the research strategy. According

to Yin (2009), case study data may come from a variety of places. Documentation, archival documents, interviews, direct observation, individual observation, and actual artifacts are the forms of evidence used. Each source is linked to a collection of data or facts. (Saunders, *et al.,* 2009) back this up by noting that a case study approach is likely to involve use of and triangulation of multiple sources of evidence.

3.5 Data Collection Methods

The data for this study was gathered from the main parties in the project who participated in the building construction project using questionnaire and document review. The questions that were used in the questionnaire were close ended based on a five-point Likert scale of 1 to 5 which was employed to measure the strength of respondents view or opinion on the critical causes of delays and recommended minimization of delays in building construction projects. The secondary data for this research comes from information obtained from a literature review on construction project delays. The aim of the literature reviews was to improve the comprehension of theory in relation to the research issue. Books, articles, magazines, the internet, newspapers, records, and other academic papers are examples of materials for literature reviews. The information, which is relevant, was used as a benchmark against primary data collected to support the research.

3.6 Method of Data Analysis and Presentation

The information was gathered via a questionnaire, and it was analyzed and summarized using descriptive statistics and the Statistical Package for Social Scientists (SPSS) application tools to assess the relative importance of different variables that lead to construction delays. The contribution of each factor to overall delays was investigated, and the characteristics were ranked in terms of their perceived criticality by respondents using the Relative Importance Index (RII), which was calculated using equation.

$$RII = \frac{\sum W}{A * N} \quad (0 \leq RII \leq 1)$$

Where:

RII is the Relative Importance Index,

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

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

N = total number of respondents.

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

Scale Level of Importance RII

1) Not Important at all $0.0 < RII = 0.2$

2) Slightly Important $0.2 < RII = 0.4$

3) Moderately Important $0.4 < RII = 0.6$

4) Important $0.6 < RII = 0.8$

5) Highly Important $0.8 < RII = 1.0$

A five-point Likert scale ranging from very high to very low effect was used. The same classification is used as Jawal N. A. (2015) used in his study "Assessment of delay causes of construction projects in Palestine". If the mean value ranging:

From 1 - 1.8 Considered to be Very low effect

1.81 - 2.6 Low effect

2.61 - 3.4 Medium effect

3.41 - 4.2 High effect

4.21 – 5.0 Very high effect

3.7 Reliability and validity

3.7.1 Pilot Study

A pilot study was conducted to ensure the validity and reliability of the questionnaire to be used for the research and the design of the questionnaire started with the development of a sample questionnaire with an intensive review of the literature to confirm the clarity, completeness, validity, and applicability of the questionnaire. The questionnaire was tested on 5 respondents which were purposefully selected from projects selected for the study. In terms of practicality of the instrument, when pilot study was conducted, the respondents were asked

to comment on the wording, timing and their understanding of the items. They were also asked to make suggestions on content that they feel are more suitable.

3.7.2 Validity and Reliability

Reliability and Validity are significant concepts in research as they are used for enhancing the accuracy of the assessment and evaluation of a research work (Tavakol, 2011)

Validity: Denotes the extent to which any measuring instrument measures what it is intended to measure (Thatcher, 2010). It involves the degree, to which you are measuring what you are supposed to, more simply, the accuracy of your measurement. To check the validity the initial questionnaire has been given to a group of referees to judge its validity according to its content, clearness of its meaning, appropriateness to avoid any misunderstanding and to assure its linkage with the study objectives.

Reliability Statistics: refers to the consistency, stability and repeatability of results i.e., the result of a researcher is considered reliable if consistent results have been obtained in same situations but different circumstances (Twycross, 2004).

The reliability of the questionnaire the researcher conducted an initial survey of client, consultant and contractor. The reliability test was conducted to assure the internal consistency using Cronbach alpha. The Cronbach's coefficient alpha was calculated for each field of the questionnaire. The normal range of Cronbach's coefficient alpha value ranges between 0-1 and the higher values reflects a higher degree of internal consistency. As a thumb rule, values of below 0.6 are poor, 0.6 to 0.7 ranges are acceptable and those over 0.7 are good. So, Table 3.1 below shows the values of Cronbach's Alpha for each field of the questionnaire and the entire questionnaire. For the fields, values of Cronbach's Alpha ranged between 0.901 and 0. 993. This range is considered high as the result ensures the reliability of each field of the questionnaire. Details are in Table 3.1 below.

Table 3.1 Reliability Statistics

Construct	No of Items	Cronbach alpha	Internal consistency
Owners related delay	9	.935	high
Consultants related delay	7	.884	good
Contractors related delay	16	.979	high
External related delay	7	.735	good

Source: Own Survey result, (2018)

3.8 Ethical Considerations

Ethical consideration is part of this study and documents reviewed from the organization would remain confidential. During this study respondents are also free to respond their own opinion from their experience and their personal information such as name and religion was not mentioned and the information used in this research will only be for academic purposes.

CHAPTER FOUR

Result and Discussion

This chapter deals with the presentation of the data collected from respondents through questionnaire and document review. An attempt was made to collect relevant data from targeted contractors, Clients/owner, and consultants through designed questionnaire. The questionnaire used in this study has Sixty-one set of questions which are related to cause of delay, effects of delay and Mechanisms to minimize delay.

4.1 Respondents Characteristics

Among the 109 responses nine of them were not filled. 36% of the responses were from the contractor group and the rest 28% of the responses were from clients and consultants 28% from each group.

Table 4.1 Response Rate

Respondent	Questionnaire Distributed (#)	Questionnaire Collected (#)		Response from Total (%)
		Invalid/No Filled Questionnaire	Complete/ Valid response	
Clients	34	4	30	28%
Consultant	34	3	31	28%
Contractor	41	2	39	36%
Total	**109**	**9**	**100**	**92%**

4.2 Respondents by Educational Background

Figure 4.1 shows that among the 100 respondents 30 of the respondent have diploma, 39 respondents have 1st degree, and 31 respondents have 2nd degree (Master's Degree). According to the findings as indicated in Figure 4.1, 70% of the participants were working in more moderate and senior positions so that the data collected from each post holder has been very relatable to analyze the views and perceptions of the participants in the area of the study.

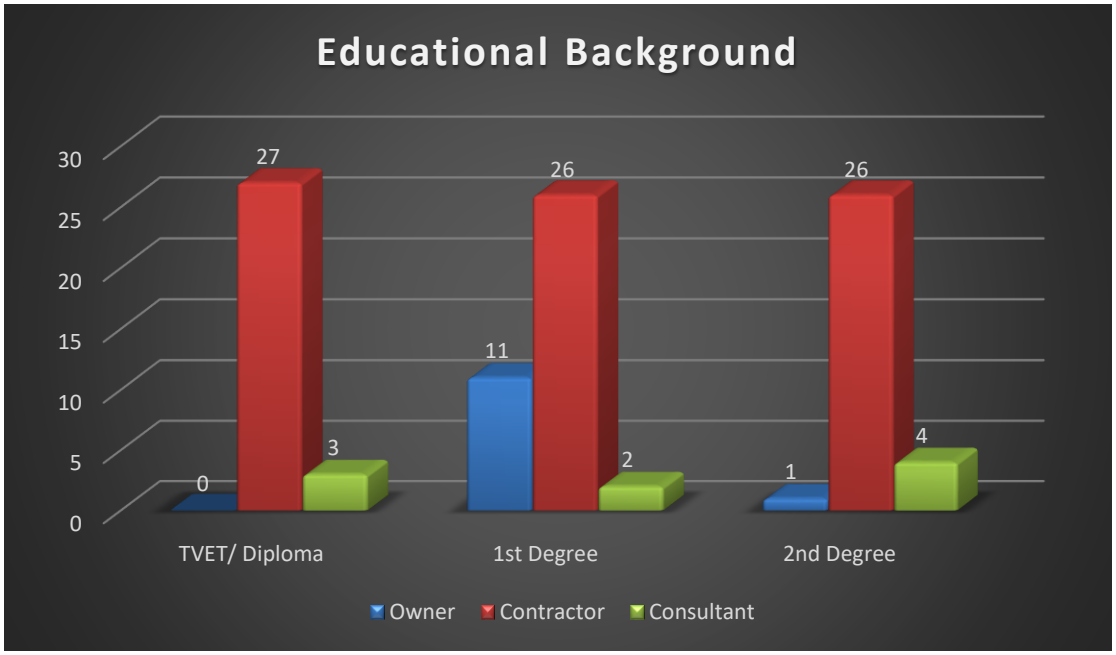

Figure 4.1 Educational Background

4.3 Respondents Experience

Among the respondents 30 respondents have 1 to 5 years' experience, 39 respondents have 6 to 10 years of experience and 31 respondents have 11 to 15 years of experience in building construction. According to the findings as indicated in Figure 4.2, above 85% of the participants had more than 5 years of experience which helped in providing a better understanding of this matter and in better position in giving much precise answer required to the questionnaires form.

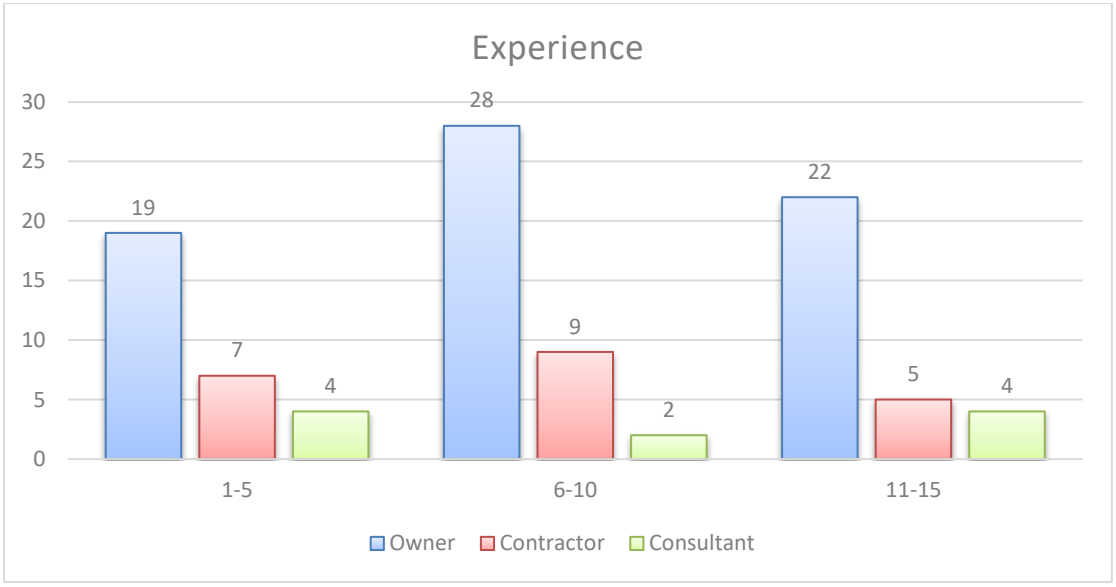

Figure 4.2 Respondents Experience

4.4 Respondents by Job Designation

Table 4.2 shows that among the total of 100 respondents 49 respondents are filled the given Job Designation area as you can see below table 4.2 and the rest 49 respondents were Contract Administrators (26), Design engineer (10), Sanitary engineers (2), Team Leader (1), Resident engineers (10) and Architect (2) regarding the organization group 30 respondents are from client, 39 respondents are from contractor, and 31 respondents are from consultant. The respondent's designation bellow showed variety positions which helped the study to assess the response of each participant in giving much precise answer.

Table 4.2 Respondents by Job Designation

Count		Job Designation						Total
		Project Manager	Quality Manager	Project Office Engineer	Site Engineer	Surveyor	Supervisor	
Organization	Owner	0	0	7	0	0	0	**7**
	Contractor	2	2	15	1	2	4	**26**
	Consultant	0	0	13	0	0	3	**16**
Total		**2**	**2**	**35**	**1**	**2**	**7**	**49**

4.5 Respondents by Gender

Table 4.3 shows that among the total of 100 respondents 51 respondents are male and 49 respondents were female and regarding the organization group 30 respondents are from client, 39 respondents are from contractor, and 31 respondents are from consultant. According to the findings as indicated in Figure 4.3 the higher number was taken by the male which is followed by a short gap of female respondents. This numbers of female employees are very good compared to males in which the gender party proportion is showing progress which should be fulfilled in all organizational types in Ethiopia.

Table 4.3 Respondents by Gender

Description		Organization			Total
		Owner	Contractor	Consultant	
Gender	Male	7	23	21	**51**
	Female	23	16	10	**49**
Total		**30**	**39**	**31**	**100**

4.6 Cause of building projects delay in Ethiopian Construction Works Corporation

This part of the paper consists of results and discussion of causes of project delay in building construction project on ECWC. The causes of delay are discussed under this are how poor project management can cause a delay on the project. Each delay causes are assessed from the viewpoint of clients, consultants and contractors. Each factor is evaluated and ranked based on their severity/importance and likelihood of occurrence as perceived by respondents and the calculated mean are taken to rank delay causes using Relative Importance Index (RII).

Table 4.4 Owners related delay

No.	Owners related Delay	Owner			Contractor			Consultant			Average		
		Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank
1	**Delays in revising and approving design document**	4.50	0.87	1	3.87	0.70	1	3.81	0.64	6	4.06	0.73	1
2	**Change orders by owner during construction.**	4.20	0.78	3	3.72	0.67	2	3.87	0.69	4	3.93	0.71	2
3	**Delays in approving shop drawing and sample materials.**	3.60	0.55	8	3.59	0.60	4	3.48	0.56	9	3.56	0.57	6
4	**Slowness decision-making process.**	4.30	0.84	2	3.46	0.51	6	4.19	0.78	1	3.99	0.71	3
5	**Poor communication and coordination.**	3.67	0.63	6	2.82	0.43	8	3.58	0.65	5	3.36	0.57	7
6	**Conflict between joint- ownership of the project**	3.27	0.57	7	2.69	0.42	9	3.26	0.57	8	3.07	0.52	8
7	**Delay to furnish and deliver the site.**	3.87	0.69	5	3.46	0.59	5	4.00	0.78	1	3.78	0.69	5
8	**Delay in progress payment.**	4.00	0.77	4	3.67	0.66	3	3.84	0.70	3	3.84	0.71	4
9	**Suspension of work by owner.**	3.00	0.42	9	3.18	0.49	7	3.65	0.63	7	3.27	0.51	9
	Grand Mean	**3.82**	**0.68**		**3.38**	**0.56**		**3.74**	**0.67**		**3.65**	**0.64**	

The results presented in Table 4.4, shows that (9) causes of delays under owners related delay in building construction projects. “Delays in revising and approving design document” identified as the most important causes of delay among all the listed delays and ranked on the first place by

respondents from contractors and owners and sixth place by consultant group with the mean value of (4.06) or average relative importance index values of (RII=0.73). “Change orders by owner during construction.” Ranked second with the RII values of (RII=0.71), followed by “Slowness decision-making process” (RII=0.71) and “Delay in progress payment” (RII=0.71), then “Delay to furnish and deliver the site (RII=0.69). In the case of Wolkite Town, Nesru and Tadele (2020) investigated “The Causes and Effects of Building Construction Delays in Ethiopia, Southern Nation Nationalities of People Region in Gurage Zone” and found that economic conditions (inflation, currency, and LC), fluctuation in commodity prices are the main causes of delay. “Delays in approving shop drawing and sample materials” (RII=0.57), “Poor communication and coordination” (RII=0.57), “Conflict between joint- ownership of the project” (RII=0.52), “Suspension of work by owner” (RII=0.51).

Table 4.5 Consultant related delay

No.	Consultant Related Delays	Owner			Contractor			Consultant			Average		
		Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank
1	**Delays in approving major changes in the scope of work**	2.77	0.48	7	2.74	0.38	7	3.10	0.51	7	2.87	0.46	7
2	**Unclear and inadequate details in drawings**	3.77	0.65	5	3.51	0.59	2	3.77	0.67	4	3.68	0.64	5
3	**Delay in producing design document**	3.93	0.66	4	3.51	0.53	5	4.00	0.73	2	3.82	0.64	4
4	**Insufficient data collection and survey before design.**	3.93	0.71	3	3.33	0.56	4	4.00	0.73	2	3.76	0.67	2
5	**Delay in approval of submittals, design drawings, and sample materials, etc.**	4.13	0.75	2	3.82	0.65	1	4.03	0.73	1	4.00	0.71	1
6	**Delay in performing inspection and testing**	4.03	0.76	1	3.62	0.58	3	3.74	0.66	5	3.80	0.67	3
7	**In adequate experience of consultants.**	3.63	0.65	5	3.31	0.48	6	3.29	0.54	6	3.41	0.56	6
	Grand Mean	**3.74**	**0.67**		**3.41**	**0.54**		**3.71**	**0.65**		**3.62**	**0.62**	

The results presented in Table 4.5, shows that (7) causes of delays under consultants related delay in building construction projects. “Delay in approval of submittals, design drawings, and sample materials” (RII=0.71), “Insufficient data collection and survey before design” (RII=0.67),

"Delay in performing inspection and testing" (RII=0.67), "Delay in producing design document" (RII=0.64), "Unclear and inadequate details in drawings" (RII=0.64), "In adequate experience of consultants", (RII=0.56), "Delays in approving major changes in the scope of work" (RII=0.46).

Table 4.6 Contractors Related Delays

No.	Contractors Related Delays	Owner			Contractor			Consultant			Average		
		Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank
1	**Poor communication and Coordination**	4.20	0.77	5	3.44	0.56	7	3.90	0.67	7	3.85	0.67	6
2	**Delay in sub - contractor work**	4.27	0.83	3	3.49	0.61	4	3.74	0.70	4	3.83	0.72	4
3	**Inadequate contractors experience.**	3.37	0.57	12	3.03	0.47	13	2.97	0.48	15	3.12	0.51	14
4	**Deficiency in planning and scheduling of project**	3.60	0.58	11	2.77	0.41	15	3.81	0.68	6	3.39	0.55	11
5	**Poor safety conditions on site**	3.57	0.63	9	3.28	0.56	7	3.23	0.59	11	3.36	0.59	8
6	**Delays due to material delivery**	4.37	0.81	4	3.79	0.73	3	4.19	0.82	1	4.12	0.79	3
7	**Shortage of equipment**	3.90	0.68	7	3.18	0.53	10	3.23	0.52	12	3.44	0.58	9
8	**Rework due to errors during construction**	4.40	0.86	2	4.05	0.76	1	4.23	0.79	2	4.23	0.80	1
9	**Conflicts between contractor and other parties.**	4.47	0.90	1	3.97	0.74	2	4.16	0.76	3	4.20	0.80	2
10	**Difficulties in financing project**	3.77	0.68	7	3.46	0.58	5	3.39	0.63	8	3.54	0.63	7
11	**Under estimation of cost of**	3.17	0.48	15	2.85	0.41	14	3.19	0.52	14	3.07	0.47	15
12	**the project by contractor**	3.43	0.53	13	3.59	0.57	6	3.16	0.52	12	3.39	0.54	13
13	**Poor qualification of contractor's technical staff**	3.00	0.47	16	2.82	0.41	15	3.16	0.46	16	2.99	0.45	16
14	**Low productivity of labor**	4.20	0.75	6	3.44	0.56	7	3.81	0.69	5	3.81	0.67	5
15	**Shortage of labors**	3.77	0.61	10	3.05	0.48	12	3.58	0.61	10	3.47	0.57	10
16	**Poor site management and supervision**	3.43	0.52	14	3.05	0.49	11	3.55	0.61	9	3.34	0.54	12
	Grand Mean	**3.81**	**0.67**		**3.33**	**0.55**		**3.58**	**0.63**		**3.57**	**0.62**	

The results presented in Table 4.6, shows that (16) causes of delays under contractors related delay in building construction projects.), “Rework due to errors during construction” (RII=0.80), “Conflicts between contractor and other parties” (RII=0.80), “Delays due to material delivery” (RII=0.79), “Delay in sub - contractor work” (RII=0.72), “Low productivity of labor” (RII=0.67), “Poor communication and Coordination” (RII=0.67), “Difficulties in financing project” (RII=0.63), “Poor safety conditions on site” (RII=0.59), “Shortage of equipment” (RII=0.58), “Shortage of labors” (RII=0.57), “Deficiency in planning and scheduling of project” (RII=0.55), “Poor site management and supervision” (RII=0.54), “the project by contractor” (RII=0.54), “Inadequate contractors experience” (RII=0.51), “Under estimation of cost of” (RII=0.47), “Poor qualification of contractor’s technical staff” (RII=0.45).

Table 4.7 External Related Delays

No.	External Related Delays	Owner			Contractor			Consultant			Average		
		Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank
1	**Inflation and fluctuation of material prices**	3.80	0.63	3	3.36	0.46	5	3.42	0.51	6	3.53	0.53	5
2	**Unforeseen site conditions**	4.57	0.89	1	4.41	0.84	1	4.48	0.85	1	4.49	0.86	1
3	**Geopolitical and regional stability**	4.00	0.74	2	3.62	0.61	3	3.77	0.68	3	3.80	0.68	2
4	**Lack of site utilities or services such as water, electricity etc.**	3.60	0.59	4	3.64	0.66	2	3.71	0.70	2	3.65	0.65	3
5	**Changes in government regulations and laws**	3.47	0.59	4	3.18	0.51	4	3.23	0.52	5	3.29	0.54	4
6	**Unforeseen Weather conditions**	3.17	0.51	7	2.85	0.39	7	3.26	0.53	4	3.09	0.48	7
7	**Global financial crisis**	3.23	0.55	6	3.15	0.42	6	3.16	0.51	6	3.18	0.49	6
	Grand Mean	**3.69**	**0.64**		**3.46**	**0.55**		**3.58**	**0.61**		**3.57**	**0.60**	

The results presented in Table 4.7, shows that (7) causes of delays under external related delay in building construction projects. “Unforeseen site conditions” (RII=0.86), “Geopolitical and regional stability” (RII=0.68), “Lack of site utilities or services such as water, electricity” (RII=0.65), “Changes in government regulations and laws” (RII=0.54), “Inflation and fluctuation of material prices” (RII=0.53), “Global financial crisis”, (RII=0.49), “Unforeseen Weather conditions” (RII=0.48).

Table 4.8 Ranking of group causes

No.	Group Cause	Owner			Contractor			Consultant			Average		
		Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank
1	**Owners related Delay**	3.82	0.68	1	3.38	0.56	1	3.74	0.67	1	3.65	0.64	1
2	**Consultant Related Delays**	3.74	0.67	3	3.41	0.54	4	3.71	0.65	2	3.62	0.62	2
3	**Contractors Related Delays**	3.81	0.67	2	3.33	0.55	3	3.58	0.63	3	3.57	0.62	3
4	**External Related Delays**	3.69	0.64	4	3.46	0.55	2	3.58	0.61	4	3.57	0.60	4
	Grand Mean	**3.77**	**0.66**		**3.39**	**0.55**		**3.65**	**0.64**		**3.60**	**0.62**	

The relative importance index rank presented in Table 4.8 above shows that owner’s group of causes are the most contributing factors to project delay with the average relative importance index value equals to 0.64. Prakash and Joseph (2014) in their study identified contractor-related delays were ranked as the most important cause of delays, followed by client related delays, and consultant-related delays whereas in this study the most important causes of delays were listed as owners, consultants, contractors and external related delays. The consultant related causes (RII=0.62) ranked second, followed by contractor related causes (RII=0.617). The external factor related delay causes category demonstrated the least aggregated relative importance index of (RII=0.60).

The result of ranking order of group causes in the study of Werku and Jha (2016) based on their order of importance as: (1) Contractor ‘s related, (2) Material related, (3) Labour related, (4) Designer ‘s related, (5) Consultants/supervisors related, (6) Client related, (7) External related factors.

In this study delay attributes there were four major groups (Clients, consultants, contractors and external) related causes. Most of material and labour related causes are categorized under contractor related causes, and designer related factors under consultant related causes. Therefore, according to this categorization, owner related causes placed on the first place, followed by consultant related, and then contractors related, finally external related causes. The effects of delays in construction projects can be country specific" none of the studies is comparable to any other and each study has different rankings for the causes of delay and the groups as project characteristics are unique and may even be region specific. As project is unique endeavor, delay attributes to projects and their ranking may differ from country to country, region to region, even project to project.

4.8 Mechanisms to minimize delays in building projects

Table 4.9 Mechanisms to minimize delays

No.	project scheduling is a mechanism to minimize delays in building projects	Owner			Contractor			Consultant			Average		
		Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank
1	**Managing ineffective planning and scheduling Tools: -**												
1.1	Critical Path Method (CPM),	2.73	0.50	5	3.69	0.70	6	3.84	0.75	2	3.42	0.65	
1.2	Program Evaluation Review Technique (PERT),	2.73	0.49	9	3.85	0.71	3	3.81	0.72	5	3.46	0.64	1
1.3	Critical Chain Project Management (CCPM),	2.60	0.43	13	3.77	0.67	10	3.87	0.74	3	3.41	0.61	
1.4	Work Breakdown Structure (WBS) etc.	2.67	0.45	10	3.92	0.72	2	3.84	0.68	9	3.48	0.62	
	Grand Mean	2.68	0.47		3.81	0.70		3.84	0.72		3.44	0.63	

2	**Managing delay in progress payment by client Tools:**												
2.1	Cash flow forecasting	2.67	0.51	3	3.82	0.71	4	3.65	0.63	10	3.38	0.618	3
2.2	Robust cost management plant	2.60	0.43	13	3.69	0.69	7	3.65	0.72	4	3.31	0.616	
2.3	Risk management plan	2.57	0.52	2	3.67	0.73	1	3.65	0.70	8	3.29	0.648	
	Grand Mean	2.61	0.489		3.73	0.71		3.65	0.68		3.33	0.63	
3	**Managing change order during construction Tools: -**												
3.1	Expert judgment, meetings	2.67	0.45	10	3.69	0.67	9	3.48	0.60	12	3.28	0.573	4
3.2	Change control tools based on the project	2.60	0.50	5	3.64	0.66	11	3.45	0.54	14	3.23	0.568	
3.3	Organization and environmental constraints (PMB) and Quick	2.83	0.49	8	3.82	0.71	4	3.42	0.56	13	3.36	0.59	
3.4	Approval of major changes	2.97	0.53	1	3.79	0.68	8	3.61	0.63	11	3.46	0.61	
	Grand Mean	2.77	0.493		3.74	0.68		3.49	0.58		3.33	0.59	
4	**Managing poor Qualification, skill and experience of the contractors' staff Tools: -**												
4.1	Possess requisite competencies (Crawford, 2005)	2.47	0.45	10	3.41	0.62	14	3.68	0.72	5	3.18	0.59	2
4.2	Project stakeholders experience	2.67	0.50	5	3.56	0.65	13	3.77	0.71	7	3.33	0.62	
4.3	Regular training etc.	2.80	0.51	3	3.59	0.65	12	4.23	0.85	1	3.54	0.67	
	Grand Mean	2.64	0.487		3.52	0.64		3.89	0.76		3.35	0.63	
	Grand Mean	**2.68**	**0.48**		**3.70**	**0.68**		**3.72**	**0.69**		**3.364**	**0.62**	

From the analysis depicted on Table 4.9, we conclude that "Managing ineffective planning and scheduling" is appeared to have very high impact on minimizing delays in building construction projects with the mean value of 3.44. The relative importance indices and ranks of the (4) major mechanisms and their tools that are classified under the "mechanism to minimize delays in building construction projects" are shown in Table 4.6. The survey result shows that "Managing ineffective planning and scheduling tools" considered as the most important mechanism of Minimizing delay in building construction projects with the average Relative Importance Index equals to 0.63. Respondents from contractor party ranked "Managing ineffective planning and scheduling" on the first place and "Managing change order during construction" on second place with the grand mean value of 3.74. However, "Managing ineffective planning and scheduling" considered by respondents from consultant and owner parties and ranked second with the grand mean value of 3.84 and 2.68, respectively.

Under "Managing ineffective planning and scheduling" the tools were stated with "Critical path method" (RII=0.65), "Program evaluation review technique" (RII=0.64), "Critical chain project management" (RII=0.61), "Work breakdown structure" (RII=0.62). According to (PMI, 2013), the tools and techniques of project management that can be applied to enhance planning and scheduling of projects are Critical Path Method (CPM), Work Breakdown Structures (WBS), Critical Chain Method (CCM), Precedence Diagram Method (PDM), Program Evaluation Review Technique (PERT) and Gantt Chart.

"Managing poor qualification, skill and experience of the contractor's staff" appeared to be on the second place in minimizing delays in building construction projects with the grand mean of 3.35. Under "Managing poor qualification, skill and experience of the contractor's staff" the tools were stated with "Regular training etc." (RII=0.67), "Project stake holder experience" (RII=0.62), "Process requisite competencies" (RII=0.59). The potential staff should be scrutinized for the needed experience for the implementation of the project and each team member may be screened to be sure they all possess requisite competencies needed to complete tasks or activities allocated to them within the system (Crawford, 2005). Again, Regular training can be provided for the project team members to build their capacity and soft skills (PMI, 2013).

"Managing delays in progress payment by clients" appeared to be on the third place in minimizing delays in building construction projects with grand mean of 3.33. Under "Managing delays in progress payment by clients" the tools were stated with "Risk

management plan" (RII=0.648), "Cash flow forecasting" (RII=0.618), "Robust cost management plant" (RII=0.616). A robust cost management plan can be applied to solve the issue of delay in headway imbursement by the project's client. By adapting to the use of effective cost management plan, policies, procedures and documentation for planning, managing and controlling project cost including cash flows needed for the project can be determined from the outset of the project (PMI, 2013).

According to the survey result, "Managing change order during construction" ranked on the last part with in the 4 major parts of mechanisms to minimize delays in building construction projects with the grand mean of 3.32. Under this part the tools were stated with "Approval of major changes" (RII=0.61), "Organization and environmental constraints (PMB) and quick" (RII=0.59), "Expert judgment, meetings" (RII=0.573), "Change control tools based on the Project" (RII=0.568). To reduce this issue causing unwanted delay in construction projects, this problem may be managed by using project management tools like expert judgment, meetings and change control tools based on the project organization and environmental constraints (PMI, 2013).

The grand mean value of all mechanisms of this group equals to 3.36. Among the respondents of the three groups (clients, consultants, and contractors), consultants gave the highest mean value for this group of mechanisms which is equals to 3.72.

CHAPTER FIVE

SUMMARY OF MAJOR FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of major findings

It was also revealed that, delays in government construction projects can be managed by considering project management principles, and problems such as ineffective planning and scheduling could be managed using tools and techniques like work breakdown structure (WBS); Critical Path Method (CPM); Program Evaluation Review Techniques (PERT) and others. Delay in progress payment by client problem could be solved by employing tools such as cash flow forecasting, robust cost management plan and risk management plan. Change order during construction could be managed by using tools like expert judgment-; meetings and change control tools and finally the problem of poor qualification, skill and experience of the contractor's staff by engaging the service of competent consultant and training of staff regularly.

5.2 Conclusions

From overall results it was found that delays in revising and approving design document, change order by owner during construction and slowness decision making process were found to be the top three causes of delay which are client related. The analysis also resulted top three delay factors which are caused by consultants which are delay in approval of submittals design, drawing and sample materials, insufficient data collection and survey before design and delay in performing inspection and testing. Rework due to errors during construction, conflicts between contractor and other parties and delay due to material delivery were considered as major delay causes that were caused by contractors. Unforeseen site condition, geopolitical and regional stability and lack of site utilities or services such as water and electricity were the top major causes of delay in building construction projects related by external factors.

Project delay is still happening and will continue to happen in the construction for various reasons. Delays are inevitable; however, they can be avoided or minimized when their causes are effectively identified and analyzed. The objective of this research was to identify factors that cause building projects and evaluate their effects while identifying the mechanism to minimize delay in Building Construction projects. A literature review and expert interviews

were conducted to identify the causes of delay. A compiled list of 38 delay attributes were identified and 4 major effects and the mechanisms of minimizing delays in building projects were listed on the questionnaire for further quantitative evaluation in a questionnaire survey to confirm the causes and to identify the most important causes of building construction project delay. The most important causes of delay identified with their respective mechanisms of minimizing by the survey through questionnaire and the results were analyzed for the overall view and for each of the three major parties in construction who participated in the questionnaire (clients/owner, consultants, and contractors) separately to make an overall view of the causes of delay in road projects.

5.3 Recommendation

Delays are a part of the construction projects, however, they can be avoided or minimized when their causes are effectively identified and analyzed. Based on the above-mentioned results and findings of this study, the following points can be recommended as ways to minimize and control delay in building construction projects.

5.3.1 Client Related Recommendations

- Engaging closely with both consultants and contractors to understand and know that design changes during construction period have no adverse effects on the critical activities to avoid causing delays.
- All change order demands must be evaluated to assess their impact on quality of work envisaged, scope and cost, possible claims and disruption to work so as to avoid unnecessary disputes and litigation.
- Approving any payment issues in time to the contractors to avoid having interest penalty clauses invoked and to facilitate the progress of works to ensure timely completion of the construction projects.

5.3.2 Consultant Related Recommendations

- Ensuring proper site investigation is carried out both during the feasibility study and the conceptual design to guarantee that suitable steps are taken care of throughout the detailed design to minimize work suspension during the construction phase to solve design difficulties.

- Implementing all design changes while following each and every critical change of design towards the project during the execution of the works while not compromising the desired outcome of the final project.

5.3.2 Contractor Related Recommendations

- Having adequate experience for a required assignment, deploy competent project team and employ appropriate construction methods for the required assignment to avoid any delay towards the project.
- Hiring a qualified and responsible subcontractor. The subcontractors must be involved with a proper contractual agreement with a contractor that can transfer risk from contractor to subcontractors.
- Having a good site manager for a smooth execution of works and planning their works properly and provide the entire schedule to clients for smooth flow of the construction project while avoiding any delay.
- Good communication channel must be used by the contracting parties to entire free flow of information to avoid delays.

5.3.4 External Related Recommendations

- Collaborating with all project stakeholders to ensure that all issues are resolved during the construction phase in order to prevent delaying the intended execution time throughout the litigation process.
- By doing a proper planning in the design and execution time to avoid any unanticipated occurrences that may extend the construction duration, raise costs, and cause property damage and injury to project participants. Having insurance could help to reduce the effect of costs in the event of delay occurrence.

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APPENDIX-A

Questioner

ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

Department of Project Management

Assessment on the Causes of Project Delay in Building Construction Projects; The Case for Ethiopian Construction Works Corporation

This questioner is to be filled by the clients, contractors and consultants who are responsible in the project. The purpose of this study is to assess the overall causes of delay in the building construction project in the case for Ethiopian Construction Works Corporation. The questionnaire is meant to secure relevant data to the study & has no intention except is solely for academic purpose and its confidentiality is maintained. Therefore, your valuable support in responding to the question raised is of paramount importance to the success of the study. Hence, I sincerely request you to fill the questionnaire so carefully. The quality and quantity of information you provide determines the ultimate of the study. Thank you in advance for your every cooperation.

N.B:

- ✓ There is no need to write your name.
- ✓ For open-ended questions, a space is provided, if the space is not sufficient, please use the back of the paper or separate paper which ever suits you.
- ✓ Close ended questions are answered by placing check mark of the blank space.

Please tick (□) on the systems which are in use to handle the physical resource management in your company.

The rating is organized in five measure of weighting you ordered them as follows;

Rating Scale	Very High	High	Moderate	Low	Very Low
	5	4	3	2	1

1. General Information

Please check which most accurately describes:

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

1.1. Organization type

1. Owner
2. Contractor
3. Consultant

1.2. Respondent gender

1. Male
2. Female

1.4. Educational Background

1. TVET/ Diploma
2. 1st Degree
3. 2nd Degree
4. PhD

1.5. Experience in Building construction work (in years)

1. 1-5
2. 6-10
3. 11-15
4. 16+

1.6. Job Designation

1. Project Manager
2. Quality Manager
3. Project Office Engineer
4. Site Engineer
5. Surveyor
6. Supervisor

   Other, Specify_____

2. Factors that cause building projects delay in Ethiopian Construction Works Corporation

A Likert scale is used to scale responses in which to identify delays and their impacts to the Building Construction Projects.

Rating Scale	**Very High**	**High**	**Moderate**	**Low**	**Very Low**
	5	**4**	**3**	**2**	**1**

I. Owners Related Delays

The result of factors of client related delays.

No	**Causes of Delays**	Strongly agree	Agree	Moderate	Disagree	Strongly disagree
1	Delays in revising and approving design document					
2	Change orders by owner during construction.					
3	Delays in approving shop drawing and sample materials.					
4	Slowness in decision making process.					
5	Poor communication and coordination.					
6	Conflict between joint-ownership of the project					
7	Delay to furnish and deliver the site.					
8	Delay in progress payment.					
9	Suspension of work by owner.					

I. Contractors Related Delays

No	**Causes of Delays**	Strongly agree	Agree	Moderate	Disagree	Strongly disagree
1	Poor communication and Coordination					
2	Delay in sub - contractor work					
3	Inadequate contractors experience.					
4	Deficiency in planning and scheduling of project					
5	Poor safety conditions on site					
6	Delays due to material delivery					
7	Shortage of equipment					
8	Rework due to errors during construction					
9	Conflicts between contractor and other parties.					
10	Difficulties in financing project					
11	Under estimation of cost of the project by contractor					
12	Poor qualification of contractor's technical staff					
13	Low productivity of labor					
14	Shortage of labors					
15	Poor site management and supervision					

3. Consultant Related Delays

No	**Causes of Delay**	Strongly agree	Agree	Moderate	Disagree	Strongly disagree
1	Delays in approving major changes in the scope of work					
2	Unclear and inadequate details in drawings					
3	Delay in producing design document					
4	Insufficient data collection and survey before design.					
5	Delay in approval of submittals, design drawings, and sample materials, etc.					
6	Delay in performing inspection and testing					
7	In adequate experience of consultants.					

4. External Related Delays

No	**Causes of Delay**	Strongly agree	Agree	Moderate	Disagree	Strongly disagree
1	Inflation and fluctuation of material prices					
2	Unforeseen site conditions					
3	Geopolitical and regional stability					
4	Lack of site utilities or services such as water, electricity etc.					
5	Changes in government regulations and laws					
6	Unforeseen Weather conditions					
7	Global financial crisis					

1. What are the factors that majorly challenges you not to minimize the project delay?

……

4. Mechanisms to minimize delays in building projects

Rating Scale	Strongly Agree	Agree	Moderate	Disagree	Strongly Disagree
	5	4	3	2	1

NO	Do you agree that project scheduling is a mechanism to minimize delays in building projects	1	2	3	4	5
1	Managing ineffective planning and scheduling Tools: -					
1.1	Critical Path Method (CPM),					
1.2	Program Evaluation Review Technique (PERT),					
1.3	Critical Chain Project Management (CCPM),					
1.4	Work Breakdown Structure (WBS) etc.					
2	Managing delay in progress payment by client Tools: -					
2.1	Cash flow forecasting					
2.2	Robust cost management plant					
2.3	Risk management plan					
3	Managing change order during construction Tools: -					
3.1	Expert judgment, meetings					
3.2	Change control tools based on the project					
3.3	Organization and environmental constraints (PMB) and Quick					
3.4	Approval of major changes					

4	Managing poor Qualification, skill and experience of the contractors' staff Tools: -					
4.1	Possess requisite competencies (Crawford, 2005)					
4.2	Project stakeholders experience					
4.3	Regular training etc.					

1. What are the current practices that is being implemented to minimize project delay in ECWC?

   ……