FACTORS INFLUENCING THE COMPLETION TIME OF WATER PROJECTS IN JIMMA TOWN

A Thesis submitted to Jimma University, School of Graduate Studies, College of Business and Economics, Department of Accounting and Finance, Master of Project Management and Finance Program in Partial Fulfillment of the Requirements for the Master of Arts Degree in Project Management and Finance.

by

Fitsum Fanuel

JIMMA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENTOF ACCOUNTING AND FINANCE

PROJECT MANAGEMENT AND FINANCE MASTER'S PROGRAM

July 2021

Jimma, Ethiopia

FACTORS INFLUENCING THE COMPLETION TIME OF WATER PROJECTS IN JIMMA TOWN

by

Fitsum Fanuel

Under the Guidance of

Endalew Gutu (Assistant Professor)

and

Monanol Terfa

JIMMA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENTOF ACCOUNTING AND FINANCE

PROJECT MANAGEMENT AND FINANCE MASTER'S PROGRAM

A Thesis submitted to School of Graduate Studies, Jimma University, College of Business and Economics, Department of Accounting and Finance, Master of Project Management and Finance Program in Partial Fulfillment of the Requirements for the Master of Arts Degree in Project Management and Finance

July 2021

Jimma, Ethiopia

DECLARATION

I declare that the research report entitled "*FACTORS INFLUENCING THE COMPLETION TIME OF WATER PROJECTS IN JIMMA TOWN"* submitted to research and postgraduate studies office of Business and Economics College is original and it was not been submitted previously in part or full to any university or other funding organizations.

Name _____

Signature_____

Date_____

CERTIFICATE

We certify that the research report entitled "*FACTORS INFLUENCING THE COMPLETION TIME OF WATER PROJECTS IN JIMMA TOWN" was* done by Mr. Fitsum Fanuel for the partial fulfillment of Master's Degree under our supervision.

_____

Endalew Gutu (Main advisor)

_____

Monanol T. (Co-Advisor)

ABSTRACT

This study intended to investigate the factors that influencing completion time of water projects in Jimma. The main objective of the study is to evaluate the factors influencing completion of water projects in Jimma towns. The study followed mixed research approach incorporating both qualitative and quantitative aspects of project completion time. The sample size of the study were 93 respondents in respective water projects. In order to get professional respondents on specific expertise of project management issues, and due to the limited size of target sample, the sample size was determined by purposive non-probability sampling for professionals (engineers, site managers, and project managers) The quantitative data that collected by structured questionnaire triangulated with qualitative data, which collected through key informant's interview. The result of the study indicated that there is time delay of projects ranges from zero year to five years (the mean of 803 days) in the study area. The major influencing factors that are identified in this study were financing, contract variations, monitoring, market related factors, and physical and environmental factors in that order. This result also triangulated with the qualitative data and all of the top five factors that were found in qualitative analysis confirmed in interview responses. The study also forwarded important recommendations for financing bodies of the projects, that they should give a great emphasis to finance in project planning, implementation and monitoring and evaluation stages. In this regard, concerning bodies should establish a special inter-organizational relationship with government financing bodies to simplify the complex financial system that hinders the smooth flow of financing to address the timely demand of the projects.

***Key words**:* Completion Time, Water Project, CCD (Construction Contract Delay)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ADB	African Development Bank
ANSI	American National Standard
BPC	Backward Pass Calculation
CAL	Client Access License
CCD	Contract Duration Time
COVID-19	Corona Virus Disease 2019
CPM	Critical Path Method
DFID	Department for International Development
ERR	Economic Rate of Return
FDRE	Federal Democratic Republic of Ethiopia
FPC	Forward Pass Calculation
IMF	International Monetary Fund
IRR	Internal Rate of Return
MDGs	Millennium Development Goals
NGOs	Non-Governmental Organizations
PDM	Precedent Diagramming Method
PERT	Program Evaluation Review Technique
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PRC	People's Republic of China
RII	Relative Importance Index
SCL	Society of Construction Law
SMART	Specific-Measurable-Achievable-Realistic-Time-Bounded
UNCTAD	United Nations Conference on Trade And Development
UNDP	United Nations Development Program

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

A project can be defined as a brief work carried out by people who work cooperatively together to create a unique product or service within a well-known period and within an established budget to produce identifiable deliverables (Project-Management-Institute, 2021). A project is unique in that it is not a routine operation, but a specific set of operations designed to achieve a particular objective. Accordingly, a project team could comprise individuals who do not usually work together, on occasion from different groups and across many locations. Project management can be defined as the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (Project-Management-Institute, 2021). In other words, project management is the process and activity of planning, organizing, motivating, and controlling resources, procedures and protocols to achieve specific goals in scientific or daily problems. Then, project management can be defined as the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (Project-Management-Institute, 2021).

In management of projects, the primary challenge is to accomplish all of the project goals and objectives while honoring the preconceived constraints. The primary constraints are scope, time, quality and budget. The time constraint refers to the amount of time available to complete a project. These constraints are often competing each other in which increased scope typically means increased time and increased cost, a tight time constraint could mean increased costs and reduced scope, and a tight budget could mean increased time and reduced scope. The discipline of project management is about providing the tools and techniques that enable the project team to organize their work to meet these constraints (Lock, 2017).

Project completion time is a common challenge in the project management not only with devastating effects on the contracting parties but also with an immense cost to country. The impact of delays is that funds committed on projects do not benefits intended recipients and subsequently results in cost and time overrun. When the project is the construction, the problem become get worse. Construction industry has both direct and indirect link with the development and growth of national economy. Therefore, the project delay in construction project such as water, road, and building projects has great impact in the life of society (Bradley, 2016). In

general, project completion time is the duration of contract within which the project deliverables in the state described in the construction contract should be completed.

Water projects are very vital than road or house construction projects because increasing access to clean water to the people of developing countries is one of the Millennium Development Goals (MDGs) now Sustainable Development Goals that have attracted attention of governments and development practitioners (UNDP, 2005). Therefore, the impact of water project is greater than road or building projects (Hoechstetter S., 2016). Water and wastewater projects experience many common issues, and one of the major problems is time delay of the water projects (Ambulkar, 2019). Water project delays in Africa are a major problem in project management with quality and cost performance (UNCTAD, 2020).

Thus, this study endeavored to evaluate the major factors influencing the project completion time or delay small and medium water projects run by either the water supply and sewerage authority or any governmental organization that carried on localized water projects in Jimma town. Since previous studies gave emphasis to delay of large-scale water projects under water and sewerage authority by overlooking the water projects in other sectors, this study attempted this research gap by incorporating water projects in different organizations in the study area.

For that reason, the study employed mixed research approach through questionnaire and interview to attain the objectives of the study such that to measure the average time delay, to identify the factors influencing the project completion time, to determine the extent of influence the factors on the project completion time in water projects in Jimma town. Finally, the finding of the study indicated that there is time delay of projects ranges from zero year to five years (the mean of 803 days) in the study area. The major influencing factors that are identified in this study were financing, contract variations, monitoring, market related factors, and physical and environmental factors in that order.

1.2 Statement of the Problem

The recent report by It is estimated that 7.5 percent of the global water crisis is in Ethiopia alone (Lifewater, 2021). This study is initiated by lack of studies that address completion of time of any type of water projects in Jimma town. There was no a single study conducted in Jimma town to address any type of water projects and their completion time. Additionally, the researcher of this study observed that water projects in Jimma town took much extended time to run the project, and this observation initiated this study. Therefore, this study focused

completion time and delay of any type of water related projects in either Jimma town that launched by the dedicated water sector or other sector in the town which carried out water projects under their programs.

The research gap of the literatures in this study indicated that studies focused only on large-scale water project that launched by concerned bodies. Small-scale water projects that launched by other sectors are skipped by all reviewed studies. this study strived to fill this gap by giving emphasis to small scale water projects that focused on small scale groundwater, water supply extension, sewerages, river culverts and bridges and other water supply related improvement works in the town not only run by dedicated governmental bodies but also any sector that run small sale water projects in the town.

Completion time and delay in construction projects due to improper estimation of the project time as Sambasivan and Soon, (2017) stated is a global phenomenon. Barbosa and Jungles, (2016), investigated 70% of the construction projects in United Kingdom were delivered late from the planned schedule. Especially in Africa, almost all construction (water, road, and building) projects practiced 100% time overrun. The delay in water projects of the country and their factors was not well planned in proportion to the magnitude of the work. However, water projects have a great impact on the economic development of the country; the studies in Jimma area give less or no emphasis to evaluate the factors that influence the completion time of water projects.

Project completion time is one of the most significant factors of project; and it is time allocated to complete the actual project construction starting from the time of tender award to the time of delivery of the project in the state described in the contract (Abbasi, et al., 2015). Water projects are very vital than road and building construction projects because increasing access to clean water to the people of developing countries is one of the Millennium Development Goals (MDGs) now Sustainable Development Goals that have attracted attention of governments and development practitioners. It is estimated that half of the people who lack access to safe drinking water and sanitation should have access by 2015 (UNDP, 2005). Sutton (2008) however, anticipated that Africa, south of the Saharan countries might not meet the target until 2040 (Angmor, 2016).

This study motivated by the unavailability of researches conducted on factors that affect water project completion time this study area. However, there have been conducted several studies on delay of the construction projects, Tolera E. (2018) and Birhan B. (2018) and time overrun

of given projects, Siraw Y. (2015) in Ethiopia, they did not address water projects in regional town that launched in any governmental or private body. Therefore, this study tried to cover this study gap.

The other reason to focus in this study area, Jimma town, is that it is one of the few towns in the country to be targeted as main area of water projects. Jimma is one of four cities in the country that targeted to improve the water projects through World Bank funds. The four-targeted secondary cities are Gondar, Hawasa, Jimma, and Mekelle; in improving/expanding water supply production and distribution, constructing new sewer networks and wastewater treatment plants, improving operational efficiency of each utility, and improving governance of the utilities. The funding included support for project management, monitoring and evaluation, and capacity building linked to the project (World Bank, 2018). However, there is no emphasis given either by government or by academic institutions to assess the water projects status in this study area. Therefore, this study focused on water projects in Jimma town to establish what factors independently or jointly contribute to project completion time in this study area.

1.3 Research Questions

- What is the average time delay in water projects in Jimma town?
- What are the major factors influencing the project completion time in Jimma town?
- To what extent do these factors influence the project completion time of the projects in Jimma town?

1.4 Objectives

1.4.1 General Objective

The main objective of the study is to evaluate the factors influencing completion time of water projects in Jimma town.

1.4.2 Specific Objectives

i. To measure the average time delay in water projects in Jimma town.

ii. To identify the factors influencing the project completion time in water projects in Jimma town.

iii. To determine the extent of influence the factors on the project completion time of water projects in Jimma town.

1.5 Scope of the Study

Due to time and budget constraints, the study area of this study limited to water projects planned in the range of 10 successive years, i.e. between 2012 up to 2022 fiscal year in Jimma town. The objectives of the study is limited to assess time related factors; and the methodological scope of the study is limited to primary data collected through questionnaires and key informants interview from samples (managers and professionals).

1.6 Significance of the Study

The main theme of this study is project completion time or project delay, it is very important aspect of any project performance and success. Unsuccessful project delay is possibly the costliest item in government expenditure; therefore, it affects the overall economic activities of the country. Therefore, it is very essential to study continuously to investigate the challenges in project completion time to mitigate the problems before they severely affect the country's economy. This study help us come up with factor affecting completion of project in this study area. Additionally, the study help not only the student researcher of this study by entertaining the practical aspects of project management activities but also the future researchers to get recent data of the study area on the project delay issues.

1.7 Organization of the Study

This study was organized in five major chapters and two additional sections at the start and end of the thesis, i.e. preliminary section and supplementary sections. The preliminary section contains the cover pages, certificate, and declaration, abstract of the study, acknowledgements, and tables of contents, list of tables and figures and abbreviations. On the other hand, the supplementary section of the thesis contains the reference that supported this study; the appendices related to this study, such as formats of the data collection instruments, and so on.

The main section of the thesis started with chapter one, which incorporates the background of the study, problem statement, objectives, research questions, significance and scope of the study. Chapter two is dedicated to reviewing the theoretical and empirical literatures related to water project completion time and delay. Chapter three is concerned with the methodological aspects of the study. It includes the study design, description of the study area, the sources and

types of data, source of data, population and sampling, data collection tools, data analysis methods. Chapter four presented the result of the study along with discussions. Chapter five, the closing of the main section of the thesis, concluded the major findings of the study and forwarded recommendations to concerned bodies.

CHAPTER 2

REVIEW OF LITERATURES

2.1 Theoretical Reviews

2.1.1 Project and Project Completion Time

Project is very difficult concept to define precisely, however, some literatures defines it as follows. The Oxford English Dictionary defines project as a collaborative enterprise, involving research or design, that is carefully planned to achieve a particular aim, in contemporary business and science (Oxford-Dictionary, 2013). Project is a temporary endeavor undertaken to create a unique product or service or result (ANSI, 2004). On the other hand, it is defined as a unique process, consist of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective confirming to specific requirements, including the constraints of time cost and resource (ISO10006, 2017).

Projects can be further defined as temporary rather than permanent social systems or work systems that are constituted by teams within or across organizations to accomplish particular tasks under time constraints. An on-going project is usually called (or evolves into) a program. In project management, a project consists of a temporary endeavor undertaken to create a unique product, service or result. Alternative definition of project in this sense is a management environment that is created for delivering one or more business products according to a specified business case (Carr, 2009).

Project also incorporate project objectives. These project objectives define target status at the end of the project, reaching of which is considered necessary for the achievement of planned benefits. Project objectives can be formulated as SMART criteria, which refers to specific, measurable, achievable, realistic and time-bounded. The evaluation (measurement) occurs at the project closure. However, a continuous guard on the project progress should be kept by monitoring and evaluating. SMART criteria are best applied for incremental type innovation projects such as construction projects. It does not apply as well for radical type projects because objectives for radical type projects tend to be broad, qualitative, unrealistic and success driven (Carr, 2009).

Projects are very diverse depending on their composition, type, scope, size and time. For example, when considering the composition of the projects, it could be the project of water service, road, dam, real estate, developing a watershed, creating irrigation facility, developing new variety of a crop, developing new breed of an animal, developing agro- processing center, construction of farm building, sting of a concentrated feed plant etc. It may be noted that each of these projects differ in composition, type, scope, size and time (Project-Management-Institute, 2021).

Despite of their diversities, projects generally share the common characteristics. These are that projects have unique in nature, have definite objectives (goals) to achieve, requires set of resources, have a specific time frame for completion with a definite start and finish, involves risk and uncertainty, and requires cross-functional teams and interdisciplinary approach (Project-Management-Institute, 2021).

According to Hillson D., (2009), all projects are risky and there are three separate reasons for that, these are all projects have uncertainty nature. Therefore, all projects are unique, complex, involve assumptions and constraints, performed by people and involve change from a known present to an unknown future; all projects are undertaken to achieve some specific objectives and all projects are affected by the external environment around them.

i. Project completion time

Project completion time is one of the most significant factors of project; and it is time allocated to complete the actual project construction starting from the time of tender award to the time of delivery of the project in the state described in the contract (Abbasi, et al., 2015). Similarly, project delay could be defined as the time overrun either beyond completion date specified in a contract or beyond the date that the parties agree upon for delivery of a project. Project delay is that project which is experiencing delays in the construction period where there are different gaps between the actual in-progress sites work compared to the work scheduled. Project Delay is an unintended postponement of a project tasks because of some incidence that obstructs the project's continuation. It is the length of time that extends the project duration and causes a disruption in the delivery of project goals and objectives.

Project delays are caused by conditions that create obstacles to launch and further implementation of project activities. The project delays are unexpected and uncontrollable, and then they have a negative impact on project activities and results (Task-management-guide, 2021). The failure to achieve targeted time can result in numerous negative effects on the

projects. When the construction projects are delayed, they are usually extended and therefore requires an increase in project costs (Task-management-guide, 2021).

It is recommended to establish delay allowance at the very beginning of a project, to prevent the negative impact of project delays. According to the definition of Task Management Guide, delay allowance is the length of time included in the project schedule in advance to cover unpredictable contingencies and expected minor delays. It is a mechanism of increasing project safety through preventing activity disruptions and creating time buffers (Task-management-guide, 2021).

ii. Project Life Cycle

Every project, from conception to completion, passes through various phases of a life cycle. There is no universal consensus on the number of phases in a project cycle. An understanding of the life cycle is important to successful completion of the project as it facilitates to understand the logical sequence of events in the continuum of progress from start to finish. According to the Project Management Institute, the typical project consists of four phases: conceptualization, planning, execution and termination phases. Each phase is marked by one or more deliverables such as concept note, feasibility report, implementation plan, resource allocation plan, evaluation report etc. (Project-Management-Institute, 2021).

These project phases stated by Project Management Institute (2021) are discussed below:

- **Conceptualization Phase/ Conception Phase**

Conception phase is identification of the product or service, pre-feasibility, feasibility studies, appraisal, and approval. The project idea is conceptualized with initial considerations of all possible alternatives for achieving the project objectives. As the idea becomes established, a proposal is developed setting out rationale, method, estimated costs, benefits and other details for appraisal of the stakeholders. After reaching a broad consensus on the proposal, the feasibility dimensions are analyzed in detail.

- **Planning Phase**

Planning phase is the project phase when the project structure is planned based on project appraisal and approvals. Detailed plans for activity, finance, and resources are developed and integrated to the quality parameters. In the process, major tasks need to be performed in this

phase are identification of activities and their sequencing, time frame for execution, estimation and budgeting, and staffing.

- **Execution Phase**

Execution phase of the project observers the concentrated activity where the plans are put into operation. Each activity is monitored, controlled and coordinated to achieve project objectives. Important activities in this phase are communicating with stakeholders, reviewing progress, monitoring cost and time, controlling quality, and managing changes.

- **Termination Phase**

Termination phase marks the completion of the project wherein the agreed deliverables are installed and project is put in to operation with arrangements for follow-up and evaluation.

The extent of project life cycle trend can be demonstrated by using life cycle paths. The life cycle of a project from start to completion follows either a "S" shaped path or a "J "shaped path as shown below in the figure:

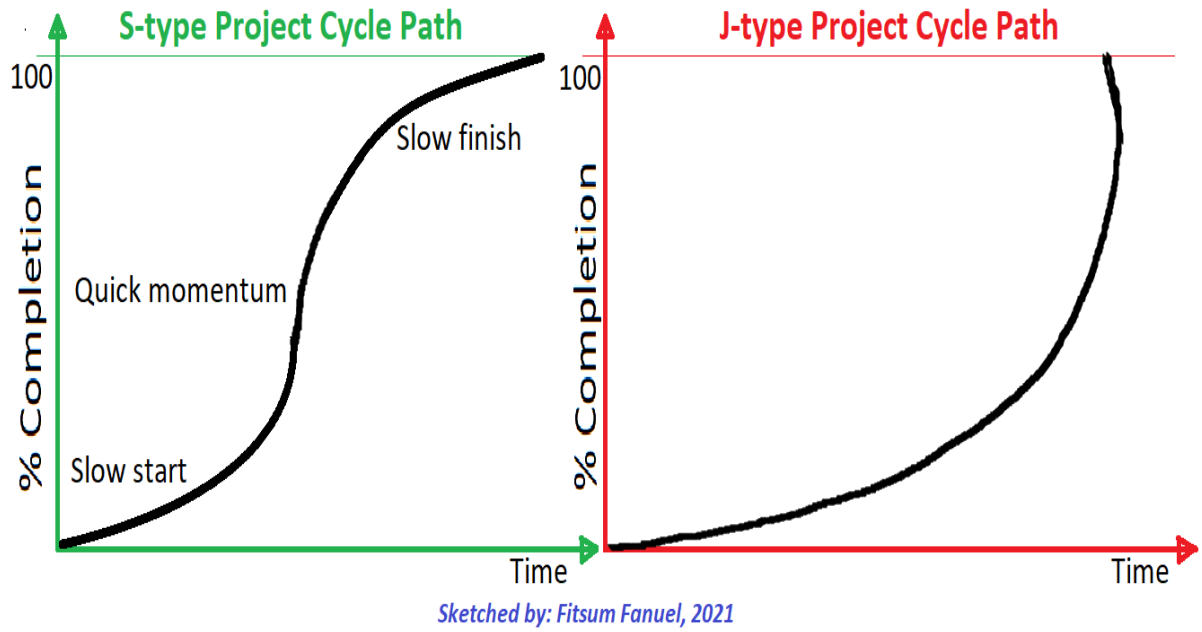

Figure 1: S-type and J-type Project Cycle Path

In "S", shape project cycle path the progress is slow at the starting and terminal phase and is fast in the implementation phase. At the beginning detailed sectoral planning and coordination among various implementing agencies etc. makes progress slow and similarly towards termination, creating institutional arrangement for transfer and maintenance of assets to the stakeholder progresses slowly. Water service projects are showing this type of path.

On the other hand, in "J", type cycle path the progress in beginning is slow and as the time moves on the progress of the project improves at fast rate. In this, the land preparation progresses slowly and as soon as the land and seedling are transplantation is under taken. The good example of project for this type of path is developing an energy plantation project.

iii. Classification of Projects

There is no standard classification of the projects. However, depending on different criteria they can be classified into several alternative categories, such as: industrial projects and Developmental projects (considering project goals).Each of these groups can be further classified considering several criteria as: Repetitive project and Non-Repetitive project (considering nature of work);Long term project, Short term project … etc. (considering completion time) ;Large project, Small project cost … etc. (considering cost) and High project, Low project, No-Risk project (considering level of risk).

Industrial projects (commercial projects), which are undertaken to provide goods or services for meeting the growing needs of the customers and providing attractive returns to the investors/stake holders. Industrial projects are further grouped into two categories; these are: demand based projects and Resource / supply based projects.

The demand based projects are designed to satisfy the customers as well the latent needs such as complex fertilizers, agro-processing infrastructure etc. The resource/ supply based projects are those which take advantage of the available resources like land, water, agricultural produce, raw material, minerals and even human resource. Projects triggered by successful research and development (R&D) are also considered as supply based. Examples of resource-based projects include food product units, metallurgical industries, oil refineries etc. Examples of projects based on human resource availability include projects in IT sector, clinical research projects in bio services and others.

Development projects are undertaken to facilitate the promotion and acceleration of overall economic development. These projects act as catalysts for economic development providing a cascading effect. Development projects cover sectors like irrigation, agriculture, infrastructure health and education.

The differences between industrial projects and developmental project depend on finance, source of fund, and interest rates & repayment period, investment, profitability, scale of project, promoters, and gestation period. In this regard, the finance of developmental projects operates

on higher debt-equity norms. On the other hand, the finance of industrial projects relied on stringent debt equity norms; source of fund for developmental projects usually are international organizations like World Bank, IMF, ADB, DFID and others mostly as loan, yet times providing for some grants, whereas source of fund for industrial projects are national stock markets from domestic institutions. The interest rates & repayment period of developmental projects very low for borrowed funds and the repayment extends up to 25 years and even beyond, but it is7 to 10 years for industrial projects.

Concerning the profitability, developmental projects has modest profitability considered on Economic Rate of Return (ERR) but industrial projects has high profitability considered on Internal Rate of Return (IRR). Usually, scale of industrial projects is larger than industrial one, which is limited. Additionally, the promotors of developmental projects are government, public sectors, and NGOs whereas the promotors of industrial projects are entrepreneurs or corporates. Moreover, investment and gestation period of the developmental projects are high.

2.1.2 Types of Project Completion Time

Predominantly, delays can be seen in these four major categories (Trauner, et al., 2009): critical &non-critical, excusable &non-excusable, compensable &non-compensable, as well as concurrent &non-concurrent.

i. Critical Delay & Non-Critical Delay

Critical delays are delays, which prevent the contractor from finishing the work on the scheduled completion date as agreed upon in the contract. This concept has roots entrenched in the Critical Path Method (CPM) schedule which helps identify the critical activities in a construction project. All projects have critical activities embedded in their execution irrespective of the kind of schedule being run. These critical activities are referred to as the controlling item of work. CPM seeks to accomplish three main objectives: to calculate the project's completion date, to identify the extent to which each activity in the schedule could slip without delaying the project, to identify which activities in the schedule would have the highest risk of affecting the project completion date if they slipped.

There are two methods of estimating the project's date using the CPM, the Forward Pass Calculation/FPC and the Backward Pass Calculation/BPC. The Forward Pass computes the early start and the early finish dates of the project whiles the Backward Pass estimates the late start and the late finish dates. That notwithstanding, identifying which activities truly impact

the completion date of the project also depends on the following factors as given by (Trauner, et al., 2009): the project itself, the contractors plan and schedule (particularly the critical path), the requirements of the contract for sequence and phasing, and the physical constraints of the project – how to build the job from a practical perspective.

It is important to note that irrespective of how one chooses to analyze a construction project schedule to identify delays; there will always be an overriding factor, which will need much attention. This is known as the contemporaneous information which refers to the daily reports, the schedules in effect and any other job data available to reflect the existing situation at the time of the delay (Trauner, et al., 2009).

Non-critical delays can be seen as those delays that do not influence 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. This leaves non-critical delays as a standalone delay classification.

ii. Excusable Delay & Non-Excusable Delay

Excusable Delays is a delay that is due to an unforeseeable event beyond the contractors or the subcontractor's control. Normally, based on common general provisions in public agency specifications, delay resulting from the following events would be considered excusable: general labor strikes, fires, floods, acts of god, owner- directed changes, errors & omissions in the plans and specifications, differing site conditions or concealed conditions, usually sever weathers, intervention by outside agencies, and lack of action by government bodies, such as building inspection (Muhammed, 2015).

Before the analyst concludes that a delay is excusable based solely on the preceding definition, he or she must refer to the construction contract documents. Decision concerning delays must be made within the context of the specific contract. The contract should clearly define the factors that are considered valid delays to the project that justify time extensions to the contract completion date, for example some contracts may not allow for any time extension caused by weather conditions, regardless of how unusual, unexpected, or sever.

Non-excusable delays are events that are within the contractor's control or that are foreseeable. There are some examples of non-excusable delays: 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 (Muhammed, 2015).

iii. Compensable Delay & Non-Compensable Delay

A compensable delay is a delay where the contractor is entitled to a time extension and to additional compensation. Relating back to the excusable and non-excusable delays, only excusable delays can be compensable. 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. Thus, the question of wheatear a delay is compensable must be answered. Additionally, a non-excusable delay warrants neither additional compensation nor a time extension (Muhammed, 2015).

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

iv. Concurrent Delay & Non-Concurrent Delay

The term "concurrent delay" is used in circumstances where a period of delay to the completion of a project is caused by two or more factors, one of which is the contractor's responsibility and one of which is the employer's responsibility. In practice, the phrase is more often used to describe the situation where the competing events occur at different times but their delaying effects on the work are felt at the same time. The generally accepted definition is of the Society of Construction Law (SCL) in 2002 as cited in (Bradley, 2016): "concurrent delay refers to delays when two or more effective causes of delay which are of approximately equal causative potency".

Concurrent delays are two or more delays that occur or overlap within the same period, either of which occurring alone would have affected the ultimate completion date; where two or more independent causes of delay occur during the same time. The same time period being referred to is not always literally within the exact period of time but can be related by circumstance, even though the circumstance may not have occurred during the exact same period; and true concurrent delay is the occurrence of two or more delay events at the same time, one an employer risk event, the other a contractor risk event and the effects of which are felt at the same time.

Concurrent delay mostly refers to the situation where two or more delay activities occur at different times but the impact is felt (in whole or in part) at the same time. It occurs when both parties to the construction contract (owner and contractor) delay the project during an excusable but no compensable delay (such as severe weather conditions). Such delays do not necessarily have to occur simultaneously but can be on two parallel critical path chains.

Concurrent delays may also be an excusable delay with compensation, which may grant some reliefs to the contractor in the form of extension of time, remission of liquidated damages and sometimes-potential delay of damages subject to the given circumstance and the contractual agreement. In the same vein, a concurrent delay may also be inexcusable where the delay of the contractor, though concurrent with that of the owner, had a more severe impact on the finishing date.

Concurrent delays could be caused by the delaying effects of events that either excusable (i.e. the events for which the employer takes the risk of time and for which extensions of time should be granted to the contractor) or culpable (i.e. events for which the contractor takes the risk of time) (Rawlings, 2003). However, the effects of two delaying events by both parties to the contract, which influenced upon progress of the contract at mutually exclusive time frames, could not be said to be concurrent.

2.1.3 Project Completion Time in Construction Industry

The project completion time in construction industry (water, road, bridge, dam, house building etc.) related to contract time or contract duration time (CCD). CCD is the maximum time allowed in the contract for completion of all work contained in the contract documents. Contract time is defined as the number of working days needed to complete a given construction project. Contract duration can simply be considered as the time agreed upon by the makers in order to complete the terms of the contract (Dursun & and Stoy, 2012).

The completion time of a construction project is dependent on many factors. Some of these factors can be somewhat controlled, such as production rate of construction, while others are uncontrollable such as weather condition, as well as the size of the project, or location of the construction site (urban vs. rural areas), effectively produced variations in the completion time of a construction project. Additionally, the financial condition of the contractor, the design, machinery and equipment or the timely/untimely delivery of material may affect the completion date of some tasks or even the entire project (Bradley, 2016).

There are several aspects to deal with the project completion time in construction projects, such as project time estimation or contract duration estimation, production rate, progress schedule and so on as reviewed below:

i. Project Time Estimation

Project completion time can be estimated based on the results of production rates and construction durations. A specified contract time affects many aspects of construction projects, such as costs, construction management and planning, contractor selection, and work zone layout etc. A proper contract time is critical for construction agencies, contractors and local businesses. Contract time sets a time limit for a contractor to complete a construction project and therefore directly affects the actual construction duration (Baker, 2016). Therefore, it is crucial to estimate and measure the project time appropriately. Altogether, contract time can be measured in several different ways:

Working days: the time that the contractor will be working on the project, excluding weekends, holidays, and adverse weather related non-working days.

Calendar days: elapsed time without regard to the contractor's necessarily being on the job.

Completion dates: a specific date in the calendar year by which the project is to be completed.

ii. Production Rate and Completion Time

A production rate is the quantity produced or constructed over a specified project time. Estimating realistic production rates is important when determining appropriate construction project completion time. Productions rates may vary considerably depending on different factors such as project financing factors, technology, project size, geographic location, and rural or urban setting, even for the same item of work. The production rates may have to be supplemented with information from other sources and should be adjusted with good engineering judgment and experience with similar work (Gondy & Hildreth, 2007).

Certain project specific information should be determined and some project management decisions made before durations for individual work items computed. The relative urgency for the completion of a proposed project should be determined. The size and location of the project should be reviewed. The availability of material for controlling items of work should be investigated. For example, it might be appropriate to consider the need for multiple crews on a specific item to accelerate the completion of the project (Gondy & Hildreth, 2007).

Procedures to accelerate project completion should be considered when project completion is crucial. When accelerating time for time-sensitive projects, production rates should be based on an efficient contractor working more than eight hours per day, more than five days per week and possibly with additional workers such as contracting/ recruiting new human resource or outsourcing from other firms. The development and application of a separate set of production rates for critical projects is recommended (Gondy & Hildreth, 2007).

iii. Progress Schedule

The contract time for most construction projects can be determined by developing a progress schedule. A progress schedule shows the production durations associated with the chosen production rates for the items of work. The time to complete each controlling item of work included in the progress schedule is computed based on the production rates applicable to that project. Items should be arranged by chronological sequence of construction operations. Minor items that may be performed concurrently should be shown as parallel activities (Gondy & Hildreth, 2007).

In determining a progress schedule, it should be remembered that the start and end dates for each controlling item need to be based on the earliest date for which work on that item will begin and how long it will take to complete. The earliest start date for each activity will be determined by the completion of preceding activities, and should allow for the fact that some activities can begin before the preceding activity is entirely completed. Additional time should be also allowed in the project planning for initial mobilization (Gondy & Hildreth, 2007).

2.1.4 Factors that Influence the Project Completion Time

i. Project Financing Factors

Chiocha (2011) defines project financing as raising of funds to finance an economically separable capital investment project, which the providers of funds look primarily to the cash flow from the project as the source of funds to service their loans and provide the returns of equity invested in the project. Matesehe (2013) defines project financing as financing a particular economic unit in which a lender is satisfied to look initially to the cash flow and earnings of that economic unit as the source of funds from which a loan will be repaid and to the assets of the economic unit as the collateral for the loan. Finance is a branch of economics concerned with resource allocation as well as resource management, acquisition and investment. Simply, finance deals with matters related to money and the markets. Therefore, if

the government treasury does not release the allocated amount of money on time this will lead to delay on projects.

ii. Technological Factors

According to Kaehka, (2013) Construction technology is use of advanced methods and equipment, which can be used to build structures. Construction builds two types of structures; these include buildings and heavy engineering structures. Construction uses various technological actions to erect a structure on the site where it will be. The use of construction technological tools like heavy tractors to prepare land where the construction will be, computer design software to create designs for structures on computers and in 3D format, using various construction technologies to enclose structures and install utilities has helped in advancing both residential buildings and commercial buildings today.

2.1.5 Factors Influencing Construction Project Completion Time

There are several factors that influencing the construction completion time that are indicated by several scholars those studied construction (road, house building, water etc.) project completion time. These factors can be grouped in three major categories as project finance related, technology-innovation related, and other factors (such as geographic, environmental, socio-political, legal, global etc.).

Studies that focus on project finance related factors indicated that budget and contract payment control (when a project is backed by a huge budget, contract time can be reduced to complete the work faster than using normal conditions);Cash flow of all parties involved and type, complexity and volume of the construction (Saad, et al., 2016; Czarnigowska & and Sobotka, 2013).

On other findings that evidenced that technological innovation related factors are : Equipment and machinery (including relocation of construction utility and mobilization time);Skill and manpower/ workmanship (including the commitment by all parties to complete the project within the deadline);Material delivery time (timely delivery of certain special items of construction has influence on project time) and transportation (availability of access roads for routine tasks and emergency situations)(González, et al., 2013; Dursun & and Stoy, 2012; Mahamid, et al., 2012)**.**

In addition there are other factors reported on different studies; Weather condition (bad weather);geographic and environmental factors (landscape, type of soil, pollution,

environmental sensitivity etc.);location of the project site; legal and right-of-way issues and socio-political and global factors (for example: effect of community institutions and events on the project, political unrest and instability, pandemics such as COVID-19) and so on (Islam & Trigunarsyah, 2017; Osman, 2016; Mohammed & and Isah, 2012).

To complete a construction project within the required contract time, a contractor may have to utilize extra resources if necessary, including extra working hours per day, equipment, materials and manpower (Lee, et al., 2002).

2.1.6 Water Projects and Their Completion of Time

i. Water Projects

Water projects are very vital than road or house construction projects because increasing access to clean water to the people of developing countries is one of the Millennium Development Goals (MDGs) now Sustainable Development Goals that have attracted attention of governments and development practitioners. It is estimated that half of the people who lack access to safe drinking water and sanitation should have access by 2015 (UNDP, 2005). Sutton (2008) however, anticipated that Africa, south of the Saharan countries might not meet the target till by 2040 (Emmanuel Narteh Angmor, 2016).

Water and wastewater projects experience many common issues (Ambulkar, 2019), such as:

anomalies in construction documents; permitting delays; bid-pricing challenges; Handling of shop drawing submittals; traffic management and mobilization needs; unexpected subsurface conditions; construction sequence difficulties; commissioning complexities; coordination and communication issues and change order disputes.

Focusing on project delays, various types of permits may be required such as construction permit, building permit, right-of-way occupancy permit, and so on. Permitting involves documents submission, regulatory authority review, and approval. This process is time-consuming and needs proper consideration in the project schedule. Delayed submittals and incomplete or wrong applications can significantly slow down the approval process and subsequent construction work. This results in overall project delay on the long run. On the other hand, close communications with regulatory staff and understanding of permit requirements along with the submission of relevant forms, fees, and supporting documents can greatly expedite the process. Permits can sometimes be challenging, but timely submissions can greatly reduce worries and project delays (Ambulkar, 2019).

2.1.7 Models and Theories on Project Completion Time

i. Mean Production Rate Model

The construction duration of a construction project is directly affected by the construction firm's production rates of the construction activities. Therefore, if the construction activities in the critical path of the construction process can be identified, the time needed for the construction project can be determined using the mean production rates. For a given construction activity, the number of days needed to complete it can be estimated as follows:

Equation 1: *Mean Production Rate Model*

$$\mathbf{T = \frac{Q}{P}}$$

Where:

T = Project time or duration of the activity (working days)

Q = Quantity for the activity

P = Production rate (daily mean) of the activity

The key for this method is to appropriately determine the sequence of construction activities in the critical path of the construction process. The sequence of construction activities in the critical path varies from project to project; and also it is sometimes difficult to provide the sequences of construction activities for all types of projects.

ii. Techniques to Calculate Contract Time

Project time determination techniques includes: estimated cost method, bar chart method, CPM scheduling, PERT (program evaluation review technique), and Microsoft project (Gondy & Hildreth, 2007), and reviewed below:

- ***Estimated Cost Method***

Estimated Cost Method is applicable for projects in which there is primarily one type of work and that work type will be performed in a linear fashion. The project should also have a well-defined scope of work resulting in minimal risk and uncertainty. The Estimated Cost Method of project time determination utilizes a comparison of money value to time. Based on historical information, tables illustrating project cost versus project time are developed for different project types. Examples of such project types include new construction, reconstruction,

extension projects, repair, and so on. Project time is essentially determined based solely on the amount of the engineer's or the project manager's estimate.

For non-complex projects and projects affecting small volumes of traffic, this procedure may be appropriate. The estimated cost method is not recommended for use on projects where completion time is a major factor. Many items affecting the completion of a project are not taken into consideration when applying this method. Any special features that are unique to a specific project cannot easily be accounted for when using this very simplistic procedure (Gondy & Hildreth, 2007).

- ***Bar Chart***

The Bar Chart Method is applicable for use with projects in which there is relatively few work components with easily understandable relationships between the components. The project should also have a well-defined scope of work. A level of uncertainty unlikely to result in significant changes may be present. Bar charts or Gantt charts are graphical representations of projects with specific completion dates and activities. Bars or lines are drawn proportional to the planned duration of each activity. The use of bar charts is not recommended for contract administration and project management of large or complex construction projects. (Gondy & Hildreth, 2007).

- ***Critical Path Method (CPM)***

Critical Path Method is appropriate for projects with several components with complex relationships. These projects exhibit a reasonable potential for significant changes and uncertainty that may result in sequence modifications and/ or scope adjustments. Critical Path Method (CPM) focuses on the relationship of the critical activities, those that must be completed before other activities are started. Working from the project's beginning and defining individual project tasks and the number of days to perform each task, a logical diagrammatic representation of the project is developed. A CPM depicts which tasks of a project will change the completion date if they are not completed on time (Gondy & Hildreth, 2007).

The evaluation of critical tasks allows for the determination of the time to complete projects. Because of the size and complexity of most projects, this method is most often applied using a computer software program. Within the CPM software, the ability to use a Precedent Diagramming Method (PDM) provides a breakdown of each activity to boxes. This enables the user to view the connection of relationships to each activity. CPM software also has the ability

to display the contract time in a bar chart view as well. Disadvantages of using the CPM include: the CPM requires experienced and knowledgeable staff to be used effectively; they require regular updates to assure that the contractor's operation is accurately represented, does not account for uncertainty, it is best used in projects where the activity time estimate can be predicted fairly accurately (Gondy & Hildreth, 2007).

- ***PERT (Program Evaluation Review Technique)***

A PERT chart presents a graphic illustration of a project as a network diagram consisting of numbered nodes (either circle or rectangles) representing events, or milestones in the project linked by labeled vectors (directional lines) representing tasks in the project. The direction of the arrows on the lines indicates the sequence of tasks (Brush, 2019).

According to (Brighthub-Project-Management, 2020)steps in the PERT planning process:

1. Identify the specific activities and milestone.
2. Determine the proper sequence of the activities
3. Construct a network diagram
4. Estimate the time required for each activity
5. Determine the critical path
6. Update the PERT chart as the project progresses

PERT is best used in projects where the activity time estimate cannot be predicted fairly accurately. In other words, it accounts for uncertainty. PERT in its pure form cannot be used for time/cost trade off analysis. PERT Network uses a probabilistic approach to estimating for each activity. To estimate for an activity, the following formula is used.

PERT probabilistic approach to estimating activity time:

$$\textbf{Expected time} = \frac{\textbf{optimistic} + \textbf{4} * \textbf{most likely} + \textbf{pessimistic}}{\textbf{6}}$$

Where,

Optimistic = lower probability (Approximately 1%) that the activity will be complete

Most likely = the highest probability of completing the activity in this time

Pessimistic = the longest possible time.

- ***Microsoft Project***

Microsoft office project, also referred to as Microsoft project, is a suite of tools for more efficient project and portfolio management. Project is used in a variety of industries including construction, manufacturing, pharmaceuticals, government, retails, financial services and health care. The main modules of Microsoft Project include project work and project teams, schedules and finances. Microsoft Project is designed to help users set realistic goals for project teams and customers by creating schedules, distributing resources and managing budgets (Microsoft, 2013).

The Project Guide helps users create projects, track tasks, and report results. The software helps contractors gain control over their resources and finances by simplifying the assignment of resources to tasks and budgets to projects. Microsoft project also comes with a customizable wizard that walks users through the process of project creation, from assigning their tasks and resources to reporting the final results. Microsoft Project management software is closely integrated with Microsoft Office suite and also includes a Client Access License (CAL) that allows easy connection with Office Project Server (Microsoft, 2013).

iii. Steps for Scheduling for Determination of Contract Time

Establishing a project's duration will be accomplished with the following steps for all categories, according to (Gondy & Hildreth, 2007): review the project plans and specifications. Analyze and determine special factors that are controls affecting completion or phasing of the work. If the project has more than one phase, determine what work can be done in each of the phases; list the required activities for each phase; list each quantity of the unit of work that will be used as a basis for estimating the duration activity, e.g. for storm sewers this would be the number of linear feet of pipe, etc.

On a project with more than one phase use only that quantity associated with that phase. List of pay items shows, for instance, 10,000 cubic yards of excavation for a project, two phases, that have approximately the same amount on each phase, put 5,000 as the unit of work for excavation in Phase 1 and 5,000 cubic yards as the unit of excavation in Phase 2. Extreme accuracy is not required. It is only necessary that of activities sum to the whole, but a percent or two of error on any phase will not affect the results.

Use the production rates to convert the units of work into work days. Do this for each phase.

Enter activities to draw the Bar Chart for Estimating Contract Time. Winter shut down due to seasonal limitations will be addressed if the contract duration requires the work to occur during two or more construction seasons.

Status of utility report from the Right of Way Division will be checked to determine if any time adjustments are needed before the project is advertised or the Contractor will be start work. Also a determination should be made for coordination with utilities for any concurrent utility relocation work required. Seuk et al. (2008) stated that usually the responsibility for determining contract time is designated to a scheduler who gathers all data required for estimating contract time referring the design drawings, specifications, bill of quantities and all other relevant data. After browsing through all the data, the scheduler prepares a list of controlling activities that represent the major tasks of the project. The scheduler then starts calculating the duration for each controlling activity in the list using production rates and estimated work quantities.

2.2 Empirical Reviews

2.2.1 International Studies on Project Completion Time

Delays are usually followed by cost and time overruns. Delays experienced in construction project have immeasurable effects on client, contractor, consultant to a contract in terms of a growth in the way they relate, mistrust, litigation, mediation, arbitration, cash-flow problems, and a feeling of apprehension toward each other (Oraro, 2012). Hassebet al., (2011) noted that a project's success depends on meeting objectives within time and budget limits. The inability of the project team to have a comprehensive overview of the construction process from inception to completion is likely to be the reason for the nonrealization of projected delivery date (Aiyetan and Smallwood, 2010). According to Memon, Rahman and Azis (2012), study on time and cost performance in construction projects in Malaysia revealed that only 21% of public sector projects and 33% of private sector projects completed within time.

The results of the study showed that most important delay factors are: design and documentation issues; financial resource management; project management and contract administration; contractors' site management; and information and communication technology.

Owolabi et al. (2014) studied the causes and effects of delay on project time in Nigeria. They stated that seven out of ten projects in Nigeria suffered delays in their execution. The results of

the study indicated that the following five major causes of delay: Lack of funds to finance the project to completion, Changes in drawings, Lack of effective communication among the parties involved, Lack of adequate information from consultants, and slow decision making. Ramanathan, Narayanan and Idrus (2012) stated in their study carried out in Malaysia to examine 41 studies carried out around the world on construction delays conclude that there is an increase in the number of construction projects experiencing delays leading to exceeding the initial time and cost budget.

In Morocco, Challal and Tkiouat (2012) researched on the causes of deadline slippage in construction projects and found out the five major causes of delay: errors in initial budget assessment; architecture and engineering volatility program, site hazards, failure of an actor, and insufficiency or lack of prior study and feasibility. In India, Ravisankar, Anandakumar and Krishnamoorthy (2014) conducted a study on the quantification of delay factors in the construction industry. The researchers indicated that time overrun vary between 50% and 80% for projects completed worldwide.

According to Shanmugapriya and Subramanian (2013) investigated significant factors influencing time and cost overruns in Indian construction projects where Shortage of unskilled and skilled labor, Design changes by owner or his agent during construction, Fluctuation of prices, High waiting time for availability of work teams; and Rework due to errors. Completion of projects requires adequate and effective project management techniques and skills of the contractor. Weak management of contractors has often affected the completion of construction projects. In Lebanon, contractual relations and project management from viewpoints of contractors and consultants have been found to affect completion of infrastructural projects (Khalafizadeh, Mirhosseini & Tayari, 2014). Choge and Muturi (2014) also associate the completion of infrastructural projects on the experience of the contractor. Contractors are selected on the basis of price, experience in undertaking particular types of construction project and their reputation or track record in producing high quality work within budget and on time.

According to Peterson (2003), budgeting is difficult in developing countries due to their limited and uncertain resources and the politicized process of resource allocation. Budgeting is how the cash is distributed to ensure that an organization is able to achieve the key functions that it is supposed to achieve and deliver its functions within specified time. Project payment contributes to project delay.

Memon, Rahman,Aziz, Ravish, and Hanas (2011) have associated prolonged delays in payment with consequences, such as high risk of industrial disputes, destruction of property, and a low turn-over of workers; while Raj and Kothai (2014) pointed out that timely payment of workers is necessary for maintaining motivation, willingness, confidence, discipline, and cheerfulness to perform work. AbdulRahman, Taki and Min (2009) linked delayed payment to causal factors, such as clients' poor financial and business management; financial impropriety and political interference; inaccurate valuation for completed works; as well as insufficient documentation and information for valuation.

Memon (2011) has focused on the effects of delayed payment of contractors on the completion of infrastructural projects. Most government-funded projects are hurdled by the financial constraints during the time of their implementation. Since budgets are based on operating departments, it is important to superimpose key non-dollar factors that would signal whether the strategic programs are proceeding on schedule. The concern for financial measurement accuracy in the budgets seems to have jeopardized the concern for relevance in some companies' budgets (Holland, 2009).

There is great concern for delays and cost overruns in public sector construction as most projects are executed with public funds. The funding for construction activities helps in regulating the economy in many countries. As the construction, industry continues to grow in size, so do planning and budgeting problems. It is now common for projects not being completed on time and within the initial budget (Apolot, Alinaitwe and Tindwesi, 2013).

A pressing concern is however the rate of project overruns (cost and time) of both economic and social infrastructure projects in most developing countries (Omoregie and Radford, 2006). Hussin and Omran (2012) states that 70% of the projects abandoned in Malaysian transport construction projects be there due to financial problems of developers, contractors, the local and national governments, stakeholders like the donors. Therefore, for a project to be completed on time, the organization should look at its financial capabilities.

Construction companies have been investing heavily in technology in recent years by adopting new processes and purchasing state-of-the-art machinery. This has enabled workers to increase efficiency, shorten the duration of projects and ultimately increase profit. Design and production of construction projects share a need for rapid access to information and communication in real time (Cowel, 2005). Improving information and communication support for the core activities at the design and construction stage has become a strategic challenge for

the construction industry to increase efficiency and productivity in the construction process (Samuelson, 2008).

It is essential that each team member receive the right documents at the right time such as the latest version of design drawings and specifications requirements. There are other numerous software packages available to complement the working process of the construction industry in varied fields including Architectural Design, Civil Engineering Design and Specifications, Financial Management, Marketing, Contracts, Project Management, Procurement, Quantity Surveying, Site Management, and Valuation. Many these applications exist already and can be bought as complete solutions (Hore, 2006).

A study on project completion time in Kenya indicated that, most of the surveyed projects had time overruns and only 13 percent of the projects completed before the projected time. One of the major factors were insufficient funding as a major hindrance to timely project completion. This is followed closely by mention of lack of public engagements as a factor causing delay in project completion. Misappropriation of funds attracted more passionate explanations together with lack of public engagement. The study determined that project monitoring and timely project completion were highly correlated. The study concludes that adequate resource allocation, strong project leadership and close project monitoring are essential elements in timely project delivery. The performance of public construction projects had a negative relationship with project planning. These results implied that performance of public construction projects might be low despite there being a very good project plan. The most significant predictor of whether a project will be completed in time is project monitoring according to the model developed by the study (Murithi, et al., 2017).

The other study that conducted on the completion time of water projects in Kenya, the findings Indicated that financing, monitoring, contractor's capacity, and contract variations has influence on time implying that the most significant factor is contractor's capacity followed by monitoring of projects. The level of financing of a project's construction activities and its timeliness found to be a determinant of its completion time, and that effective monitoring partially depends on adequacy of supervisory personnel as well as timeliness in decision making and taking of actions to alleviate significant project target deviations that exist. Contractor's incompetence that can be attributed to inadequate equipment and personnel with required skills as well as financial difficulties among others is a key factor contributing to time

overruns in the water projects, while contract variations are common among the water projects and they influence negatively on the projects' completion time (Wangari, 2014).

The other similar study in Kenya also found that budgeting, staff competencies, monitoring and evaluation had appositive and significant correlation with timely completion of construction projects. The study also found that contract variation had a negative and significant correlation with timely completion of construction projects (Nyamwange & Nyang'au, 2018).

A study in Pakistan indicated the top ten factors that influenced project completion time. These are slow decision making process by owner, difficulties in financing project by owner, inadequate contractor's human resources, inadequate supervision consultant, act of god (war, terrorism, earthquake, flood etc.), long waiting time due to owner's authority decentralization in approving the project, lack of coordination and information between parties, change orders, unwillingness of government towards construction of hydropower projects, and difficulties in financing project by the contractor, among others (Anwar & Malik, 2017).

2.2.2 Studies on Projects and Project Completion Time in Ethiopia

The report by Borgen Project indicated that there are about five major developmental project categories in Ethiopia in last decade (Borgen-Project, 2017). These are projects backed by national and international funding organizations. To mention :Federal Democratic Republic of Ethiopia (FDRE);The government of the People's Republic of China (PRC);International Fund for Agricultural Development (IFAD);United Nations Development Program (UNDP) and World Bank.

The current focus of FDRE projects is on advancing industrial development to relieve fiscal and capacity deficits in Urban Local Governments (ULG). The country's Agricultural Transformation Industry ATI is focused on influencing the smallholder farmer level. The PRC projects in Ethiopia focused on industrial parks, dams, and roads. IFAD projects in Ethiopia focused on focus on improving poor rural people's access to natural resources, agriculture and livestock production technologies. UNDP projects in Ethiopia focused on providing innovative technological productivity solutions (Borgen-Project, 2017).

The strong supporter of Ethiopia in developmental projects is World Bank, primarily through its International Development Assistance (IDA), the World Bank's fund for the poorest. The IDA is Ethiopia's largest provider of official development assistance. Since 1991, the IDA has

committed over $17 billion to Ethiopia's development primarily to protect basic services, productive safety nets and roads. The World Bank and IDA provided Ethiopia with $200 million to fund the expansion of access to energy. They has committed $380 million to Ethiopia's GTP II in 2017. The World Bank has implemented development projects in Ethiopia to address education, water and sanitation and road quality and is a large contributor to Ethiopia's poverty rate reduction from 55.3 percent in 2000 to 33.5 percent in 2011 (Borgen-Project, 2017). Therefore, water projects as one of development program in Ethiopia is backed by World Bank until now, since major projects on road and water services are funded mainly by World Bank.

2.2.3 Studies on Water Projects in Ethiopia

According to US Aid report, people in different regions of Ethiopia are living under serious clean water shortage conditions. Thirty-three/ 33 million Ethiopians lack access to an improved water source and eighty-nine/ 89 million lack access to improved sanitation. Of those who lack access to improved sanitation, a staggering 23 million practice open defecation. In rural Ethiopia, a Water.org survey found that many women and children walk more than three hours to collect water, often from shallow wells or unprotected ponds they share with animals. Recurring droughts result in famine, food shortages, and water-related diseases, as people are forced to rely heavily on contaminated or stagnant water sources (Water.org, 2021).

Drinking water is not safe since it is not protected from surface contamination and people drink this untreated water. However, Ethiopia has relatively abundant water resources, it is considered water stressed due to rapid population growth over the last decade. Unpredictable rainfall and the shortage of existing water related infrastructure has many regions of the country in conditions of extreme water scarcity, degraded water quality and chronic food insecurity (BridgeIT-Water-Foundation, 2018).

Currently, the water projects in Ethiopia that mainly supported by World Bank framed around three components. The first focused on Addis Ababa, including: improvements and expansion of water supply production/distribution and sewage collection/treatment, improvements in operational efficiency, and improved governance for Addis Ababa Water and Sewerage Authority (AAWSA). The second supported four targeted secondary cities – Gondar, Hawasa, Jimma, and Mekelle – in improving/expanding water supply production and distribution, constructing new sewer networks and wastewater treatment plants, improving operational efficiency of each utility, and improving governance of the utilities. The third component

included support for project management, monitoring and evaluation, and capacity building linked to the project (World-Bank, 2018).

According to the recent report of Ministry of Water, Irrigation and Electricity, Ethiopia has significantly increased access to improved water supply to 57% (2015) and access to improved sanitation to 28%, which is still below the sub-Saharan average of 68 % for water supply and 30% for sanitation. The report stated that Ethiopia's rapid urbanization is putting stress on the already inadequate water supply and sanitation (WSS) system in urban areas. The capacity of urban centers to adequately dispose of wastewater is low, exposing natural resources to pollution and posing a risk to human health. Out of the estimated 398,985 m3/day of wastewater produced in Addis Ababa, Addis Ababa Water and Sewerage Authority (AAWSA) only has the capacity to properly dispose of 1,727m3/day or 0.43% of wastewater. The situation is even worse in other secondary cities including Mekelle 0.35%, Bahirdar and Hawassa 0.22%, Gondar 0.07%, Dire Dawa 0.05% and Adama 0.41%. In light of these challenges, the second phase of the Urban Water Supply and Sanitation Project (UWSSP) is primarily intended to improve urban sanitation holistically and equitably in the urban space and provide assistance to improve operational efficiency in 22 Ethiopian cities (MoWIE, 2020).

- **Water Projects in Jimma**

According to Jimma town water supply and sanitation project environmental impact assessment study, the Urban Water Supply and Sanitation Program (UWSSP) is designed to implement the National Policy, Strategy and WSSP, and its development objective is increased access to sustainable water supply and sanitation services in Addis Ababa, Hawassa, Jimma, Gondar and Mekelle. Under the Ministry of Water Resources (MoWR), Jimma Town Water Supply and Sewerage Enterprise (JTWSSE), have been selected since 2011 among 10 secondary cities in Ethiopia, including Hawassa, Gondor and Mekelle to participate in the Urban WSS Project (Jimma-ESIA, 2011).

The existing water supply system of Jimma town depends on Gilgel-Gibe river (GGR) as a source of raw water and has a weir intake structure, raw water pumping station, raw water rising main, conventional treatment plant, clear water collection and pumping system, three reservoirs, one booster station and distribution systems. In addition, the envisaged expansion project will depend on the GGR and it has been estimated that the flow of GGR is adequate to supply the water demand of the Jimma town until Year 2035 considering 50% of the minimum flow for downstream requirements (Jimma-ESIA, 2011).

2.3 Conceptual Framework

The conceptual framework of the study is developed from different authors findings (Nyamwange & Nyang'au, 2018; Anwar & Malik, 2017; Murithi, et al., 2017; Wangari, 2014).

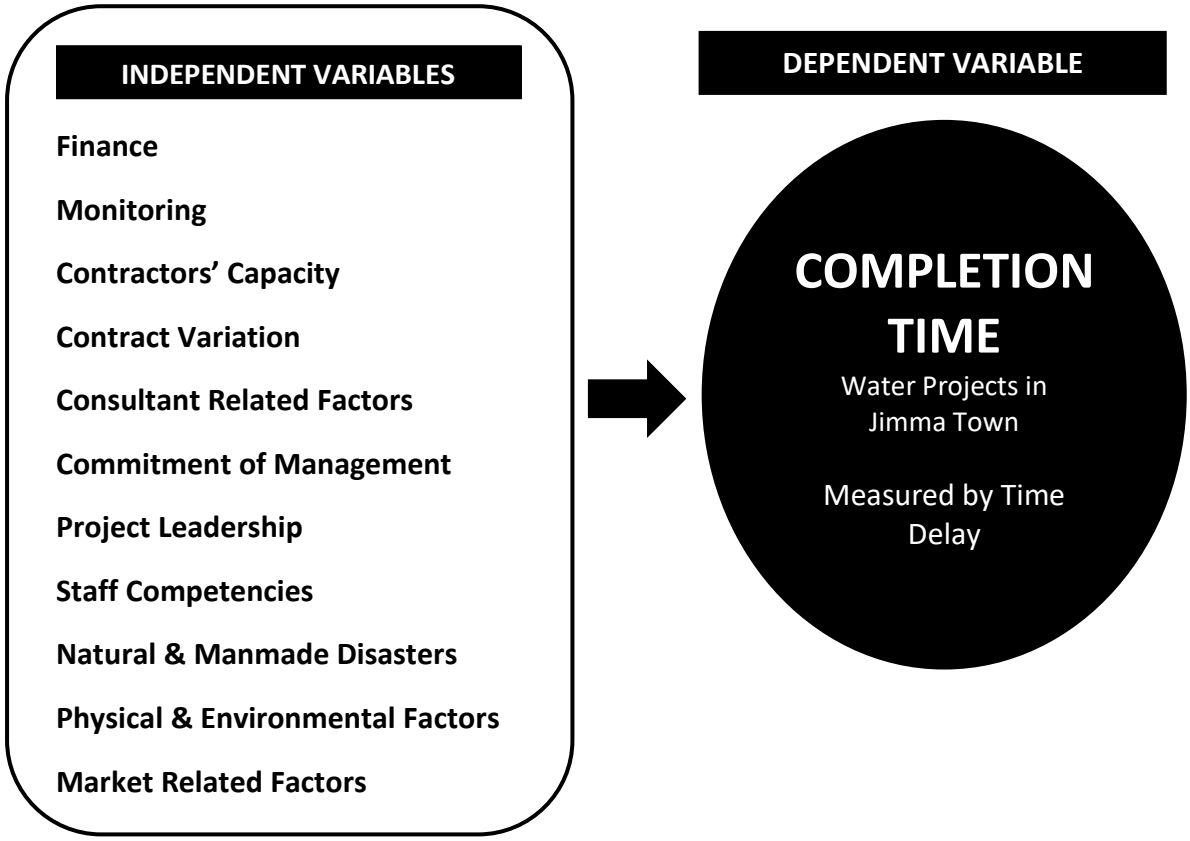

Figure 2: Conceptual Framework of the Study (Compiled by researcher, 2021)

Dependent variable of the study is completion time of water projects in Jimma town that measured by planned duration and actual durations. The independent variables that affect water project completion time are financing, monitoring, contractor's capacity, contract variations, consultant related factors, commitment of senior management, project leadership, staff competencies, act of God, physical and environmental factors and market related factors. These ten factors considered as independent variables of this study.

These factors can affect project completion time along with project cost and project scope. For the purpose of this, study the following conceptual framework prepared by relating the 10 hypothesized independent factors and 1 dependent factors, which measured by planned, and actual durations of the projects. Therefore, the independent variables measured as indicated in the following table:

Table 1: Measurement of Independent Variables

SN	Independent variables	Measured by
1	Financing	Adequacy of project budget Timely payments of contractor's certificates Contractor's financial capacity
2	Monitoring	Adequacy of supervisory personnel Ability to effectively supervise the project Timely approvals and actions on decisions
3	Contractor's capacity	Experience, Ability to effectively plan and schedule project activities Sufficiency of equipment and materials
4	Contract variations	Changes in scope Unexpected ground and weather conditions Percentage variance Risk factor Construction disputes
5	Consultant related factors	Inadequate supervision of consultant Incompetent design consultant Incompetent project management consultant
6	Commitment of senior management	Adequate funding Adequate supervision
7	Project leadership	Flexibility Stakeholders' engagement
8	Staff Competencies	Qualifications Training Experience
9	Act of God	War Terrorism Earthquake Pandemic
10	Physical and environmental factors	Weather conditions Topography Pollution Soil type
11	Market Related Factors	High cost of construction materials Unavailability of the required materials in market Poor quality of available construction materials

CHAPTER 3

RESEARCH DESIGN & METHODOLOGY

3.1. Research Design

Research design is a blueprint for conducting a research. It provides a clear plan on how the research conducted and helps the researcher in sticking to the plan (Ventu & Shukla, 2010).

This study followed mixed research approach that incorporate qualitative and quantitative approaches within a particular timeframe. The study was conducted by both descriptive and inferential research methods by collecting both qualitative and quantitative data. Descriptive approaches was employed for the data that the researcher collects from respondents through questionnaire. Detail description of the findings displayed in tables and charts.

3.2. Study Area

The study area of this research is Jimma town, central city of Jimma zone in Oromia region of Ethiopia. Jimma town having a total area of 220 Km2. It is located: 07o39' Latitude and 36o50' Longitude, at an altitude of 1700-1750m above sea level and 335 km southwest of the capital-city, Addis Ababa. The water service projects in the city that run by Jimma town Administration, Jimma town water and sewerage authority, water projects launched by other institutions were included in the study

3.3. Data Source and Collection Method

The researcher employed primary data sources to achieve objectives of this research. In this study, data were obtained from managers and professionals of water projects in Jimma town. Therefore, the data collection techniques that were employed to collect data of the study were questionnaire (5 scale Likert), key informants interview.

All questionnaires are 5 point Likert and completed by managers and professionals. The benefits of Likert Scale: quick and economical to administer and score, easily quantify (easy to calculate mean) most attitude measurement, provide direct and reliable assessment of attitudes and they lend themselves well to item analysis procedures. The respondents were asked to rate each statement and overall retention level respectively with Likert scales of (1= strongly disagree, 2 = disagree, 3 = nether agree nor disagree, 4 = agree and 5 = strongly agree). The Researcher used four enumerators to collect data by giving brief instructions of how to distribute and collect questionnaires.

The qualitative data also collected from the managers also to triangulate the data collected from professionals. For this purpose, the interview was administered to managers in the projects.

3.4. Population of the study

Target Populations to be studied were managers and professionals in the study area. This include project managers, site engineers, supervisor and other employee that was participated in the project. According to the information gathered from the project managers of the projects and key informants of the study, the total size of estimated target population is about 150 (50 ± five from each organization). This population comprises samples in the organizations that carried out water projects in the town (Jimma town Administration, Jimma town water and sewerage authority and other institutions that run significant water projects in the town).

3.5. Sampling Design

In order to select the appropriate representative of the total population and to make the research findings more relevant and accurate, the sample design would be well-structured (Davis, 2000). Therefore, the researcher designed the sample as follows.

3.5.1. Sampling Technique

Currently operating water projects in the study area all are selected through purposive sampling. After the projects samples selected, the determination of sample size of the population was done by selecting proportional number of samples from each project. Therefore, all projects of study area have equal chance to be selected as a sample. Therefore, sample is selected from elements of a population that are easily accessible. The numbers of managers and professionals in water projects were selected for both questionnaires and interview techniques through non-probability sampling, i.e. snowball sampling and purposive sampling respectively.

3.5.2. Sample Respondents of the Study

The target population of the study was 150 from organizations that carried out water projects in the town (50 ± 5 from Jimma town Administration, ± 50 from Jimma town water and sewerage authority and 50 ± five from other institutions that run significant water projects in the town). In this regard, Jimma University found to be the organization in Jimma town that launched several water projects under its different programs and campuses (including Jimma university Agaro campus) was selected as the only institution in the town other that the town administration and water authority. There were no any other organization found in the town

that conduct water project, and then this study limited to these three organizations. Since Jimma water authority and the town administration working in collaboration and strong intergovernmental sector relationship, they are considered as one group of samples in the presentation of sample size.

Therefore, the sample size of respondents in each group of organizations and in each projects presented in the following with the proportionated planned sample size. The actual sample respondents in each projects that participated in the data collection of this study also presented below in the table.

Table 2: Sample Respondents of the Study

Group of Organizations that run water projects in the town		**Projects under each group**	**Sample size from each project**	**Sample respondents during data collection**	**Remark**
			Frequency	Frequency	
Jimma town water and sewerage and Jimma town administration		bridge	4		
		culvert	4		
		sewerage	5		
		supply	7		
		supply	8		BosaAddis
		Awetu River	3		Beautification
		Rural bridge	7		
		supply	7		Agaro road
Group total			***45***	***39***	
Jimma university	Agriculture Campus	Ground	3		
	Agriculture Campus	supply	5		
	Main Campus	CGICOP	4		
	Main Campus	JUCS	5		
	Main Campus	Ground	3		
	Main Campus	sewerage	5		
	Main Campus	supply	7		
	Technology Campus	Ground	5		
	Technology Campus	sewerage	8		
	Technology Campus	supply	10		
Group total			***55***	***54***	
TOTAL			**100**	**93**	

***Note**: CGICOP is China Gansu International Corporation for Economic and Technical Cooperation with Jimma University – a project on internal compound rigid pavement, bridge, and sewerage project. JUCS is Jimma University Community School water tanker project*

3.6. Method of Data Analysis

The data were analyzed by computing the multivariate linear regression technique since the dependent variable is continuous. The regression model generally assumes the following equation:

$$Y = ß0 + ßX1 + ßX2 + ßX3 + \cdots ßX11 + e$$

Where;

Y = Project completion time – The dependent variable

ß0 = this is the Y – intercept which is a constant not a variable

X1= finance

X2= monitoring

X3= contractor's capacity

X4 = contract variations

X5 = consultant related factors

X6 = Commitment of senior management

X7 = Project leadership

X8 = Staff competencies

X9 = Natural and manmade disasters

X10 = Physical and Environmental Factors

X11 = Market related factors

e = error; variable which represents all the factors that affect the dependent variable but were not included in the model either because they were difficult to measure or not known.

The qualitative data was analyzed by thematic and coding methods of analyses.

CHAPTER 4

RESULTS AND DISCUSSIONS

This chapter presents the findings of the study in which factors influencing the completion time of water projects in Jimma town. The findings of the study have been discussed in line with the study variables and objectives. In this regard the sociodemographic statistics, estimation of time delay in water projects at this study area, the reliability test of variables, the factors that influenced the projects time and the discussion from qualitative results are presented here

Socio Demographic Characteristics

Ninety-three (93) respondents participated from water projects in Jimma town. From the total participants 82 (88.2 %) of them were male and 11(11.8%) of them were female. Majority 44.1% (41) of the respondents job title was categorized as other following by 28 % (26) of them were site engineers.

Table 3: Socio-demographic characteristics (2021)

Variable name	Category	Frequency	Percent
Sex	Male	82	88.2
	Female	11	11.8
Job title	Head of the Organization	1	1.1
	Project Manager	7	7.5
	Site Engineer	26	28.0
	Office Engineer	18	19.4
	Other	41	44.1
Working experience	less than 1 Year	8	8.6
	1- 4 Years	39	41.9
	5-8 Years	35	37.6
	above 8 Years	11	11.8
Level of education	Certificate	12	12.9
	Diploma	17	18.3
	First Degree	51	54.8
	Second Degree	12	12.9
Name of the organization where the water projects found	Jimma town water & sewerage	18	19.4
	Jimma town Administration	3	3.2
	Jimma University	61	65.6
	Jimma town Administration (collaboration projects with and vicinity towns)	11	11.8

More than 75% of the respondents have 1-4 years and above working experience at the time of the study. Regarding their level of education majority 63 (67.7%) of the respondents have first degree and above. (Table-2).

4.1.1. Response Rate

Total response rate is the number of sample respondents who answered the questionnaire divided by the total number of people in the sample. It is usually expressed in the form of a percentage. A low response rate can give rise to sampling bias. Evans SJ. Good surveys guide 1991 stated that getting a high response rate above 80% from a small, random sample or judgmental sample is considered preferable to a low response rate from a large sample (Choung, et al., 2013). If a questionnaire achieves only a 25% response rate, the study suffers from a nonresponse bias of 75%. One way of dealing with lack of representativeness is to weight the study sample segments to reflect the greater population attributes (Fincham, 2008). Therefore, the response rate of this study computed for both the total sample respondents (93) and for planned sample size (100).

From the planned sample size of hundred, the data were collected from 93 respondents in two major groups of organization, these are water projects run by governmental offices (Jimma water and sewerage authority and Jimma town administration office) and water projects run by other sectors (in this case Jimma university). Total response of the study was 93%, which is very favorable to consider that there is no sample bias in the study.

Group of organization		**Sample Size**		**Response Rate**	
	Target population distribution within groups (T)	**Planned Sample size (P)**	**Actual Sample respondents (S)**	**Within the actual respondents of the study (R)**	**Within the group (Rg)**
	frequency	**frequency**	**frequency**	**$R = S/(P_{total})$ $(P_{total} = 100)$**	**Rg = P/S**
Jimma town water & sewerage + Jimma town administration	140	100	39	39 %	86 %
Jimma university	57		54	54 %	98 %
Total	197	100	93	**93 %**	**92 %**

Note: *≈ designated the approximated sample size from each group of target population by the researcher*

4.2. Delay Statistics of the Projects

To analyze the delay in the completion time of the projects in the study area the appropriate statistical relationship is computing the central tendency with normal distribution of the data. For the convenience of the computation, the value of delay is put in the percentage form. That means the delay time of the project divided by the total duration of the project and the multiplied by hundred. The most common measures of central tendency are the arithmetic mean, the median and the mode, maximum and minimum limits and they are described below in the tables and graphs. A central tendency can be calculated either for a finite set of values or for a theoretical distribution.

The respondents of this study were Jimma town water and sewerage authority, Jimma town Administration (which include the new Awetu river beautification project, Jimma University, and Jimma town Administration (collaboration projects with and vicinity towns). This organization of the town generally include almost all water projects in the town and this study contacted ninety-three respondents from eighteen water projects. The central tendencies of the delay shown in the following graph.

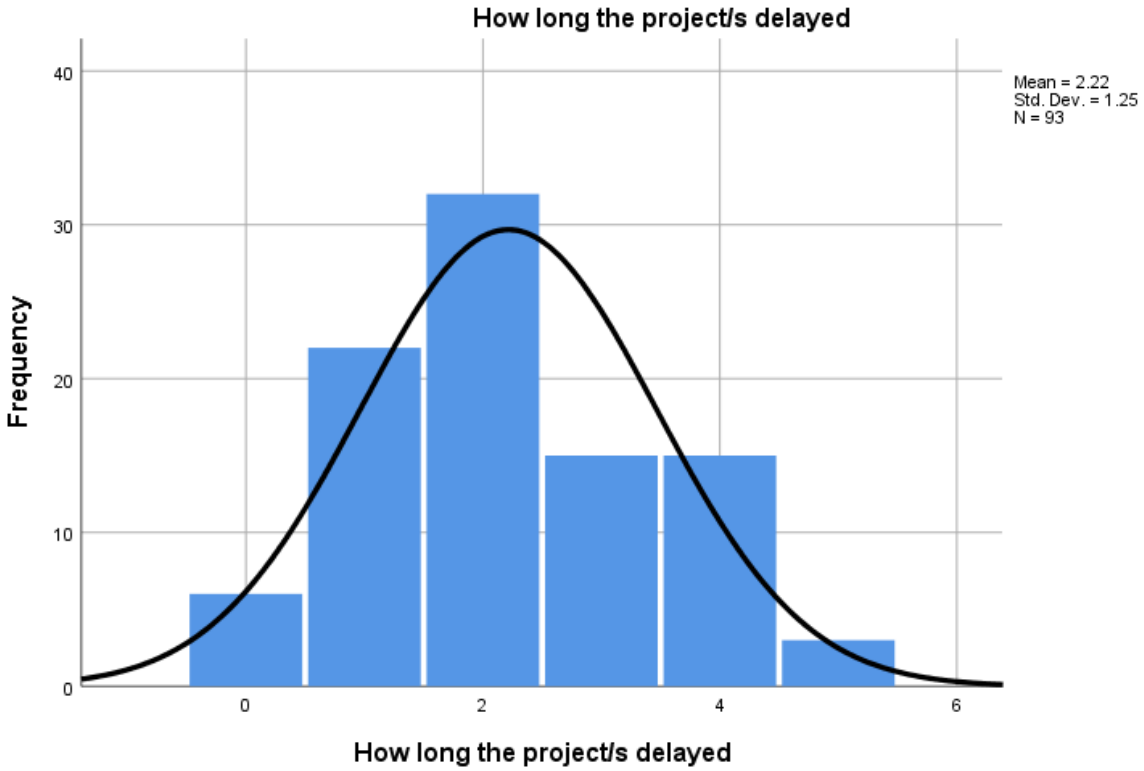

Figure 3: How long the project/s delayed (2021)

The result indicates that the average delay time in these water projects is 2.22 years (803 days). The graph also indicated that the minimum delay is 0 year and the maximum delay is 5 years.

The following table shows the time delay in years with in each respective projects.

Table 4: Time delay in each projects

SN	Project	Delay (t) In yrs.	Frequency (f)	t*f	Cumulative t*f
1	• Agri Ground • Awetu trench	0	2	0	0
2	• AGARO supply • Agri supply • Main sewerage • Techno sewerage	1	4	4	4
3	• CGICOP sewerage & bridge • Rural bridge • Techno Ground • Techno supply • Town bridge • Town supply	2	6	12	16
4	• JUCS • Main supply	3	2	6	22
5	• Main Ground • Town culvert • Town supply (Saris)	4	3	12	34
6	• Town sewerage	5	1	5	39
	Total		18	39	
	Mean = Σ(t*f)/ f = 39/ 18	2.167			

The table showed that the only two projects in the town that completed without any delay are Awetu River project that launched by Jimma town administration and Agriculture campus ground water project that run by Jimma university. On the other hand, the maxim-delayed project is a sewerage project of Jimma town water and sewerage authority.

4.3. Reliability Test

The tool that used to collect data for "the factors that affect completion time of the projects" tested for its reliability. The 11 variables tested for Cronbach is α reliability test and all of them found to be reliable items to collect the data for this study (table 4). Acceptable range of Cronbach's α reliability test result is from 0.5 to one indicating good reliability of the items.

Table 5: Item Reliability test

SN	Variable	Cronbach's α	Mean	Std. deviation
1.	Financing	0.898	9.4	3.133
2.	Monitoring	0.916	8.31	3.782
3.	Contractors capacity	0.812	9.43	2.741
4.	Contract Variation	0.649	12.04	1.901
5.	Consultant related factors	0.911	10.04	2.910

6.	Commitment of senior management	0.745	9.65	2.638
7.	Project leadership	0.889	9.30	3.495
8.	Staff competencies	0.832	9.62	2.982
9.	Disasters	0.522	9.63	2.573
10.	Physical and environmental factors	0.743	10.52	8.680
11.	Market	0.774	11.48	2.43

4.4. Factors Affecting Completion Time of Water Projects

The variables Finance, Monitoring, Contractors Capacity, Contract Variation, Consultant Related Factors, Commitment of Senior Management, Project Leadership, Staff Competencies, Natural and Manmade Disasters, Physical and Environmental Factors and Market Related Factors were considered candidate variables for multivariable regression analysis and hence, entered to multivariable regression model.

4.4.1. Major Factors Influencing Project Completion Time

In the final model, five variables viz. Finance, Monitoring, contract Variation, Physical and Environmental factors and market related factors found to have significant associations with delay time in the water project.

Table 6: Factors that Influence Project completion time

Model		Unstandardized Coefficients		t	Sig.
		B	Std. Error		
1	(Constant)	19.479	8.712	2.236	.028
	Finance	6.923	.839	8.252	.000*
	Monitoring	3.296	1.401	2.352	.021*
	contractors capacity	.036	.720	.050	.960
	Contract Variation	6.396	1.127	5.673	.000*
	consultant related factors	.959	.789	1.216	.227
	commitment of senior management	.021	.943	-.022	.983
	Project leadership	.172	1.088	.158	.875
	Staff Competencies	.015	.848	.018	.986
	Natural and manmade disasters	1.317	.759	1.736	.086
	Physical and Environmental factors	2.635	.827	3.185	.002*
	Market related factors	3.255	1.163	2.799	.006*

The study indicated that financial factors (adequacy, timely payment and budget capacity) have an effect on the delay of the water projects under study. Compering with other factors the top

most affecting factor is found to be finance [coefficients = 6.923] and contract variation [coefficients = 6.396]; followed by monitoring (3.296), market related factors (3.255), and physical and environmental factor (2.635). Note that the beta value indicated in the table 5 taken as absolute value of the actual integer value of the output. The sign of integer (negative, positive) indicated only the form of the question in the Likert questionnaire, but not the direction of influence of the variable on the dependent variable as interpreted in following sub sections.

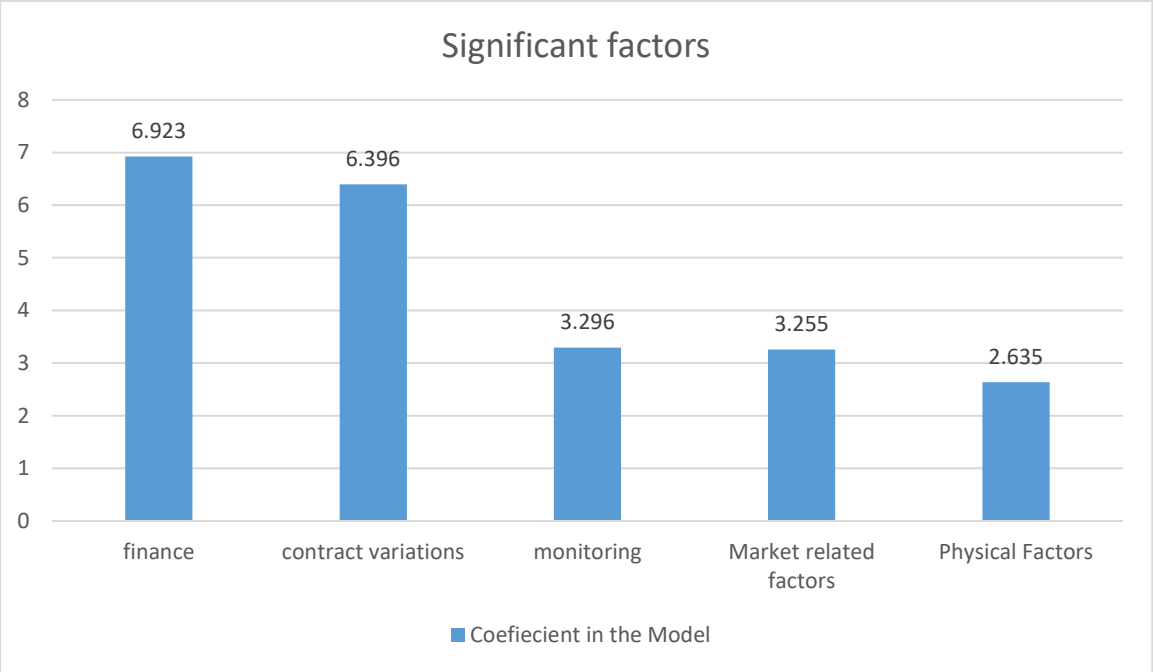

Figure 4: Significant Factors

The regression model generally assumes the following equation:

$$Y = ß0 + ßX1 + ßX2 + ßX3 + \cdots ßX11 + e$$

Where;

Y = Project completion time – The dependent variable

ß0 = this is the Y – intercept which is a constant not a variable

X1= finance, X2= monitoring, X3= contractor's capacity, X4 = contract variations, X5 = consultant related factors, X6 = Commitment of senior management, X7 = Project leadership, X8 = Staff competencies, X9 = Natural and manmade disasters, X10 = Physical and Environmental Factors, X11 = Market related factors

e = error; variable which represents all the factors that affect the dependent variable but were not included in the model either because they were difficult to measure or not known.

From the regression findings, the substitution of the equation becomes:

Y= 19.479 + - 6.923 X1 + 3.296 X2 + .036 X3 + 6.396 X4 + .959 X5 + -.021 X6 + - .172 X7 + .015 X8 + 1.317 X9 + - 2.635 X10 + 3. 255 X11 + 8.712

According to the equation, taking all factors (financing, monitoring, contractor's capacity, contract variations, consultant's related factors, commitment of senior management, project leadership, staff competencies, natural and manmade disasters, physical and environmental, and market) constant at zero, timely completion of the projects is 19.479. This finding can be interpreted as follows.

X1%*Delay (yrs.) = New Delay (yrs.)

Delay (yrs.) – New Delay (yrs.) = Time (yrs.) Saved due to unit effectiveness of that factor

4.4.2. Degree of Influence of Significant Factors on Project Time

The factors that strongly influenced the project delay or completion time are finance (6.923%), contract variations (6.396%), monitoring (3.296%), and market related factors (3.255%) from the top most to least ones respectively. The analysis of the degree of influence of the factors takes the mean delay time 2.2 years or 2 years 2 months and 13 days (803 days) as benchmark, to discuss the influence of the certain factors in reference to the possible maximum time delay of the project in the study area, as identified by this study.

4.4.2.1. Finance

The findings showed that a unit increase in financing effectiveness leads to a 6.923% increase in timely completion of projects. Taking the mean delay as a reference, 6.923% of 2.2 years becomes 0.15 years (1 month and 26 days). This implies that, effective finance would save 1 month and 26 days (56 days) of project time in average.

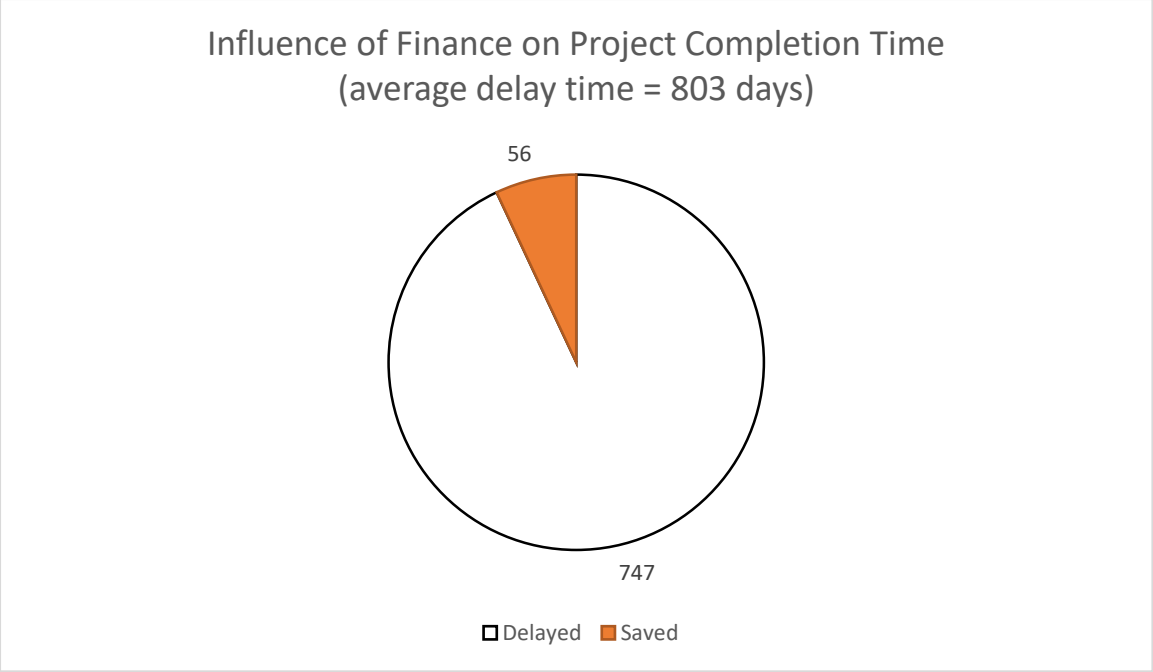

Figure 5: Influence of Finance on Project Completion Time

4.4.2.2. Contract Variations

A unit increase in contract variations effectiveness leads to a 6.396% increase in timely completion of projects. Taking the mean delay as a reference, 6.396% of 2.2 years becomes 0.14 years (1 month and 21days). This implies that, effective contract variations would save 1 month and 21 days (51 days) of project time in average.

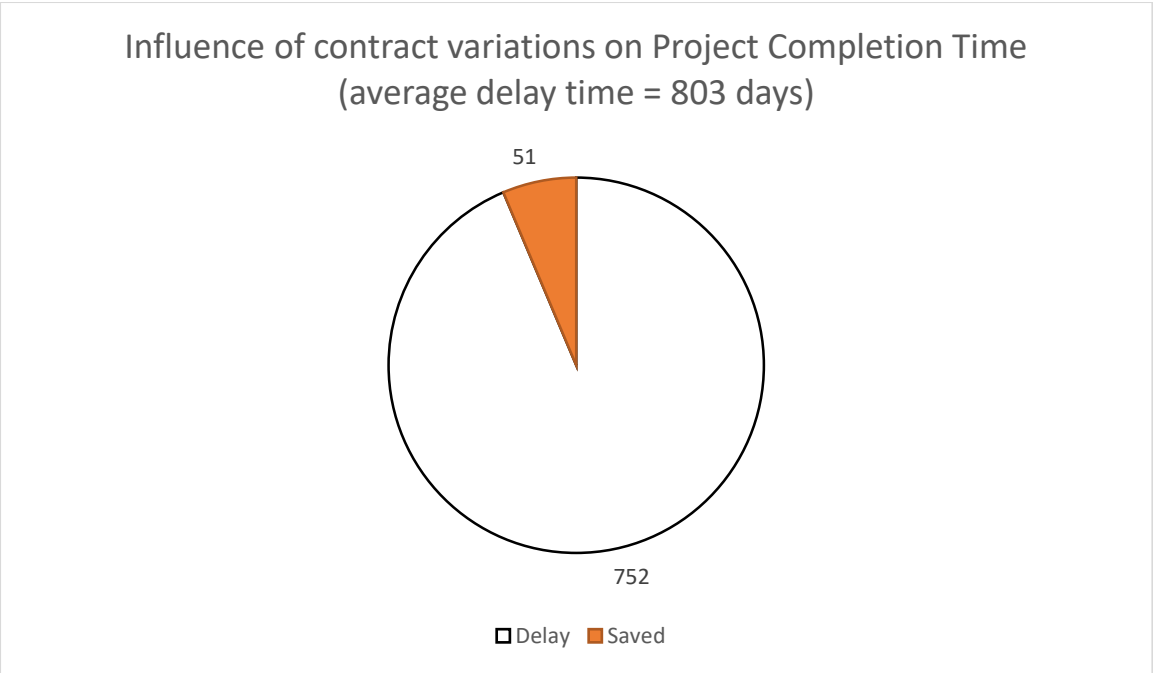

Figure 6: Influence of contract variations on Project Completion Time

4.4.2.3. Monitoring

A unit increase in monitoring effectiveness leads to a 3.296% increase in timely completion of projects. Taking the mean delay as a reference, 3.296% of 2.2 years becomes 0.07 years (26 days). This implies that, effective monitoring would save 26 days of project time in average.

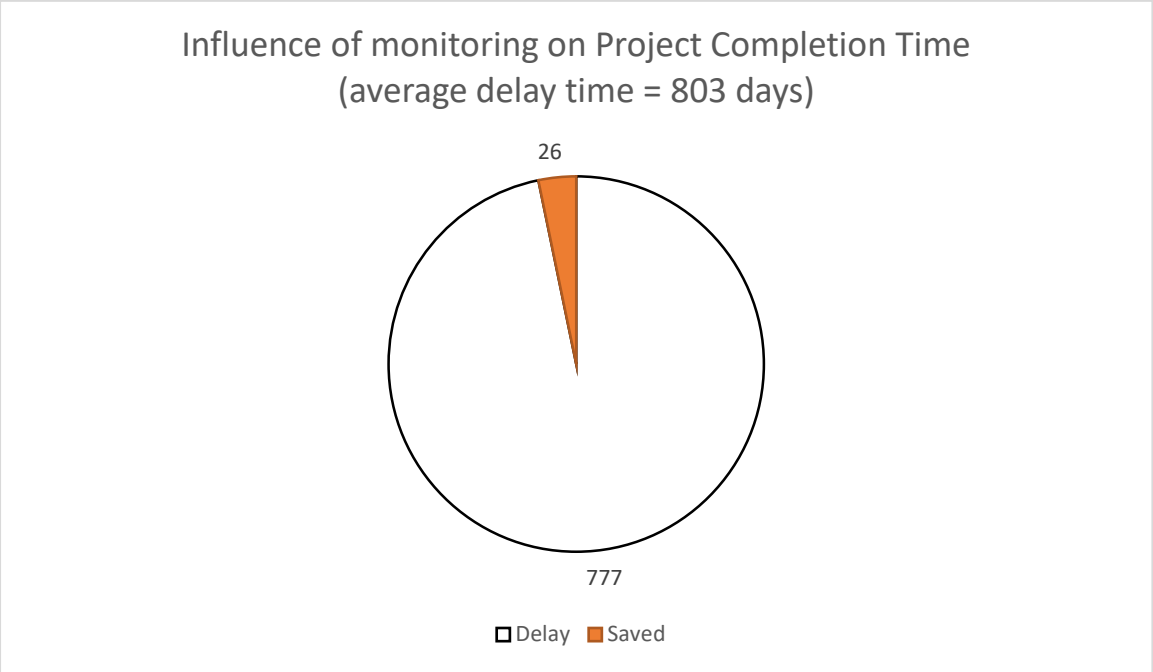

Figure 7: Influence of monitoring on Project Completion Time

4.4.2.4. Market Related Factors

A unit increase in market related factors effectiveness leads to a 3 255% increase in timely completion of projects. Taking the mean delay as a reference, 3 255% of 2.2 years becomes 0.07 years (26 days). This implies that, effective market related factors would save 26 days of project time in average.

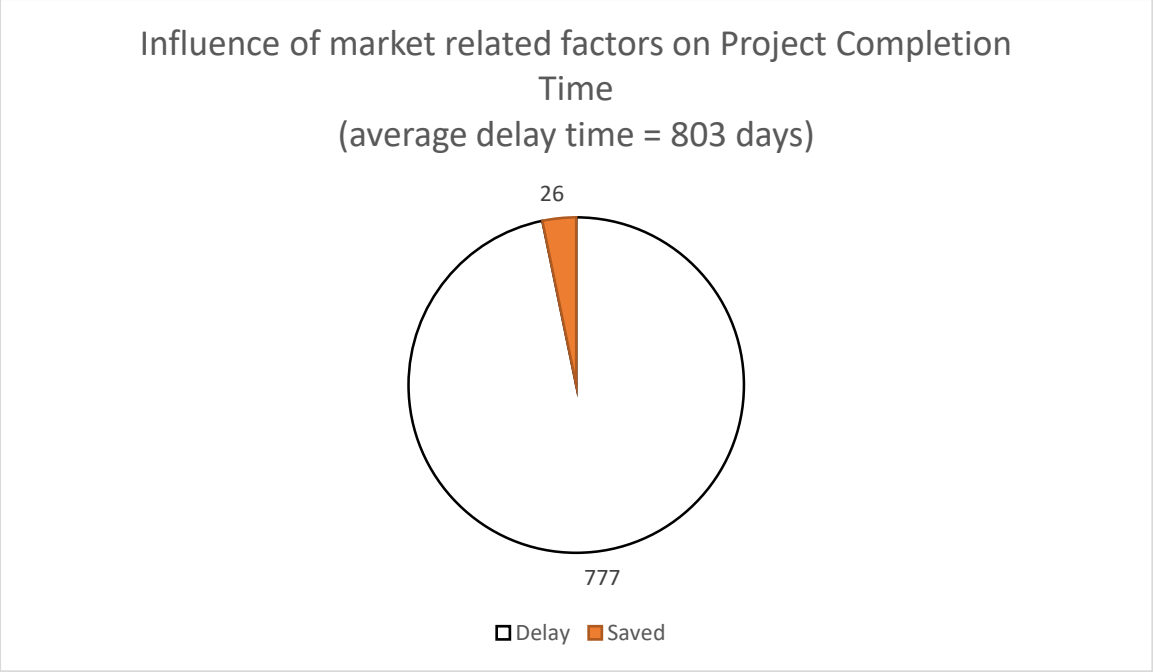

Figure 8: Influence of market related factors on Project Completion Time

In similar way, the interpretation can be done for the remaining factors by considering also four, three, two, and one years of delay that identified in the study.

At 1% level of significance and 99% level of confidence, financing had a 0.00 level of significance; monitoring .021, contract variation 0.00 level of significance while physical and environmental factor had a .002, and market related factors had a .006 level of significance; implying that the most significant factor is financing followed by contract variation of the projects.

Project time saved due to the unit effectiveness of the most significant factors can be shown in the following graph.

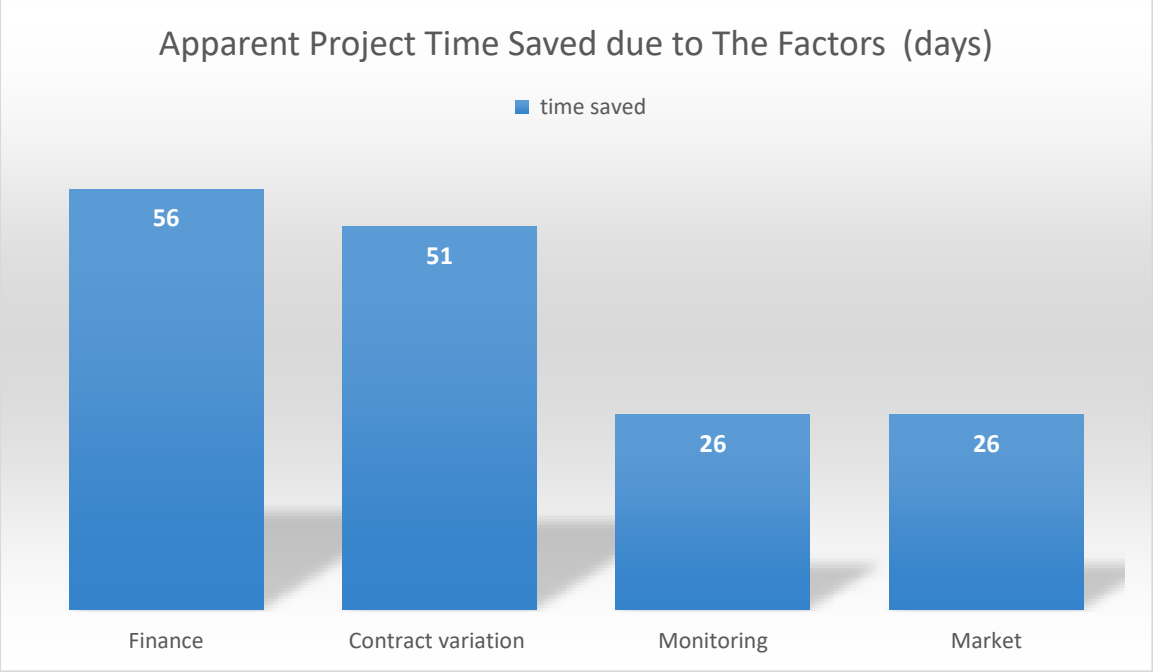

Figure 9: Apparent Project Time Saved due to The Factors (days)

4.4.3. Triangulation of the Qualitative and Quantitative

The interview technique was employed in this study for the triangulation purpose. The interview data was analyzed with thematic qualitative analysis to identify the major factors that influence water project completion time in the area. In this regard finance, monitoring, contract variation, physical factors, and market related factors found to be the top most factors from the rank of one to five respectively. When comparing to quantitative result, all of these factors also have been identified as major factors. Therefore, the result of qualitative data are also in line with the results of interview of this study. This implies that, the study has good internal validity, consistency and reliability.

The data for qualitative analysis collected through questionnaires from 12 top project managers and current representatives of the projects (one head of organization, 7 project managers and 4 site engineers those were in charge of the leadership of the project at the time of data collection of this study). The common factors influencing the project completion time that forwarded by the interview respondents were organized and analyzed by qualitative data analysis methods. The responses of the interviewee were different one from another and they have to be uniform and align to the factors/ variables of the study.

The responses look likes,

“Inadequate financing, high market cost (of construction materials), and unavailability of the item in the market”;

“Poor project management practice, design change insisted by the clients and improper design”;

“Poor workmanship (low job experience and poor educational qualification), and corruption”;

“Bad weather condition, lack of good communication among staff members, and unexpected ground conditions (e.g. large bed rock that inhibit the ground water works)”.

And, this raw and disorganized data were transcribed, edited, organized and arranged in aligning to study variables, newly mentioned factors grouped in new category, all responses coded for suitability of thematic analysis, frequently mentioned factors prioritized and ranked based on emphasis given by the respondents, and finally the result of the analysis presented textually as shown in the following paragraphs.

The result of data analysis from the interview response of project managers in water projects indicated that the major factors affecting completion time listed in according to the emphasis given by individual respondents from the most reported to the least are; financing, market related factors, contract variation, project leadership, monitoring, physical and environmental factors, shortage of labor force, natural and manmade disasters(most importantly the current political instability), unrealistic deadline, and low relevance of the projects for the community (poor design).

This is finding is in line with the quantitative result found and all the five significant factors are also listed in qualitative responses. In addition; Natural and manmade disasters (most importantly the current political instability) and project leadership are described as factors that affect project completion time which were found to be insignificant in quantitative analysis. There are also three new factors identified in this qualitative analysis: shortage of labor force, Unrealistic deadline, and Low relevance of the projects for the community (poor design).

Comparing the qualitative result with the quantitative one, the factors can be paralleled as follows:

Table 7: Triangulating Qualitative with Quantitative result

Quantitative analysis		Qualitative analysis		Triangulation	
Major factors	Rank	Major factors	Rank	Common Factors	Rank

Finance	1	**Finance**	1	**Finance**	**1**
Monitoring	2	**Market**	2	**C/ Variation**	**2**
C/ Variation	3	**C/ Variation**	3	**Monitoring**	**3**
Physical factor	4	Project Leadership	4	**Market**	**4**
Market	5	**Monitoring**	5	**Physical factor**	**5**
		Physical factor	6		
		Law Labor Force	7		
		Natural & Manmade	8		
		Unrealistic Deadline	9		
		Low Relevance	10		

Therefore, the major factors affecting the completion time of the projects are, financing, contract variation, monitoring, market related factors, and physical and environmental factors from the triangulation of both analysis techniques.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1. CONCLUSION

The analysis of this study, factors that influencing the completion time of water projects in Jimma town, showed that the most affecting factors on project completion time are financing, market related factors, contract variation, monitoring, and physical and environmental factors. The others contractors capacity, consultant related factors, commitment of management, project leadership, staff competencies, natural and manmade disasters are affected the project completion time but there are not significant.

In addition; natural and manmade disasters (most importantly the current political instability) and project leadership, shortage of labor force, unrealistic deadline, and low relevance of the projects for the community (poor design) found to be factors affecting the project completion time.

In addition to the findings from the quantitative analysis, the result of interview also in line with the result of questionnaire. In this regard, the finance, contract variation, monitoring, market conditions, and physical factor found to be the major factors influencing the project completion time in water projects in Jimma town.

5.2. RECOMMENDATION

The following points forwarded to concerning bodies from the results of this study:

- **To Financing Bodies**: Financing of the projects, that found to be the top most influencing factor of the project completion time in the study area, should be given a great emphasis in project planning, implementation and monitoring and evaluation stages. In this regard, Jimma Town Administration and its water supply authority and other concerning bodies should establish a special inter-organizational relationship with government financing bodies to simplify the complex and lagging financial system that hinders the smooth flow of financing to address the timely demand of the projects.
- **To Government:** Market condition (price inflation and unavailability of goods in shop stores) is aggravated recently due to current economic problem of the country. This issue influenced the completion time and caused delay in most of the water projects in

the town except the Awetu river trench and beautification project. This specific project given special treatment by government bodies through suppling construction materials by extended government loan and inter-institutional cooperation. Therefore, this good trend and experience should be taken as a good example and other projects have to also establish special market agreements directly with manufacturers, wholesalers, and factories to mitigate the current market problem. In addition to this, government must provide a special loan to projects in such difficult time to motivate water projects, which are very vital for wellbeing of the society.

- **To Water Project Administrations**: The monitoring and supervision of the projects found to be the most influencing factor of water project completion time. Therefore, the project administrations in different sectors of the town that involved in water projects must launch a new separate supervision body to water projects that functions free from any influence from the senior management the projects, the contractors and the consultants. This monitoring team could be establish from different volunteer and professionals (project managers, water and civil engineers, researchers and so on).

REFERENCES

Abbasi, M., Tarhini, A., Hassouna, M. & Shah, F., 2015. Social,organizational,demography andindividuals'technology acceptance behaviour:A conceptual model.. *European Scientific Journal, 11(3),* pp. 39-68.

Ambulkar, A., 2019. *Top 10 Challenges In Water And Wastewater Construction Projects.* [Online]
Available at: https://www.wateronline.com/doc/top-ten-challenges-in-water-and-wastewater-construction-projects-0001
[Accessed 1 February 2021].

ANSI, A.-N.-S. A., 2004 . *A Guide to the Project Management Body of Knowledge.* Third ed. Pennsylvania, USA: American National Standard ANSI/PMI 99-001-2004.

Anwar, A. & Malik, S. A., 2017. A Conceptual Model of Delay Factors Affecting Government Funded Hydropower Projects. *Developing Country Studies,* 7(10), pp. 1-8.

Baker, C. D., 2016. *Construction Handbook: a Guide for Modernization and Development of State-Aided Public Housing.* 1st ed. Massachusetts: Construction Management Unit.

Borgen-Project, 2017. *Five Development Projects in Ethiopia.* [Online]
Available at: https://borgenproject.org/development-projects-in-ethiopia/
[Accessed 1 February 2021].

Bradley, A., 2016. *Consequences of concurrent delay on construction projects.* [Online]
Available at: https://www.pinsentmasons.com/out-law/guides/consequences-of-concurrent-delay-on-construction-projects

BridgeIT-Water-Foundation, 2018. *Ethiopia has an extreme water crisis situation ~ US Aid.* [Online]
Available at: https://www.bridgitwater.org/water-projects-ethiopia
[Accessed 2 February 2021].

Brighthub-Project-Management, 2020. *PERT - project management.* [Online]
Available at: brighthubpm
[Accessed 1 February 2021].

Brush, K., 2019. *PERT chart (Program Evaluation Review Technique). Tech-target.* [Online]
Available at: https://searchsoftwarequality.techtarget.com/definition/PERT-chart
[Accessed 1 February 2021].

Carr, D., 2009. *Make Sure Your Project Goals are SMART,* s.l.: Project Management Hut.

Choung, R. S. et al., 2013. A low response rate does not necessarily indicate non-response bias in gastroenterology survey research: a population-based study. *Journal of Public Health,* 21(1), pp. 87-95.

Czarnigowska, A. & and Sobotka, A., 2013. Time-cost relationship for pre-dicting construction duration. *Arch. Civ. Mech. Eng., 13(4),* p. 518–526.

Davis, D., 2000. *Business research for decision making, 5th ed..* Belmont: : Duxbury Press..

Dursun, O. & and Stoy, C., 2012. Determinants of construction duration for building projects in Germany. *Eng. Constr. Archit. Manage., 19(4),* p. 444–468.

Dursun, O. & and Stoy, C., 2012. Determinants of construction duration for building projects in Germany. *Eng. Constr. Archit. Manage., 19(4).*

Emmanuel Narteh Angmor, C. T. a. T. A., 2016. Management of community water projects: Assessinghe challenges of indigenous arrangements. *Journal of Geography and Regional Planning,* 9(6), pp. 122-127.

Fincham, J. E., 2008. Response Rates and Responsiveness for Surveys, Standards, and the Journal. *American Journal Of Pharmaceutical Education,* 72(2), p. 43.

Gondy, C. & Hildreth, a. J., 2007. *Contract Time Determination Guidelines. Report. 32 p. TR – 07-08,* Virginia: Virginia Tech, Virginia Polytechnic Institute and State University, www.virginiadot.org.

González, P., González, V., Molenaar, M. & and Orozo, F., 2013. Analysis of Causes of Delay and Time Performance in Construction Projects. *Journal of Construction Engineering and Management, 140(1),* pp. 1-9.

Hoechstetter S., B. C. F. H., 2016. *Major Water Engineering Projects: Definitions, Framework Conditions, Systemic Effects. In: Hüttl R., Bens O., Bismuth C., Hoechstetter S. (eds) Society - Water - Technology. Water Resources Development and Management.* 1 ed. s.l.:Springer, Cham. https://doi.org/10.1007/978-3-319-18971-0_3.

Islam, M. S. & Trigunarsyah, a. B., 2017. Construction Delays in Developing Countries. *KICEM Journal of Construction Engineering and Project Management, Online,* pp. ISSN 2233-9582 .

ISO10006, 2017. *Quality management — Guidelines for quality management in projects.* Third ed. Geneva, Switzerland: INTERNATIONAL STANDARD/ ISO copyright office.

Jimma-ESIA, 2011. *Jimma Town Water Supply and Sanitation Project Environmental and Social Impact Assessment Study (ESIA), Final Report, January 2011.* , Addis Ababa: Minstry of Water Resources of Ethiopia and IDA-International Development Agency.

Johnson, J. & LeBreton, J., 2004. History and Use of Relative Importance Indices in Organizational Research. *Organizational Research Methods, http://dx.doi.org/10.1177/1094428104266510,* 7(1), pp. 238-257.

Lee, E.-B., Harvey, J., Ibbs, C. & St. Martin, J., 2002. Construction Productivity Analysis for Asphalt Concrete Pavement Rehabilitation in Urban Corridors.. *Transportation Research Record,* 18(13), pp. 285-294.

Lifewater, 2021. *Lifewater.org: Ethiopia water projects.* [Online]
Available at: https://lifewater.org/ethiopia-water-projects/
[Accessed 10 May 2021].

Lock, D., 2017. *Project Management.* ISBN 0-566-08772-3: Gower Publishing, Ltd..

Mahamid, I., Bruland, A. & Dmaidi, a. N., 2012. Causes of Delay in Road Construction Projects. *Journal of Management in Engineering,* p. DOI: 10.1061.

Microsoft, 2013. *"Microsoft Project 2010 Ribbon Guide" (Silverlight animation). Microsoft Project Training. Microsoft. Retrieved 20 January 2013.*, s.l.: Microsoft Corporation.

Mohammed, K. & and Isah, A., 2012. Causes of delay in Nigeria construction industry. *Interdisciplinary Journal of Construction Research in Business, 4(2),* p. 785–795.

MoWIE, M. O. W. I. A. E., 2020. *URBAN WATER SUPPLY & SANITATION PROJECT - PHASE II, ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK,* Addis Ababa: FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA, MINISTRY OF WATER, IRRIGATION AND ELECTRICITY.

Muhammed, T. A., 2015. Delays in Construction Projects. *Researchgate Publication,* p. 4.

Murithi, S. H., Makokha, E. N. & Otieno, C., 2017. Factors Affecting Timely Completion of Public Construction Projects in Trans-Nzoia County. *International Journal of Scientific and Research Publications,* 7(4), pp. 405-434.

Nyamwange, R. & Nyang'au, S. P., 2018. DETERMINANTS OF TIMELY COMPLETION OF CONSTRUCTION PROJECTS AT KENYA AIRPORTS AUTHORITY. *The Strategic Journal of Business & Change Management. ISSN 2312-9492(Online) 2414-8970(Print). www.strategicjournals.com,* 5(2), p. 376 – 403.

Osman, H., 2016. Causes of Construction Delays in Countries with High Geopolitical Risks. *Journal of Construction Engineering and Managemen, Cairo University.*

Oxford-Dictionary, 2013. *The Oxford English Dictionary, online and on CD-ROM Version 4.0 Windows/Mac Individual User Version.* Second ed. London: Oxford University Press.

Project-Management-Institute, 2021. *What is Project Management?*. [Online]
Available at: https://www.pmi.org/about/learn-about-pmi/what-is-project-management

Rajgor, M. et al., 2016. RII & IMPI: EFFECTIVE TECHNIQUES FOR FINDING DELAY IN CONSTRUCTION PROJECT. *International Research Journal of Engineering and Technology (IRJET),* 3(1), pp. 1173-1177.

Saad, G., Algahtany & & Kashiwagi, D., 2016. Owners ' perspective of factors contributing to project delay : case studies of road and bridge projects in Saudi Arabia. *Procedia Eng., vol. 145, no. 480,* p. 1402–1409.

Task-management-guide, 2021. *What is Project Delay.* [Online]
Available at: http://www.taskmanagementguide.com/glossary/what-is-project-delay.php

Trauner, T. et al., 2009. *Construction Delays - Understanding Them Clearly, Analyzing Them Correctly, 2nd ed.*. Florida: Elsevier Publishing, ISBN 978-1-85617-677-4..

UNCTAD, U. N. C. T. a. D., 2020. *Activities undertaken by UNCTAD in support of AfricaReport by the Secretary-Generalof UNCTAD,* Geneva: United Nations.

Ventu & Shukla, 2010. *Essentials of Marketing Research.* s.l.:APS Publishing.

Wangari, N. R., 2014. *FACTORS INFLUENCING THE COMPLETION TIME OF WATERPROJECTS IN WATER SERVICE BOARDS IN KENYA: A CASE OFATHI WATER SERVICES BOARD, KIAMBU COUNTY,* NAIROBI: UNIVERSITY OF NAIROBI.

Water.org, 2021. *Ethiopia's water and sanitation crisis.* [Online]
Available at: https://water.org/our-impact/where-we-work/ethiopia/
[Accessed 5 February 2021].

World-Bank, 2018. *Implementation Completion and Results Report On the Federal Democratic Republic of Ethiopia (FDRE) For The Urban Water Supply and Sanitation Project (P101473). Water Global Practice, Africa Region. June 29, 2018.*, Addis Ababa: The World Bank, Urban W.

APPENDICES

APPENDIX 1- QUESTIONNAIRE (for professionals and managers)

JIMMA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENTOF ACCOUNTING AND FINANCE

PROJECT MANAGEMENT AND FINANCE MASTER'S PROGRAM

Dear respondents I am Fitsum Fanuel, postgraduate student attending at Jimma University department of Economics masters of developmental Economics dealing with my master's thesis. On the title of "Factors That Influencing the Completion Time of Water Projects in Jimma Town". This questionnaire is designed with my objectives to evaluate the water projects delay factors in Jimma town. The output of the study is beyond doubt important for the reduction of delay in projects of the town. Therefore, you are kindly requested to give genuine responses. I would like to assure you information you are going to provide will be exclusively used for academic purpose only. The information will remain confidential. So that I would like to ask you to give relevant information below listed questions by choosing and circling the best alternative for the close ended and by filling the blank space with correct figure for the open ended questions.

Section 1: Respondents Information (tick ✓ the box in the table)

1. Sex:

	Male		Female

2. Job title:

Head of the Organization	
Project Manager	

Site Engineer	
Office Engineer	

Other (specify) _____

3. Working experience (In years):

1Yr	
1- 4 Yrs.	
5-8 Yrs.	
>8 Yrs.	

4. Level of education:

Certificate	
Diploma	
First Degree	
Second Degree	
PhD degree	

Section 2: Projects Information

5. Name of the organization:_____
6. Name of the particular water project/s

_____

7. Opening Year/ date: _____
8. Expected Year/ date of completion: _____
9. Actual time of project till now_____
10. How long the project/s delayed? _____

Section 3: Factors Affecting the Completion Time of Projects

Tick [✓] in the appropriate boxes in the following table under the five/5 columns. Where:

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
SA	**A**	**N**	**D**	**SD**
5	**4**	**3**	**2**	**1**

Table:

SN	Variables	Degree of Agreement				
		SA	A	N	D	SD
		5	4	3	2	1
1	**Financing**					
	The project budget is adequate					
	There is good timely payments of contractor's certificates					
	The contractor's financial capacity is good					
2	**Monitoring**					
	There is enough number of supervisory personnel					
	The supervisory personnel supervise the project effectively					
	There is timely approvals and actions on decisions					
3	**Contractor's capacity**					
	The contractors have optimum experience					
	The contractors plan and schedule project activities effectively					
	The contractors have sufficient equipment and materials					
4	**Contract variations**					

	There was changes in scope of the project					
	The unexpected ground condition caused delay					
	The construction disputes caused delay					
5	**Consultant related factors**					
	There was adequate supervision of consultants					
	The competency of design consultant is good					
	The competency of project management consultant is good					
6	**Commitment of senior management**					
	Senior management approved adequate funding					
	Senior management provided adequate supervision					
	Senior management motivate and reward good achievements					
7	**Project leadership**					
	There is flexible project leadership to cope up with delay					
	There is good stakeholders' engagement					
	The is good communication among teams and leaders					
8	**Staff Competencies**					
	Staff members have appropriate qualifications					
	Staff members of the project get timely training					
	Staff members have optimum experience					
9	**Act of God**					
	Political/ social unrests (war, …) affected project time					
	Natural disasters (earthquake, famine,) affected project time					
	The endemic or pandemic (COVID-19) affected project time					
10	**Physical and environmental factors**					

	Weather conditions of the project area affected project time					
	Topography and soil type affected project time					
	Pollution/ environmental problems affected project time					
11	**Market related factors**					
	High cost of construction materials (raw, imported products) affected the project time					
	Unavailability of the required construction materials (raw, imported products) from market affected the project time					
	Poor quality of available construction materials (raw, imported products) affected the project time					

APPENDIX -2: KEY INFORMANTS INTERVIEW (for managers only)

1. Mention the major factors affecting the project completion time of the project.
2. Arrange in ascending order (from severe to mild) the following factors with respect to the completion time of your projects
    i. Financing
    ii. Monitoring
    iii. Contractor's capacity
    iv. Contract variations
    v. Consultant related factors
    vi. Commitment of senior management
    vii. Project leadership
    viii. Staff Competencies
    ix. Act of God
    x. Physical and environmental factors
3. Do you think that the financing affected the project completion time of the project? If yes, how?
4. Explain hoe monitoring affected the time of the project.
5. How does the contractors' condition affected the time of the project?
6. How does the consultants' condition affected the time of the project?
7. How the senior management does affected the time of the project?
8. What external factors do you think affected the project completion time in your organization?
9. What other points do you want to raise about the factors affecting project completion time in your project?
10. What do you recommend to confront these factors?