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Factors of Project delay: In the Case of the Gibe III Hydroelectric Power Project.

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FACTORS OF PROJECT DELAY: IN THE CASE OF THE GIBE III HYDROELECTRIC POWER PROJECT.

BY

KIRUBEL NEGUSSU

A THESIS SUBMITTED TO ST. MARY'S UNIVERSITY SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFLIMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER IN PROJECT MANAGEMENT.

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Endorsement

This thesis has been submitted to St Mary's University School of Graduate Studies for examination with my approval as a university advisor.

June 11, 2021

Muluadam Alemu (Ph D)

Advisor

Signature and Date

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List of Abbreviations and Acronyms

SI – Salini-Impregilo

EEP – Ethiopian Electric Power

DEC – Dang Fang Electric Corporation

SPSS – Statistical Package for Social Science

COCOMO – Constructive Cost Model

LOF – Lack of Finance

IQP – Inadequate Quality Procedure

DC – Design Change

UC – Unforeseeable Circumstances

IPP – Improper Project Planning

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Abstract

This paper studied factors that caused delay to the GIBE III hydroelectric power project. Using data collected from 63 former and current employees of the GIBE III Hydroelectric Power Project. Accordingly, the ranks of delay factors are as follows. Lack of finance, Improper planning, Inadequate quality procedure, Design change and unforeseeable circumstances. The research study considered a population of 75 to collect data using census survey. Structured questionnaire and secondary data were also used to collect data. The Data were analyzed using multiple linear regression method. Subsequently, it was determined that Lack of Finance (LOF), Inadequate Quality Procedure (IQP), Design Change (DC), Unforeseeable Circumstances and Improper Project Implementation had negatively impacted the GIBE III hydroelectric power project by causing delay to the project.

Keywords: *GIBE III Hydroelectric Power Project, Factors of Delay, Project Delay, Ethiopia.*

CHAPTER ONE: INTRODUCTION

1.1. Background of the study

In a given project, project length often serves as a benchmark for assessing the performance of a project and the efficiency of the project organization (Hammadi & Nawab, 2016). A project is said to be successful on timely completion. The time required to complete project is often more than the specified time in the contract. Subsequently, time extensions or delay happen due to many reasons such as design changes or errors, economic conditions, resource availability and performance of project parties. Assaf and Al-Hejji, (2006) in their study define delay as "the time overrun either beyond completion date specified in the contract, or beyond the date that the parties agreed upon for the delivery of the project.

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. Project delays are always measured as expensive to all the parties involved and it has been seen that very often it results in claims, clash and total desertion. 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 Project delay can be accounted at the beginning from the initial conception of the project to the signing of the contract between the owner and the contractor. Additionally, it can also be faced during the execution phase of the project. Therefore, 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 really important for avoid any loss to the contractor.

The primary challenge of a project is the handling of constraints to meet the desired goal where one aims to honor the primary constraints of time and budget to produce quality result (ECIDP, 2014; Warszawski, 1996). In order to achieve this objective, project duration must be managed well in order to minimize the impact of delay towards the project. Subsequently, the mismanagement of project duration can negatively impact the project progress and result in delayed delivery time, cost and poor quality of works Gajewska and Ropel (2011).

So while delays affect a project in a numbers of aspects, Cost Overrun is a primary impact and mismanagement of the project is a secondary impact. Choudhry (2004) defined Cost Overrun as the difference between the original cost estimate of project and actual construction cost on completion of works of a project. Cost-overrun has the ill effect of affecting the financial viability of the project. The problem of cost-overrun will get more compounded if the finance necessary to meet the increased cost cannot be arranged in time. Any delay in arranging for the finance needed to meet the cost overrun will only further tend to increase the cost and this may land the project in trouble leading eventually to the death of the project and the project may not take off (Adhikarib, 2002).

Subsequently the study takes the GIBE III Hydroelectric Power Project as a case study. The GIBE III Hydroelectric Power Project is a 1,870 MW hydroelectric power project constructed on the Omo River in Ethiopia's Southern Nations, Nationalities and People's Region State (SNNPRS). The project was launched in July 2006, with the first unit starting its running generation in September 2013. Nevertheless the project was inaugurated in December 2016. Therefore the project endured a three year delay from the project inception date to the inauguration date. Accordingly, this research study examined factors of delay that caused delay to the GIBE III Hydroelectric Power Project.

1.2. Statement of the Problem

Despite the assumption project completion does adhere to its respective timeframe, the inability to complete projects on time and within budget continues to be a chronic problem worldwide and is worsening (Ahmed, *et al.,* 2002). Subsequently when contextualizing this phenomenon to the Ethiopian context, according to the study conducted by (Hareru & Neeraj, 2016) the reason for such completion date irregularities points to difficulty in financing the project, escalation of material price, ineffective project planning, scheduling or resource management, delay in progress payment and lack of skilled professionals. Additionally, (Abubeker, 2015) reveled that delay to deliver site (right of way problem), financial problems, improper planning, weather condition and unrealistically imposed contract duration found to be chronic problems. Subsequently, exceeding beyond the designed completion date of a project, forking up large sums of delay payment as well as poor contract administration are results of above factors. The rational for conducting the current study comes from consideration of Ethiopia's ambition to venture into large renewable energy projects to accommodate the need of electricity to its citizens. As such, performing the study on the GIBE III Hydroelectric power project given its magnitude and being the current biggest hydroelectric power project, findings linked to the subject matter can be beneficial for future hydroelectric power projects to be developed. Following that, the study tries to investigate delay factors in the GIBE III Hydroelectric Power Project.

1.3. Research Question

The research questions are the following.

1. What are the factors of project delay in the GIBE III Hydroelectric Power Project?
2. What are the steps taken from stakeholder in the project to curb project delay?

1.4. Objective of the study

1.4.1. General Objective

The main objective of this study is to find out factors that caused project delays in the GIBE III Hydroelectric Power Project.

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1.4.2. Specific Objectives

The specific objectives of this research are.

- ✓ To examine the relationship between lack of finance and the project completion
- ✓ To examine the relationship between Inadequate Quality Procedure and the completion of the project
- ✓ To examine the relationship between Design Change and completion of the project.
- ✓ To examine the relationship between Unforeseeable Circumstances completion of the project.
- ✓ To examine the relationship between improper project implementation and completion of the project.

1.5. Research Hypothesis

Based on the research model, the following hypotheses were formulated to test "factors of project delay that impacts management control and quality" or to measure the correlation between the impact of project delay on management control and quality. Subsequently, the dependent variables are conceptualized independently as impacts caused from delay on management control and quality. Hence on management control we have the following.

H1: Lack of finance has a significant negative impact on project completion.

H2: Inadequate Quality Procedure has a significant negative impact on project completion.

H3: Design Change has a significant negative impact on project completion.

H4: Unforeseeable Circumstances has a significant negative impact on project completion.

H5: Improper Project Implementation has a significant negative impact on project completion.

1.6. Significance of the study

This study possibly helps the Ethiopian Electric Power (EEP) to recognize major factors of project delay which impacts the execution of the project. Subsequently, the findings of this study can yields tools and techniques to mitigate the impacts resulting from project delay in future hydroelectric power projects. Subsequently, given the growing development of future project in this sector in the country, the findings and recommendations of this study are instrumental for the government, donors as well as policy makers to design policies that are suitable and applicable to mitigate potential impact stemmed from project delay.

1.5. Scope and Limitation of the Study

The study was restricted to concentrate on examining the determinants of project delay. The scope of the research is to carry out the conceptual and practical review on impact of project delay on management control and quality. Subsequently the research tries to investigate the impact project delay resulted in mega projects such as Hydroelectric Power Projects in Ethiopia specifically the GIBE III Hydropower project. Ultimately, the research takes this context into consideration to develop the mitigation methods to prevent significant impact resulting from project delay.

1.6. Organization of the study

The structure of the study was organized into five (5) interdependent chapters, and followed the following outline. Chapter one discuss about the background of the research, statement of the problem, the research aims, research questions, objectives, and hypothesis. Chapter two covers the related literature review. Chapter three discusses with the methodology that was used in this specific study during conducting the research. Chapter four explains the result and discussion and chapter five states the conclusions and gives recommendations as well as direction for future study.

CHAPTER TWO: REVIEW OF LITERATURE

This chapter serves as the foundation for the development of the research study. Therefore, the main purpose of this chapter is to give theoretical and empirical understanding in assessing project delay with regards to its impact on management control and quality. Based on that, a conceptual and analytical framework for the research was developed. In particular, the literature review focuses on related literatures regarding project planning, project length or duration estimation, objectives of project duration estimation, concept of project delay, the possible effect of project delay on the relationship with management control and quality.

2.1. Theoretical literature

2.1.1. Project Planning

Project planning has been defined as “the process of selecting the greater method as well as order of work to be used on a project among various methods and sequences in which it could be done” (Callahan, *et al.,* 1992). According to Arıkan and Dikmen (2004), the main purpose of planning is to provide the primary duties of the manager, namely, direction and control.

Planning is also defined as trying to anticipate what will happen and devising ways of achieving the set of objectives and targets. Needless to say, in the concept of planning there are always objectives to be reached in the future. Furthermore planning is a process during which efforts and decisions are made to achieve the goals at the desired time in the desired way. Accordingly, the process of planning supplies detailed information that will be used for time estimation and schedule in addition to being a baseline for project control. Mubarak (2005) states that project planning works for several functions such as: cost estimating, scheduling, project control, safety management, etc. The second objective of planning is to organize all the relationships and information systems among the many parties involved in the construction project. The third function of planning is to enable project control and forecasting. Smith (2002) emphasizes the importance of careful and continuous project planning in realizations of a project success. Furthermore, he also notes that the activities of designers, producers, suppliers, workers and contractors, along with their resources must be coordinated and integrated with the objectives of the contractor.

Oberlender (2000) stated that planning coordinates all works of the construction to reach a completed quality project. The basic benefit of project planning and scheduling is to be used as an effective tool of preventing some of the problems like delays in work, cost overrun or decline in productivity and principally puts in order the desired results of project planning and scheduling. Subsequently the results that are desired are to finish the project on time, continuous (uninterrupted) flow of work (no delays), reduce the amount of rework (least amount of changes), minimize confusion and misunderstandings, increase knowledge of status of project by everyone, meaningful and timely reports to management, run the project instead of the project running you, gain knowledge of scheduled times of key parts of the project, gain knowledge of distribution of costs of the project, accountability of people, defined responsibility/ authority, clear understanding of who does what, when, and how much and integrate of all work to ensure a quality project for the owner.

2.1.2. Project Duration Estimation

Project duration estimation is a critical stage in project planning. It requires the ability to predict how long it will take to perform a certain task. However, a potential bias in time estimation prevails. In the psychology literature, it is known as the planning fallacy, i.e., the tendency to underestimate the amount of time needed to complete a given project, or overestimate the amount of work that can be completed within a given time frame Pychyl, Morin and Salmon (2000). Buehler, Griffin and Ross (1994) claimed that planning fallacy occurs because individuals focus primarily on the future, i.e., how they will perform the task, what steps they will take and so on, and ignore past experiences, when making predictions about future outcomes. However, Burt and Kemp (1991) proposed predicting task durations from knowledge about the durations of categories of tasks, and claimed that memory plays a vital role in the process. All the same, as many duration estimation models are based on memory or categories, they are claimed to be inaccurate, inconsistent, unreliable, and usually lead to project failure (Chatzoglou & Macaulay, 1996).

An alternative approach for duration estimation is based upon mathematical models. In these models, the dependent variable is the task duration, or its cost, and the independent variables are technical parameters of the task and the experience of the individuals performing the task. A well-known example for duration and cost prediction model used in software projects is the Constructive Cost Model COCOMO (Boehm et al., 2000). The effort, expressed in labor-months, required for a software project is:

$$E = a_b \, KLOC^{b_b}$$

$$D = c_b \, E^{d_b}$$

Where

E is the effort applied in person-months

D is the development time in chronological months

KLOC is the estimated number of delivered lines of code for the project (expressed in thousands)

The coefficients a_b and c_b and the exponents b_b and d_b with specific values.

2.1.3. The objective of Project duration/estimation.

After a successful planning process, the schedule of the project will be prepared. There are major objectives that are expected from good project scheduling. According to Mubarak (2005) there are eight important objectives of scheduling. Those are, to calculate the project completion date, calculate the start or end of a specific activity, expose and adjust conflicts between trades or subcontractors, predict and calculate the cash flow, evaluate the effect of changes, improve work efficiency, resolve delay claims and finally serve as an effective project control tool.

A project schedule is viewed as a valuable project control tool for Project Managers to successfully conduct construction projects (Trauner, Manginelli, Lowe, Nagata & Furniss, 2009). Trauner, *et al.* (2009) further explain the basic purposes of a project schedule as effectively depicting the construction plan to the project participants, permitting management to control and measure the progression of the work, and finally accommodating the participants with information for timely decisions. Callahan, *et al.* (1992) claim that the probabilities of on-time, on-budget, and dispute free completion may be increased by means of a schedule and the purpose of the schedules is specified by the individual using the schedule. The authors further explain that the purpose to predict project completion for contractors is that they can arrange crew sizes, shifts or equipment to speed or slow progress. While, for architects or engineers the purpose is to determine how long design and construction will take for completion of the project. The authors add that subcontractors use the information of specific activities‟ start and finish times to predict when they are needed at the site. Also, the activity completion dates are used by owners in order to decide when to deliver owner-furnished equipment and to coordinate partial occupancy. Another purpose of scheduling for contractors is to reveal and resolve conflicts between firms or subcontractors. Both for contractors and owners schedules are used to plan cash flow.

Callahan, *et al.* (1992) indicated that schedules are used for measuring delay and time extensions. If the schedules are regularly updated including work sequences, unanticipated delays, actual activity completion dates and change orders, then the owner and contractor can measure the effect of additional works and unanticipated delays, thus avoiding disputes.

2.1.4. Understanding project delay

Baldwin and Manthei (1971) investigated delay causes in building projects in the United States. Sullivan and Harris (1986) examined delay causes in large construction projects in the United Kingdom. Kaming, *et al.,* (1997) analyzed the causes of time and cost overruns in high rise construction projects in Indonesia. Odeh and Battaineh (1999) investigated delay causes in large construction projects in Jordan. In most of the above investigations, the causes identified for project delay included design changes, poor labour productivity, and inadequate planning. Furthermore, previous studies showed that delays can be caused by owners, planners/designers, contractors, or acts of God. However, most studies focused mainly on identifying delay causes in the construction phase, rarely emphasizing on the planning and design phases. McManus, *et al*., (1996), who evaluated delay causes in architectural construction projects, concluded that many delays manifest during all project phases and primarily occur during the construction phase; however delays that start in the design phase include inadequate schedule control by architects, inability of owners to review design in a timely manner, late incorporation of emerging technologies into a design, and ineffective coordination and/or inclusion of project user groups. Project can be defined as a discrepancy where actual completion of the project exceeds the planed period according to the contract (Chabota, *et al.,* 2008).

Basu (2005) identified factors at the start of a project that almost certainly lead to project delays and provided insight into the reasons for the delay and their impact on schedule. Toor and Ogunlana (2008) based on their studies in construction delays in Thailand, they have found that the problems faced by the construction industry in developing economies like Thailand could be: (a) shortages or inadequacies in industry infrastructure (mainly supply of resources); (b) caused by clients and consultants and (c) caused by contractor's incompetence/inadequacies. Chan and Kumaraswamy (2008) conducted a survey to determine and evaluate the relative importance of the significant factors causing delays in Hong Kong construction projects. They analyzed and ranked main reasons for delays and classified them into two groups: (a) the role of the parties in the local construction industry (i.e. whether client, consultants or contractors) and (b) the type of projects. Results indicated that five major causes of delays were: poor site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, client initiated variations and necessary variations of works.

2.1.5. Types Project delay

Delays related to construction projects are caused as a result of a number of factors. Ahmed, *et al.* (2003) grouped delay in two broad categories: the internal causes which come from parties involved in a particular contract; and external ones come from the proceedings that exceed the party's control. These include the act of God, actions of the government, as well as material supplies. Scott (1993) identified three categories of delays namely; employer‘s responsible delays; contractors responsible delay and external delays.

However, Ahmed, *et al*, (2003) and Ochoa (2013) believe that, delay can be grouped to be under concurrent, excusable, and non-excusable delays. In addition, Trauner, *et al.* (2009) came out with an opinion based on study conducted that construction delays could be as: non-excusable or excusable, non-concurrent or concurrent, non-critical or critical, and non-compensable or compensable.

2.1.5.1. Excusable non-excusable delays

Construction delays are basically either excusable or non-excusable. Callahan, *et al.* (1992) and Trauner, *et al.* (2009) claim that whether a delay is excusable or non-excusable depends on the clauses in the contract. The standard construction contracts specify types of delay that will allow the contractor to an extension of time. For instance, in some contracts, unexpected or unusual weather conditions are not considered as excusable and so these contracts do not allow for any time extensions. According to Trauner, *et al.* (2009) an excusable delay, in general, is owing to an unforeseeable event beyond the contractors or the subcontractor's control. Accordingly, GIBE III Hydroelectric Power Project has experienced this specific type of delays. The authors further explain that delays resulting from the following issues are known as excusable:

- General labor strikes,
- Fires,
- Floods,
- Acts of God,
- Owner-directed changes,
- Errors and omissions in the plans and specifications,
- Differing site conditions or concealed conditions,
- Unusually severe weather,
- Intervention by outside agencies,
- Lack of action by government bodies, such as building inspection.

In another study, Levy (2006) added two more excusable delays to the above list as:

- Illness or death of one or more of the contractors,
- Transportation delays over which the contractor has no control.

Moreover, Kelleher (2005) supplied the above list with two more delays as:

- Epidemics,
- Quarantine restrictions.

Mubarak (2005) defined non-excusable delays as "delays that are either caused by the contractor or not caused by the contractor but should have been foreseen by the contractor". He also points out that a non-excusable delay does not entitle the contractor to either a time extension or monetary compensation. Trauner, *et al.* (2009) enumerated some examples of non-excusable delays as follows:

- Late performance of subcontractors,
- Untimely performance by suppliers,
- Faulty workmanship by the contractor or subcontractors,
- A project-specific labor strike caused by the contractor's unwillingness to meet with labor representatives or by unfair labor practices.

2.1.5.2. Compensable versus non –compensable delays

With Non-compensable delays, Ahmed, *et al.* (2003) and Mubarak (2005) grouped both excusable non-compensable and that of the compensable and determined that the delays that are compensable are caused by the client or the designer (i.e. architect/engineer). In the event such as this, the contractor may be given an extension of time or the opportunity will be given to him to reclaim for cost relating to the delays or both. Mubarak (2003); Ahmed, *et al.* (2003); Trauner, *et al.* (2009); and Ochoa (2013) established that, for an excusable delay, one can classify it as excusable non-compensable as well as excusable compensable. Delays that are compensable result either through the client or the architect/engineer as Mubarak (2005) opines. Trauner (2009) claimed that, factors specified within the terms of the contract that causes delays like contradictory site conditions are the factors that regardless of them being excusable they do not render to the contractor any compensation. According to Mubarak (2005), delays that are excusable non-compensable are usually above the client or the 18 contractor's control like fire, conflicts, labour unrest, weather conditions, national cries etc. Trauner, *et al.* (2009) stressed that whether delays are non-compensable or compensable, it depends essentially on the contract condition. The contract condition will have some effect on the kinds of delays which require extension of time or fiscal compensation.

2.1.5.3. *Concurrent Delays*

Levy (2006) described this type of delay to be an overlapping one. The author identified concurrent delays to be generated by either the clients or the contractor. Levy (2006) further stressed that, when these delays happen the two parties are held accountable where none of the two parties can repossess damages. Concurrent delays comprise of more than one independent cause that occur in the same frame of time (Mubarak, 2005). These delays sometimes include non-excusable and excusable delays.

2.1.5.4. *Critical or Non-Critical Delays*

While several authors (Mubarak, 2005; Kelleher, 2005; Levy, 2006) categorized delays into three groups as Excusable and Non-excusable, Compensable and Non compensable and Concurrent and Non-concurrent; certain authors (Trauner, *et al.*, 2009; Callahan *et al.*, 1992) added one more category to these three groups which is Critical and Noncritical delays. According to Trauner, *et al.*, (2009) and Callahan, *et al.*, (1992), the primary focus in any study of delays in a project is to see if the delay affects the progress of the entire project or the project completion date. Subsequently they stressed that, delays in which the outcomes cause an extension in the time of the project is considered to be non-critical delays while having no effect on the project completion. On the other hand, Trauner, *et al.* (2009) claimed that challenge of critical delays result from the forecast of a critical path method. All projects have what is called critical path and should it happen that these critical undertakings along the path as they delayed then the completion of the project date ought to be extended. The researchers believe that the critical factors used in determining the date of completion of a project are contractor‘s duration as to the critical path‘s activities, the project itself, the project‘s physical restraints, and the activity sequence and phasing.

2.1.5.5. *Summary of Causes of Construction Project Delays*

Studies that are related to delays in construction projects have shown that most of the causes of delays are commonly global, like, bad supervision, delay in carrying out payment certificate over a task performed, inadequacy of a client‘s fiscal resources, poor management of site by contractors, project cost underestimation, problem of access to bank credit; variations orders; design and specifications errors; poor communication among parties; delays in works of subcontractors; slow making of decision; incomplete or lack of adequate document before starting work; price fluctuation of materials; delay by statutory authorities etc.

Effective time control is challenged by different factors. Nevertheless, often times according to (Olawale & Sun, 2010), the top five factors inhibiting effective project time control in African countries descending order are: design changes, inaccurate evaluation of projects time/duration, complexity of works, risk and uncertainty associated with projects and ill-performance of subcontractors and nominated suppliers. Likewise, Kasimu and Abubakar (2012) conducted delay study in the Nigerian construction industry and identified the top five factors that influence delay in ascending order as improper planning, lack of effective communication, design errors, shortage of supply like steel, concrete and slow decision making. Mengistu (2010) showed that project controlling supportive techniques and software are not applied well for the control of actual and planned activities in the Ethiopia construction sector and recommends the significance of training requirement for the concerned project staff. Similarly, Abadir (2011), found out that among the knowledge areas of project in Ethiopia, project time management is considered the critical one with only 24% projects managed well.

2.2. Empirical Literature

Empirical finding are one of the important components of the literature review in the research study. This type of literature contribute a lot to the effectives of the investigation under study by revealing the gap what the researcher wants to find out and how the researcher under take the study. This helps the researcher by providing insight about how and what with respect to the research he/she stand for.

2.2.1. Lack of finance and project completion

According to Zaporsky (2007), financial difficulty is defined as getting into a situation where a respondent's credit is adversely impacted, such as not paying bills. Contractor's financial difficulties are defined as the contractor not having sufficient finds to carry out the construction works. This includes payment for the materials, labourers salaries and equipment to be used for the construction works. According to Kaming *et al* (1997), one of the most important factors causing delays in high-rise projects in Indonesia is the shortage of resources. In addition, Noulmanee *et al* (1999) investigated the causes of delays in highway construction in Thailand and concluded that one of the main causes of delays is the insufficient resources of an organization. A survey by Ubaid (1991) concluded that the contractor's resources are the major measures on the contractor's performance that cause delays. The resources include financial resources, human resources, material resources and equipment resources. However, only the financial resources are focused in the research, as Abdul-Rahman *et al* (2006) addressed that lack of funds may affect the project's cash flow and lead to delay in site possession, which consequently causes delays in the project as whole. The factors that would cause insufficient financial resources are (1) difficulties in obtaining loan from financiers and (2) allocation of government budget not in place.

2.2.2. Inadequate quality procedure on project completion

Quality failures were identified and analyzed according to two major categories: the impact and frequency of quality failures. In terms of the impact on cost, Mills, Love, and Williams (2009) found quality failures deplete construction projects with an increase in direct cost. Also, quality failures can impact on energy performance. Quality failures in the construction stage are acknowledged as causes of the mismatch between the energy performance as predicted in design documents and as measured in operation Alencastro, Fuertes and de Wilde (2018).

Some studies were conducted that evaluated and ranked quality failures from the frequency perspective. Forcada *et al.* (2012) identified common quality failures in new building construction like incorrect fixtures and incomplete tile grouting. Georgiou (2010) refined and ranked the various quality failures to find significant quality failures like cracks to grout.

Many researchers in different regions have identified various causes of quality failures. Love *et al*. (2010) showed that the changes in the design documents are likely to happen on construction projects and to cause quality failures. In India, Dixit *et al.* (2017) introduced one of the leading causes as poor coordination between various trades in construction projects. Additionally, Shanmugapriya and Subramanian (2015) indicated that the non-conformance to codes and standards in the process was ranked first, which influences quality negatively in India. In Spain, Forcada *et al*. (2012) attempted to show that bad craftsmanship is the typical cause for the quality failures. Also, Forcada *et al.* (2014) continued to show that poor craftsmanship is more likely to cause technical faults than non-conformance materials or products used. Kakitahi *et al.* (2011) described inadequate communication, graft, and a dishonesty environment as the three substantial causality factors to cause quality failures in Uganda. The causes of quality failures can be explained by defining causes as stemming from internal or external Sustainability 2019, 11, 4203 4 of 23 to the project. Internal causes are those causes that originated within the projects, such as incomplete design documents and poor craftsmanship. While external causes are originated outside the projects, such as culture environment and the natural environment.

In the context of China, Gang *et al.* (2016) claimed that the inappropriate treatment of the external wall is most likely to happen. Chen *et al*. (2016) and Liu 2015 observed the quality failures in the existing building renovation, such as the wrong dimension of opening doors and windows, and the invalid fill between the frame and window panes. Qiao (2014) regarded the cracks as universal quality failures during the external wall renovations. Wang (2012) gave recommendations on the technical level regarding the quality failures of the renovations of the external wall during the construction processes. Due to the novelty of building energy renovation projects, specific quality failures have not been yet treated in the academic literature in a systematic way in the Chinese context. Even with the consideration of the previous studies worldwide, quality failures and their sources, frequency, impacts, and causes in building energy renovation projects have still not been fully identified in China.

2.2.3. Design change of a project and project completion

Nearly all projects go through assorted changes from the design stage right through to construction. These various changes have considerable impacts during the lifecycle of a project, which may be minor or major according to the result of the change. However, the impacts are always being underestimated by construction practitioners (Olawale & Sun, 2010). Design changes in construction projects will inevitably lead to cost overrun or schedule delay (El-Razek, Bassioni, & Mobarak, 1995; Kaming, Olomolaiye, Holt, & Harris, 1997; Le-Hoai, Lee, & Lee, 2008; Owalabi et al., 2014). Overruns in project schedule and project cost are key principles for a successful project that adversely impacted by design changes (Chan & Kumaraswamy, 1996; Frimpong et al., 2003).

A study by Cox, Morris, Rogerson and Jared (1999) revealed that design changes often have a major impact on the client objectives in construction projects where the cost associated with post contract award design changes typically amount about 5% to 8% of the contract value. Another study by Chang (2002) reported that cost increased on average of 24.8% and schedule increased on an average of 69% based on four sampled projects in California as a result of design changes. Chang, Shih, and Choo (2011) reported that design changes has resulted in an increased in redesign cost of 2.1% to 21.5% and on average 8.5% of the construction change cost. Similarly, a study by Burati et al. (1992) found that 79% of rework costs arising in industrial engineering projects were the result of design changes, errors and omissions. Williams, Eden, Ackermann and Tait (1995) also reported that design changes and delays in design approval would have caused delay to the project. Undoubtedly, design changes are on-going problems that continue to raise concerns in the construction industry.

Project changes have obvious impacts on the construction process, not only on the project's schedule and cost but also on the project's performance, e.g. labour efficiency (Hanna et al., 1999). Several studies on causes of delays and cost overruns in construction projects have highlighted design changes as major contributing factor. Kaming et al. (1997) studied influencing factors on thirty one high-rise project in Indonesia and found that design changes is one of the most important factors causing time overrun. This claim is further supported by studies of Apolot, Alinaitwe, & Tindiwensi (2013) in Uganda, Rosenfeld (2013) in Israel, Yang, Chu, & Huang (2013) in Taiwan, Ijaola & Iyagba (2012) in Nigeria, Alnuaimi et al. (2010) in Oman, Le-Hoai et al. (2008) in Vietnam, Assaf & Al-Hejji (2006) in Saudi Arabia, Sweis, Sweis, Hammad, & Shboul (2008) in Jordan, Kartam, Al-Daihani, & Al-Bahar (2000) in Kuwait, and Ogunlana et al. (1996) in Thailand. The findings from previous studies in several parts of the world are consistent that design changes impose significant detrimental effects to time and cost performance of construction project. However, the author failed to recognize any published research from Malaysia that supports this proposition.

2.2.4. Unforeseeable Circumstances and project completion

Construction projects as human-oriented projects are more exposed to failure because human interaction with the complex systems makes the situations more complicated. In this essence, Akintoye and Macleod (1997) argue: "Those within the construction industry are continually faced with a variety of situations involving many unknown, unexpected, frequently undesirable and often unpredictable factors." In a similar vein , Loosemore (1998,b) states that on account of the fact that future conditions in construction industry are progressively affected with uncertainty and interrupted by the unexpected events, construction organizations are becoming progressively susceptible to crisis.

Thevendran and Mawdesley (2004) conducted a research in construction industry of Malaysia to find out how construction practitioners consider human risk factors. They define human risk factors as "Individual, project team and organization factors which influence the behavior of people and the climate at work, in a way which can increase or decrease productivity of a construction projects". They conclude that while the human element is the most influential construction risk, there is a lack of an effective process to manage this significant risk factor.

On the other study pertinent to the crisis in construction projects, Hällgren and Wilson (2008) discovered that unexpected events can come from a wide range of completely unanticipated sources such as a guerrilla attack in a construction site. In that case, the project manager with no means could predict the incidents or respond in appropriate way because the unexpected events caught him off guard. Hällgren and wilson (2008) believe: "The idea behind the risk management is to be forewarned is to be forearmed", and for this case we can see obviously how far it is impossible to be equipped in advance; or in other words, author Salman Rushdie says: "One of the extraordinary things about human events is that the unthinkable becomes thinkable" .

Construction practitioners unlike the other industries are not regarding human risk factors deservedly and thus have been suffered from their actions greatly (Thevendran and Mawdesley, 2004). Additionally, the prevalent uncertainty existing in construction industry related to producing a unique product in a pre-determined time indicates that the type of construction crises is often unpredicted and unexpected. Along with this, Reid (2000) concludes crises are unavoidable either for small or large corporations, since human element is interfering. Interestingly, Hällgren and Wilson (2008) direct our attention to the occurrences of these incidents in spite of the existence of risk management process in projects.

2.2.5. Improper Project Implementation and project completion

The inability to complete projects on time and within budget continues to be a chronic problem worldwide (Ahmed et al., 2000). According to Azhar and Farouqui (2008) observation that the trend of cost overruns is common worldwide. As the construction industry continues to grow, so do planning and budgeting problems. This is because it is common for projects not to be completed on time and within the initial project budget. There are quite many examples at the national and international scene. For instance, most of the construction projects in Ethiopia have had problems with time and cost overruns and this has caused a lot of concern (Becker and Behailu, 2006).

Different researchers have studied the main causes of delay derived from the lack of proper project implementation in the construction industry. Lo et al. (2006) summarized some of the studies that took place from 1971 to 2000, presented as follows. Baldwin et al. (1971) identified in the United States reason for delay. Those are inclement weather, shortages of labor supply, subcontracting system. Arditi et al. (1985) identified in Turkey reasons for delay. Those are shortages of resources, financial difficulties faced by public agencies and contractors, organizational deficiencies, delays in design work, frequent changes in orders/design and considerable additional work. Okpala and Aniekwu (1988) as well as Mansfield et al. (1994) identified in Nigeria reason for delay. Those are shortages of materials, failure to pay for completed work, poor contract management, improper financial and payment arrangements, poor contract management, shortages of materials, inaccurate cost estimates, fluctuations in cost Semple et al. (1994) identified in Canada reasons for delay. Those are increases in the scope of the work, inclement weather and restricted access. Al-Khal and AlGhafly (1999) in Saudi Arabia identified reasons for delay. Those are cash flow problems/financial difficulties, difficulties in obtaining permits and “lowest bid wins” system. Al-Momani (2000) in Jordan identified reasons for delay. Those are poor design, changes in orders/design, inclement weather, unforeseen site conditions and late deliveries. Lo et al. (2006) in Hong Kong identified reasons for delay. Those are inadequate resources, unforeseen ground conditions, exceptionally low bids, inexperienced contractor, work in conflict with existing utilities, poor site management and supervision and unrealistic contract duration. Abubeker (2015) in Ethiopia identified reasons for delay. Those are delay to deliver the site (Right of way problem), financial problems; Improper planning, Weather condition, unrealistically imposed contract duration.

2.3. Conceptual framework

Given the theoretical as well as empirical literature review, the following conceptual framework has been developed. Subsequently, project delay is a prominent denominator that either impact project negatively or positively depending on its completion time against its envisaged duration. The investigation will focus on how project delays impacts management control and quality. The conceptual framework of the study was developed from the above literature review taking into consideration different authors findings (Olawale & Sun, 2010; Abubakar, 2012; Mengistu, 2010; Abadir, 2011). The study was guided by this conceptual framework.

Independent Variable (Factors of delay)

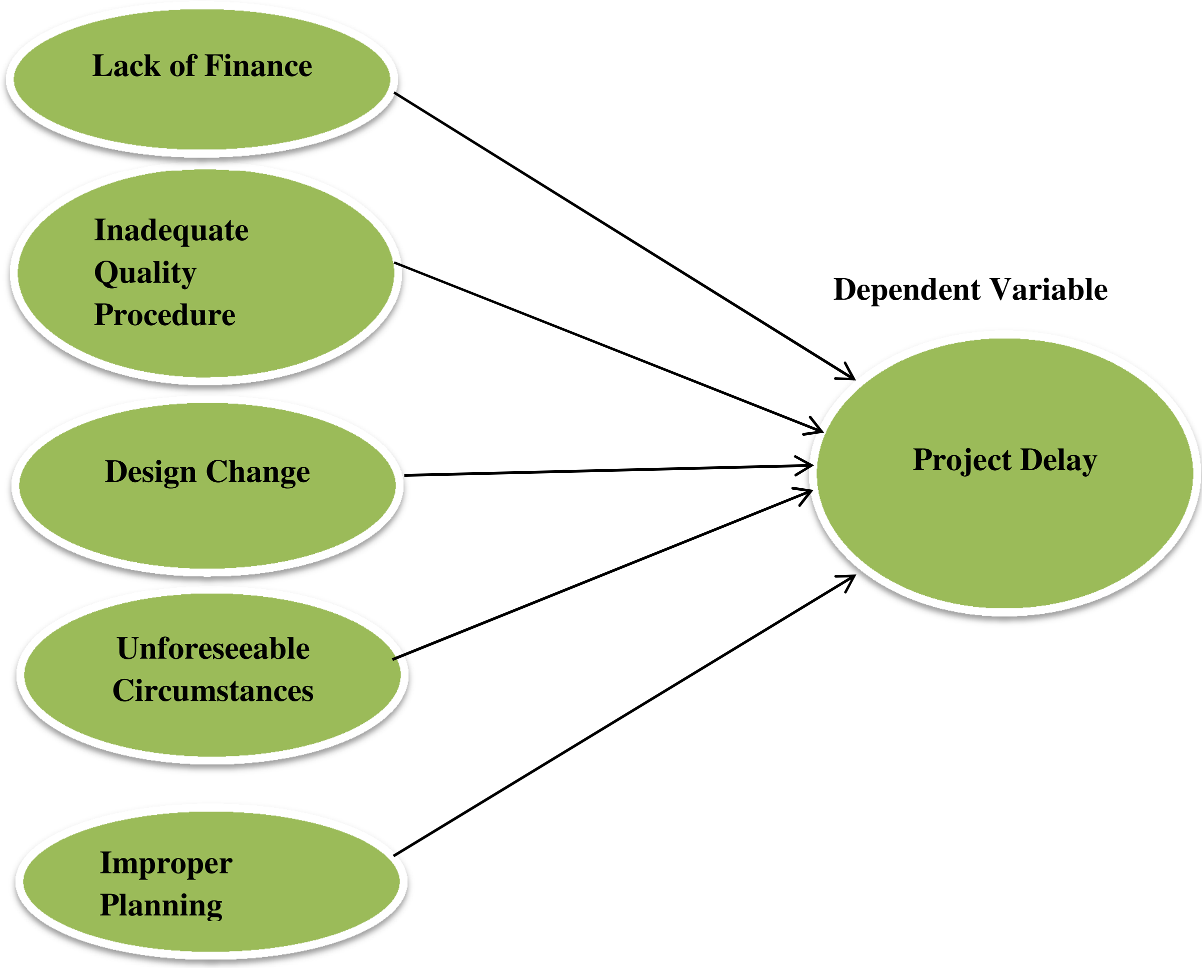
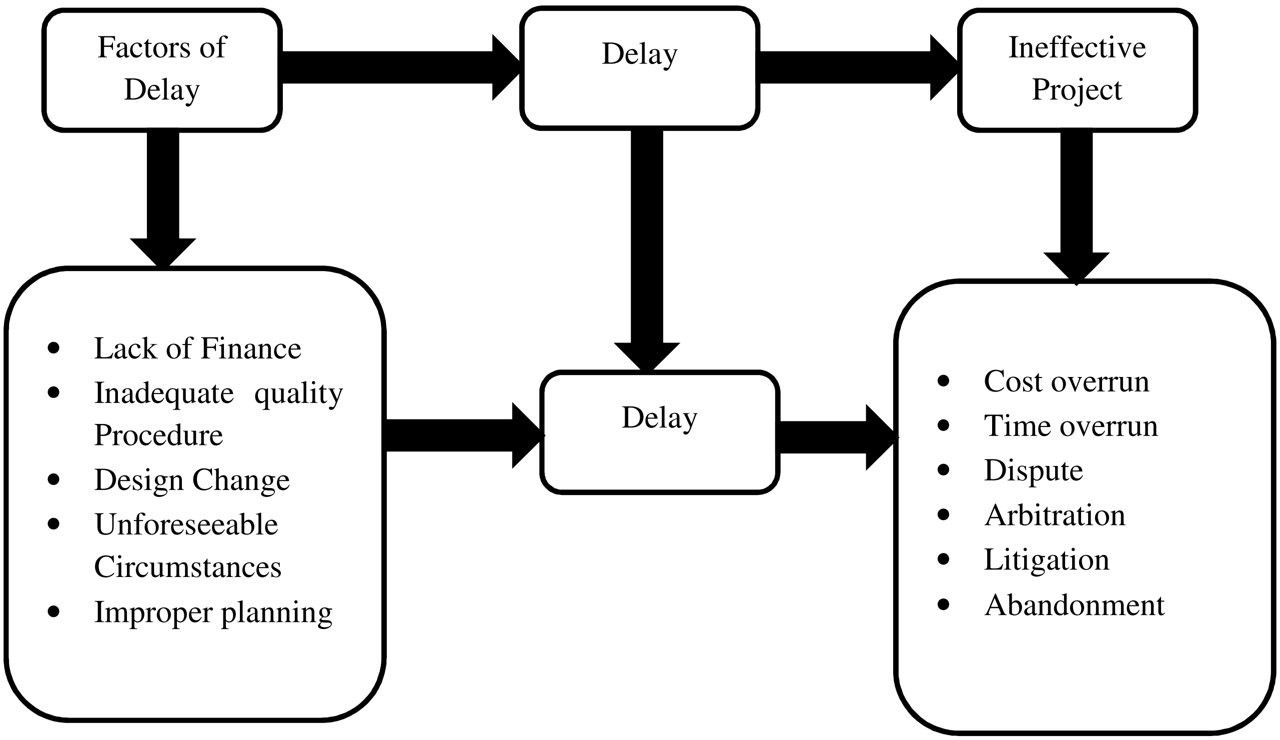


Figure 2.1: Conceptual framework of factors of delay.

2.4. Analytical framework

The aim of this section is to summarize the idea about past literature and to bring out the contributions for this study area. Thus, this part starts with the idea generated and the contribution follows. The general idea from the past literature shows that there is a relationship between delay causing factors and construction delay; and also, there are delay effects consequently. The relationship between construction delay and delay causing factors can be conceptualized at a fairly general level, depicted in Figure 1, as two stage relationships where a set of casual factors are categorized based by the responsible body which in turn determine the outcome in terms of effects of delay in construction. The framework is developed from works of two different authors. Abdella et al (2002) who categorized delay causing factors in eight groups and Sambasivam et al (2007) who identified six effects of delay.

Figure 2.2: Analytical frame work of the study.



CHAPTER THREE: RESEARCH DESIGN AND METHODS

This chapter presents how the current study was designed and provides a clear description of the specific steps that were taken to address the research problem and mechanism applied to test the hypotheses.

3.1. Research Approach and Design

The study intends to carry out by assessing factors of project delay in the GIBE III Hydroelectric Power Project. The cause and effects (casual) relationship between the variables will be evaluated throughout the study. Subsequently the above approach makes the explanatory research design appropriate for the study. Accordingly, structured questionnaires in the form of closed ended and open ended questions are used. Those data that are quantifiable are gathered by applying closed ended questions using the linkert scale which is designed to keep the respondents in scope. On the other hand, data's that are unquantifiable are expressed in the form of open ended questions to allow the respondents to have the liberty of expressing what they believed is relevant data to the study from their perspective. Leedy and Ormrod (2001) and; Williams (2011) described the research methodology as the holistic steps researchers employ in embarking on a research work. Reasonably, the combination of quantitative with qualitative methods of data collection in research has become a common practice for greater understanding and validation of results (Bryman, 2006). Accordingly, based on the above reasoning, the research study used the mixed method research approach.

3.2. Population, Selection of Participants

In the GIBE III Hydroelectric Power Project there were two contractors that were carrying out the task at hand and the client who is following the work. As such, the civil work was carried out by the contractor Salini-Impregilo (SI) while the electromechanical and hydraulic steel structure works was carried out by Dong Fong Electric corporation (DEC). Provider of construction and civil engineering services in Italy, the company engages in the development and sale of properties and also specializes in the construction of large buildings and infrastructure. On the other hand, Dongfang Electric Corporation Limited is primarily engaged in the business of manufacture and sale of main thermal power equipment, main hydro power equipment and AC/DC motors which are used in large-scale coal-fired, gas-fired, and nuclear power plants and wind power generation sets, as well as provision of engineering and repairing services. Aside from that there is Ethiopian Electric Power (EEP) who is the owner who follows up the progress of work.

Accordingly, in the GIBE III Hydroelectric Power Project, during its peak time, there were close to eleven thousand employees. Nevertheless, the relevant targeted population that can provide essential data purposively only considered those who were closely engaged in the construction activity such as quality controls, production, technical support team and laboratory testing teams. Thus, the total population that were appropriate to provide reliable information for the research was found to be 75. Accordingly, censes survey was employed to collect data given the fact that all the populations were considered to be sampled.

3.3. Data collection

The data was collected through structured questionnaire. Purposive sampling methodologies were employed to focus on those that are relevant responders. Secondary data sources from company archives were used in a restricted manner to help support certain findings. Potential respondent are located in various parts of the country as well as outside of the country. Thus, primary data is collected through structured and semi structured questionnaires which were sent out via email address to the selected sections of heads. Subsequently, the sections of heads they themselves participated in answering as they also distributed the questioners to their subordinates.

3.4. Data Analysis

The analyses process integrated both the quantitative and qualitative methods of data analysis techniques. Subsequently the analysis of the study for this research was carried out using statistical tools such as correlation and multiple regressions. Descriptive analysis has been applied to describe respondents' characteristics such as gender, age, education level and years of experience. Following that, Pearson Correlation analysis was applied to assess the presence of significant relationship between factors of delay presented and delay. Furthermore, multiple regression analysis was performed using the method of statistical package for social science (SPSS) version 24 to verify the relationship between the independent variable i.e factors of delay and the dependent variable which is delay. However, prior to implementing the types of multiple regression analysis to use, the dependent variable in both cases was checked whether or not it is normally distributed. Based on the result, the dependent variables in both cases were normally distributed and the standard multiple linear regression analysis was implemented to test the hypothesis.

Accordingly, tables were employed to present the data. Subsequently, based on the conceptual model of the study expressed in Figure 2.2, mathematically the relationship between delay factors and project delay is expressed using the multiple regression equation models as the following:

$$Yi = \alpha + \beta 1(IP) + \beta 2(LOF) + \beta 3(PI) + \beta 4(PME) + \beta 5(UC) + e$$

Where; Yi = PD = Project Delay.

IP = Improper Planning.

LOF = Lack of Finance.

PPI = Poor Project Implementation.

PME = Poor Monitoring and Evaluation.

UC = Unforeseeable Circumstances.

α = is the intercept term

β1 refer to the coefficient of the independent variable (Improper planning)

β2 refer to the coefficient of the independent variable (Lack of finance)

β3 refer to the coefficient of the independent variable (Poor Implementation)

β4 refer to the coefficient of the independent variable (Poor Monitoring and Evaluation).

β5 refer to the coefficient of the independent variable (Unforeseeable Circumstances) e = model error term

Based on the above mathematical model the developed hypotheses were tested taking into consideration the significance level of each constant parameter in multiple regression analysis.

3.5. Validity

Validity refers to the extent to which the research measures what it claims to measure. Kumar, (2005) as cited by Ndegwa, (2013) defines validity as the degree to which the researcher has measured what he set out to measure. It is a determinant factor that measures if the study accurately reflects the truth. Validity therefore is whether an instrument is on target in measuring what is expected to measure. In order to validate the instrument of the validity of this research, the researcher the adviser was considered as the expert and agreed whether the instrument was valid or not. The instrument was subjected to face validity, content validity test and construct validity test through testing it using the research done in the past.

3.6. Reliability

In quantitative research, reliability refers to the capability to reproduce the result of a study. Joppe (2000,) defines reliability as the extent to which results are consistent over time and an accurate representation of the total population under study. For example, if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable and demonstrates internal consistency. Subsequently Cronbach's alpha coefficient is the most frequently used index of reliability test to see if multiple-question Likert scale surveys are reliable. As such value of Cronbach's alpha coefficient above 0.70 is regarded as acceptable according to (Sekaran, 2003 as cited by Sirbel, 2012) to ensure reliability. So, as shown in Appendix B, the Cronbach alpha value for this study has a value of 0.967 which is considered to be excellent and demonstrates internal consistency.

$$\alpha = \frac{n}{n-1}\left(1 - \frac{\sum_i V_i}{V_t}\right)$$ (Cronbach, 1951, p. 299)

Where

n is the number of test item

ΣV_i is sum of item variance

V_i is the variance of total score

Table 3.1: Cronbach's Alpha for total questionnaire.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.967	0.968	73

Source: Own Survey (2021)   n= 73

3.7. Ethical considerations

The primary responsibility of the researcher is to preserve and protect the confidentiality of the research participants Leedy and Ormrod, (2010). Subsequently, the respondents in the study were guaranteed of confidentiality of the information they provided. In order to guarantee the level of confidentiality, it was not mandatory for the respondent to provide their names. Rather it was left as optional for them to release that information. No respondent was forced to participate except those that voluntary agreed to do so. The researcher maintained the up most integrity and commitment while conducting the research avoiding any distortions and misleading data manipulation. The researcher reported the research findings in a complete and honest manner, without confusing others about the nature of the results. Therefore the study will not raise any ethical anxiety.

CHAPTER FOUR: RESULTS AND DISCUSSION

This chapter presents the result and discussion of questionnaires that were distributed regarding the delay factors in the GIBE III Hydroelectric Power Project. Subsequently, this chapter examines and analyses the data gathered from the questionnaire administered. The procedure used in analyzing the results has aimed at establishing the perceived causes of factor of delay to the project under study.

3.8. Characteristics and Profiles of Respondents

The respondents were categorized mainly into two groups, namely contractors and clients which were implementing agencies and financiers.

Table 4.1: Response rate of the structured questionnaire.

Group	Distributed	Returned	Valid	Valid among distributed in percentage
Contractor	43	41	41	95.3 %
Clients	27	22	22	81.4 %

Source: Own Survey (2021)

Table 4.1 above indicates that the response rate of the questionnaire survey for contractors and clients are 95.3 % and 81.4 % respectively. According to Sekaran (2001), a response rate of 30% is acceptable for most studies. Therefore as the response rate of this study is more than what is referred as adequate by Sekaran (2001), the response rate considered adequate for the study.

3.9. Characteristics of the Respondents

The characteristics of the respondents based on the collected data are presented in table below followed by interpretations. Frequency analysis was conducted for the profiles related to the general information about the respondents. This information includes the gender of the respondents, education level of the respondents, Job status of the respondents and working experience of the respondents.

Table 4.2: Characteristics of the respondents

No	Characteristics of respondents	Type	Frequency	%
1	Gender of respondents	Male	54	85.70%
		Female	9	14.30%
2	Education Qualification	Masters	15	23.80%
		Degree	44	69.80%
		Diploma	2	3.20%
		Certificate	0	0.00%
3	Job Status	Managers	14	22.20%
		Supervisors	8	12.70%
		Engineer	41	65.10%
		Forman	0	0.00%
4	Work Experience	1 to 10	24	38.1%
		10 to 15	39	61.9

Accordingly, as shown in the table 4.2, the gender of the respondent's shows that out of the 63 participants, 54 (85.7%) were males and only 9 (14.3%) were females. This tells us that most of the data presented are gathered mainly from the male point of view. The account of females is nearly insignificant. With regards to education qualification, 15 (23.8%) were master degree holders, 44 (69.8%) were first degree holders; and diploma/certificate holders were 2 (3.2%). Consequently, this demonstrates that majority of the respondents are well educated and provides reliable information. When it comes to job status, out of the

63 respondents, 14 (22.2%) of them are managers, 8 (12.7%) of them are supervisor while the remaining 41 (65.1%) are engineers. Based on the given description, the respondents have hold positions that can provide helpful information that can help to make sensible analysis of the study. The fact that majority of the respondents have held positions described above gives the confidence that they are knowledgeable about the information that they are providing.

Finally the work experience of the respondents revels that, the data implies that out of the total 63 respondents 24 (38.1%) have < 10 years of experience while 25 (39.7%) and 14 (22.2%) of them have < 15 and > 15 experience respectively. Again this data tells that most of the participants are most knowledgeable with regards to the work that was being carried out and can give informative data.

3.10. Ranking the factors associated with delay.

Based on the different delay factors extracted and combined from different literatures to serve as a structured questioner shown in Appendix I, The respondents were asked to rate with likert scale for factors causing delay on the GIBE III Hydroelectric Power Project. The responses were collected with the help of structured questioner of 32 delay factors extracted from literatures among the three classified categories. That is delay factor resulted from management control and quality and finally mitigation method of project delay.

The data in Table 3 shows the ranking of delays factors based on their mean values. According to the ranking, the presumed factors of delays are lack of finance (LOF) with a mean value of 4.40. Improper Project Planning (IPP) with a mean value of 3.68. Inadequate Quality Procedure (IQP) with a mean value of 3.42. Design Change (DC) with a mean value of 3.37 and Unforeseeable Circumstances (UC) (mean = 3.34).

Clearly in the GIBE III Hydroelectric Power Project, finical constraints were the major benefactor to cause the project to go beyond the designed date of completion. Both the client and the contractor management in regards failed to facilitate the required finance to complete the project on time. Accordingly, the client was not able secure any foreign banks to lend towards the project whereas the contractor failed to deliver on its promise of facilitating foreign banks that could lend the necessary finance to complete the project. Following that improper planning contributed its own share towards the delay. The two main contractors at times were having difficulties in communication have resulted the coordination works to suffer. In turn, this influences the completion of the project to some extent. Accordingly this finding is in line with (Hareru & Neeraj, 2016) and (Abubeker, 2015) where ineffective project planning, financial problems unrealistic contract duration is among the problems that causes delay.

Table 4.3: Ranking of factors of delay.

Management Control Related Delay Factor		
Code	**The Delay Factor**	**Mean**
LOF	Lack of Finance	4.40
IPP	Improper Project Planning	3.68
IQP	Inadequate Quality Procedure	3.42
DC	Design Change	3.37
UC	Unforeseeable Circumstances	3.34

Source: Own Survey (2021)

3.11. Result and Discussion of Inferential Statistics

Five point likert scale for both factors of project delay as well as impact of project delay was used as a measurement technics.

3.11.1. Normal Distribution Test

The dependent variables for both impact of management control as well as quality was checked and conformed that it is normally distributed as shown in the Tables 5 and 6 respectively. Hence, by analyzing the Skewness and Kurtosis as well as Shapiro-Wilk's for the respective dependent variables, it was determined that they both have a non-statistically significant values where (P>0.05) under the Shaprio-Wilk's results (Shapiro &Wilk, 1965; Razali & Wah, 2011) and skewness of 0.389 (SE 0..302) and a Kurtosis -0.322 (SE 0.595) for impact of delay on management control and a Skewness of 0.305 (SE 0..302) and a

Kurtosis -0.345 (SE 0.595) of impact of delay on quality. This demonstrated that the dependent variables are normally distributed. Based on this result, the Standard Multiple Linear Regression Analysis is performed to assess the hypothesis.

Table 4.4: Skewness and Kurtosis of factors of delay

Descriptives		Statistic	Std. Error
PD	Skewness	-.353	.302
	Kurtosis	0.205	0.595

Source: Own Survey (2021)

Table 4.5: Test of Normality for factors of delay.

Tests of Normality	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
[redacted]	0.081	63	0.200	0.982	63	0.051
a. Lilliefors Significance Correction						

Source: Own Survey (2021)

3.11.2. Multiple Linear Regression Analysis and Hypothesis Test Result

In Table 4.6, the Adjusted R Square value explains by how many percent the model explains the dependent variable. In the case of management control, the model explains 76.8 % of the variance in the dependent variable which is statistically significant as indicated by the p (sig) value that is 0.000. The remaining 21.4% is determined by other factors.

Table 4.6: Model Summary showing R Square Value for factors of delay.

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change
1	.887[a]	0.786	0.768	0.37878	0.786

a. Predictors: (Constant), IPP, LOF, DC, IQP, UC

Source: Own Survey (2021)

Under the table 4.7 labeled coefficients, the collinearity statistics reveled that there is no multiple correlations among the independent variables which rules out multicollinearity among the independent variables. As shown in table, the collinearity statistics revels that the values for the tolerance and VIF of the independent variables are greater than 0.1 and less than 10. The tolerance collineraity statistics explains how much of the variability of the independent variables are not explained by any of the other independent variables. Whereas the VIF is the variance inflation factor which is the inverse of the tolerance value. As a result, both of these statistics gives us an inclination that we do not have mulitcollinearity among the independent variables.

Subsequently, the tolerance and VIF values for factors of delay are LOF = .833 & 1.200, IQP = .441 & 2.267, DC = .401 & 2.497, UC = .426 & 2.347 and IPP = .508 & 1.968. Accordingly the tolerance values are all above 0.1 while the VIF values are all under 10.

Table 4.7: Coefficients value for factors of delay.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-0.299	0.433		-0.690	0.493		
	LOF	0.278	0.089	0.210	3.134	0.003	0.833	1.200
	IQP	0.442	0.071	0.578	6.265	0.000	0.441	2.267
	DC	0.292	0.250	0.250	2.329	0.023	0.401	2.497
	UC	0.278	0.101	0.259	2.763	0.008	0.426	2.347
	IPP	0.258	0.052	0.019	0.222	0.006	0.508	1.968

a. Dependent Variable: PD

Source: Own Survey (2021)

According to table 4.7, under the coefficients the unstandardized coefficients gives us the beta coefficients assigned for each independent variable in the multiple linear regression equation. Whereas the standardized coefficient expresses the level of contribution each independent variables made towards the dependent variables. At the same time, the P values of each independent values which are expressed by (sig) in the tables below determines whether or not to reject the null hypothesis (H_0) of each independent variables hypothesis that is being tested in both cases. Subsequently, given the fact that this is a sig. (1-tailed), if P is < 0.05, the hypothesis made is statistically significant and the null hypothesis can be rejected.

Hypothesis 1:

H_1= Lack of finance has a statistically significant negative impact on management control.

From the result displayed in Table 9, the multiple regression shows that P = 0.003. So P is < 0.05. This demonstrates that Lack of Finance is statistically significant. As such, Lack of Finance had negatively affected the project completion time and caused delay. Thus the proposed hypothesis was accepted. This result agrees with Chabota, *et al.* (2008) who studied the Zambian road construction sector which revealed that protracted financial processes (67%) and financial difficulties (60%) are rated among the top major causes of delay. Similarly financial constrains was a major problem that the GIBE III Hydroelectric project encountered.

Hypothesis 2:

H_2 = Inadequate Quality Procedure has a statistically significant negative impact on quality.

As displayed in Table 12 above, the multiple regression result revels that $P = 0.000$. Hence $P < 0.05$ shows that Inadequate Quality Procedure is statistically significant. As such Inadequate Quality Procedure had affected the project negatively and caused delay towards the project. Thus the proposed hypothesis was accepted. This agrees with Chism and Armstrong (2010) where no proper inspection/supervision, inadequate site inspection and poor quality control are causes to compromise quality of work hence extending duration of work. Further Shanmugapriya and Subramanian (2015) indicated that the non-conformance to codes and standards in the process was ranked first, which influences quality negatively in India.

Hypothesis 3:

H_3 = Design Change has a statistically significant negative impact on management control.

As presented in Table 10 above, the multiple regression result demonstrates that $P = 0.023$. Thus, $P < 0.05$ shows that Design Change is statistically significant. Accordingly, Design Change during the project had negatively affected the project and caused delay towards the project. As a result, the proposed hypothesis was accepted. Subsequently from the study carried out by Odeh and Battaineh (1999) on large construction projects in Jordan, we see that the causes for project delay included design changes, poor labor productivity, and inadequate planning. Additionally, from the study conducted by Kaming et al. (1997), the study investigated influencing factors on thirty one high-rise project in Indonesia and found that design changes is one of the most important factors causing time overrun.

Hypothesis 4:

H_4 = Unforeseeable Circumstances has a statistically significant negative impact towards management control.

As shown in Table 9 above, the multiple regression result that P = .008. Thus, P is < 0.05 which demonstrates that Unforeseeable Circumstances is statistically significant. As a result to that, Unforeseeable Circumstances had affected the project negatively and caused delay to the project. Thus the proposed hypothesis was accepted. This concurs with .Akintoye and Macleod (1997) where they argue: "Those within the construction industry are continually faced with a variety of situations involving many unknown, unexpected, frequently undesirable and often unpredictable factors." In a similar vein, Loosemore (1998) states that on account of the fact that future conditions in construction industry are progressively affected with uncertainty and interrupted by the unexpected events, construction organizations are becoming progressively susceptible to crisis.

Hypothesis 5:

H_5 = Improper Project Planning has a statistically significant negative impact on management control.

As presented in Table 6 above, the result of the multiple regressions reveled that P = 0.006. Thus, P > 0.05 which shows that improper implementation was statistically significant. Based on the test, the test revealed that Improper Project Planning negatively affected the project and caused delay subsequently, the proposed hypothesis was accepted. At the same time, other study finding such as Olawale and Sun (2010) agrees with the hypothesis where they explained inaccurate evaluation of projects duration is the second most important factors inhibiting effective project time control related to improper project planning. Similarly, Kasimu and Abubakar (2012) argued that improper planning is 1st out of 43 factors causing delay in the Nigerian construction sector and Bertin (2011)'s study in Cameroon showed lack of project planning is ranked in the top three important causes of time delay.

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CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter includes the conclusions and recommendations that would help in solving the occurrence of delay and its relative impact during the construction of the GIBE III Hydroelectric Power Project here in Ethiopia. The main objective of this study was to determine the actual delay causing factors during the construction of the project. Subsequently, it is also to recommend mitigation so that significant impact won't be induced on the project.

3.12. Summary and Conclusion

The main objective of the study was to investigate how lack of finance, inadequate quality procedure, design change, unforeseeable circumstances and improper project planning has impacted the GIBE III Hydroelectric Power Project. Subsequently, the study implied that the above delay factors had adversely impacted the project. In order to make sure these factors truly delayed the project, the integrity and reliability of the analysis was checked. Hence as it can be seen from Table 3.1, the questioner used was reliable and acceptable based on the Cronbach's Alpha result of 0.968.

In order to make sure data gathered are informative and sensible, Table 4.2 demonstrates the characteristics of the respondents. As it can be seen from the table, 23.8% are masters, 69.8% are degree holders and only 2% are diploma holders. Furthermore, more importantly as Table 4.7 indicated that the identified delay factors based on their P value that they are statistically significant when it comes to delaying the project. As such the main groups of delay and their sub-groups that have delayed the GIBE III Hydroelectric Power Project are follows.

A. LACK OF FINANCE RELATED DEALY FACTORS

Late project payment and delay in payment for completed works were major factors that impacted management control. It is worth pointing out that during the construction phase, due to lack of finance, the project was temporarily suspended. Consequently, although the project was not fully put on hold, a major part of the construction was suspended. That had put strain on both the contractor and the client's management team. Therefore this has triggered the contractors to suspend certain activities which in turn caused delay in the project.

B. INADQUATE QUALITY PROCEDURE RELATED DEALY FACTOR

Lack of quality assurance and specification, incomplete plans and specification, slow decision making, bureaucracy in the owners organization, delay in quality related communication to production, unreasonable client and end user expectation of quality as well as insufficient working drawings details impacted the quality of works. In particular during the execution of the electromechanical and hydraulic steel structure works, these deficiencies were observed and they were negatively impacting the progress of the project. Given the fact that the electromechanical contractor was not adequately equipped with quality procedure, the quality was impacted and consequently caused delays.

C. DESIGN CHANGE RELATED DEALY FACTORS

Contractors request on updating or changing initial drawings, frequent scope change by client re-work due to mistake during construction, technical problem faced, long period for approval of test and inspections, discrepancies between contract documents lack of technical knowledge and design errors were issues that impacted the quality of works. Certain instances such as design changes, discrepancies in design documents and contract documents specifically in the erection of the electromechanical works have caused problem in the project. Thus this has caused delay in the project.

D. UNFORSEEABLE CIRCUMSTANCES RELATED DEALY FACTORS

Unexpected occurrence, effect of local community, labor strike and site accidents have contributed to the project delay which has impacted the management control. Events such as geological issues during the dam foundation preparation and unstable tunnel were among the issues that were unexpected occurrence that added delay to the project. The effect of local communities was noticed during the relocating process to secure the area for the project. Labor strike and site accidents are issues that delayed the project while trying to sort the differences and also trying to have the workers mentally strong to go back to work after major accents had happened that delayed the project.

E. IMPROPER PROJECT PLANNING RELATED DELAY FACTORS

Late deliveries of material to site, dispute or variation order of material to site, lack of effective communication, lack of site management and supervision, adversarial/oblivious relationship between consultant and contractor, client heavy involvement, client delayed decision, time constraints of design and failure to manage conflict has delayed the project. .

3.13. Recommendation

To overcome future drawbacks that may be encountered, this research has presented recommendations based on the experience gained from the GIBE III Hydroelectric Power Project. The tested hypothesis, demonstrated that the delay factors identified had an adverse impact on management control and a mild impact on quality based on the result of the respondents. At the same time, as demonstrated on the literature review, for the most part in the world of construction, factors that cause delays in the project have a tendency to be similar. Thus, given the homogeneity of the hydroelectric power project, it is instrumental to put in place mitigation methods that can best serve to tackle the issue of delay and its impact. Based on the shortcomings of the management team in the GIBEIII Hydroelectric Power Project, the following can best severe for future projects.

1. Improving the communication between all parties

    - Productive and constructive communication between client and contractor can be instrumental to maintain the efficiency of the project
    - Standard and realistic reporting need be followed in reporting progress report
    - Periodical meetings need to be organized to facilitate the communication between all parties involved.
    - Hiring qualified consultant

2. Having realistic planning

    - Standard planning that is realistic need be formulated to monitor the progress of the project
    - Avoiding formulating the project plan based on the progress of work on site.
    - Making timely decisions

3. Reducing owner interference

    - Minimizing the pressure put on the contractor in order to maintain the quality of works.

4. Eliminating discrepancies in the contract document

    - Making sure the contract document is free of any ambiguity
    - Liabilities and responsibilities of each stakeholder shall be clearly stated.

5. Securing project fund

- Formulating contingency plan of finance
- Exploring different types of contract options such as PPP (public and private partnership) that can minimize the burden of financial scrutiny.

5.3. Suggestions for Further Research

This study mainly focused on finding out practical delay factors that has impacted the GIBE III hydropower electric project. It is worth noting that in GIBE III Hydroelectric Power Project, there were two contractors that operated under EPC (Engineering Procurement Construction) contract. Subsequently, future studies shall investigate how the different contractors attributed to the delay of the project independently by looking into the working environment, the contract discrepancies and also cultural differences.

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Appendices

Appendix I

Impact of Project Delay on Management Control and Quality Questionnaire

IMPACT OF PROJECT DELAY ON MANAGEMENT CONTROL AND QUALITY QUESTIONNAIRE

ST. MARY'S UNNIVERSITY

SCHOOL OF GRADUATE STUDIES

SCHOOL OF GRADUATE STUDIES DEPARTMENT OF PROJECT MANAGEMENT

PURPOSE OF QUESTIONNAIRE: A project is said to be successful if it is safely completed within the planned time, budget and quality without any legal disputes of claims. This research will assess factors of delay and its relative impact on management control and quality. The purpose of this questioner is to gather data that fill full the above statement and ultimately device mitigations to prevent delays impacting the project significantly. Your response is highly important and will be kept confidential.

SECTION – A (General Information)

Q.1. Name of Respondent (Optional) ________________________________

Q.2. Gender

☐ Male ☐ Female

Q.3. Job Status

☐ Manager ☐ Supervisor ☐ Engi☐ Forman

Q.4. Relevant work experience (years)

☐ < 5 years ☐ 0< 5 <10 years ☐ >10 < 15 years ☐ > 15 years

Q.5. Educational qualification

☐ Master's ☐ Degree ☐ Diploma ☐ certificate

The following are the significance rate of each factor. Please check off the appropriate box for each question. Indicate your level of agreement with the factors that causes delay to impact management control and quality.

1) Strongly Agree
2) Agree
3) Not Sure
4) Disagree
5) Strongly Disagree

SECTION B

Q6.

	CODE	**Do you agree that this is a Factor that has caused delay on the GIBE III Hydroelectric Power Project?**	1	2	3	4	5
Lack of finance	**LOF1**	Late project payment					
	LOF2	Delay in payment for completed works					
Inadequate Quality Procedure	**IQP1**	Slow decision making					
	IQP2	Mistakes during construction					
	IQP3	Bureaucracy in the owners organization					
	IQP4	Incomplete Plans and Specifications					
	IQP5	Lack of quality assurance/control					
	IQP6	Delay in quality related communication to production					
	IQP7	Unreasonable client and end user expectation of quality					
	IQP8	Insufficient working drawings details					
Design Change	**DC1**	Contractors request on updating or change initial drawings					
	DC2	Frequent scope change by the client					
	DC3	Re-work due to mistake during construction					
	DC4	Technical problem faced					
	DC5	Long period for approval of tests and inspections					
	DC7	Discrepancies between contract documents					
	DC8	Lack of technical knowledge					
	DC9	Design errors					
Unforeseeable Circumstances	**UC1**	Site accidents					
	UC2	Effect of local community					
	UC3	Unexpected occurrence during construction					
	UC4	Labor strike					

	IPP1	Late deliveries of material to site					
	IPP2	Dispute or variation order of materials to site					
	IPP3	Lack of effective communication					
	IPP4	Lack of site management and supervision					
	IPP5	Adversarial/oblivious relationship between consultant and contractor					
	IPP6	Clients heavy involvement					
	IPP7	Client's delayed decision					
	IPP8	Time constraints of design					
	IPP9	Failure to manage conflict					
Do you agree that this is Impact of Project Delay in GIBE III Hydroelectric Power Project?							
	PD1	Dissatisfaction of project owners and end users					
	PD2	Doubtfulness of end users in other projects					
	PD3	Loss of income generation					
	PD4	Delay claims					
	PD5	Extra cost for consultancy and supervision work					
	PD5	Loss of economic development					
	PD6	Overrun of the project cost					
	PD7	High cost of supervision and contract administration					
	PD8	Dispute					
	PD9	Arbitration					
	PD10	Change of quality scope					
	PD11	Defective work					
	PD12	Minimizing quality control procedures					
	PD13	Using unacceptable material for construction					

SECTION C

Open ended item questions. Here you are allowed to give your written opinion

Q.8. What do you believe to be the main factor to delay the GIBE III Hydropower project?

Q.9. Do you believe the quality of works executed in the GIBE III Hydropower project satisfactory? If No please explain the reasons

Q.10. How do you think the management from the contractor side managed factors that delayed the project?

Q.11. How do you think the management from the client side managed factors that delayed the project?

Appendix II

<u>Cronbach α Analysis</u>

$$\alpha = \frac{n}{n-1}\left(1-\frac{\sum_i V_i}{V_t}\right)$$ (Cronbach, 1951, p. 299)

CRONBACH'S α	INTERNAL CONSISTENCY
0.90 and above	Excellent
0.80 - 0.89	Good
0.70 - 0.79	Acceptable
0.60 - 0.69	Questionable
0.50 - 0.59	Poor
below 0.50	Unacceptable

VARIABLES	DESCRIPTION	VALUES	INTERNAL CONSISTENCY
K	# of items	73	
Σv^i	sum of the item variance	81.21	
V^i	variance of total score	1755.60	
α	Cranach's alpha	0.97	Excellent