



**ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**CAUSES OF DELAYS IN SEWERAGE PROJECTS: THE CASE OF ADDIS
ABABA WATER & SANITATION INFRASTRUCTURE DEVELOPMENT
DIVISION OFFICE**

**BY
BEDRU ALIY JEMAL**

March, 2023

ADDIS ABABA, ETHIOPIA

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

Advisory: Maru Shete (PhD & Associate Professor)

March, 2023

ADDIS ABABA, ETHIOPIA

**ST. MARY’S UNIVERSITY
SCHOOL OF GRADUATE STUDIES
FACULTY OF BUSINESS**

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DECLARATION

I, the undersigned, declare that this thesis is my original work, prepared under the guidance of Dr. Maru Shete. All sources of materials used for the thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any degree.

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March, 2023

Endorsement

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

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March, 2023

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ACKNOWLEDGMENTS

First and foremost, I would like to thank Allah for providing me with the strength to complete this thesis and for blessing me in every aspect of my being. ALHAMDULILLAH!!!

I would like to express my heartfelt gratitude to my advisor, Maru Shete (PhD and Associate Professor), for his assistance in completing the thesis.

Next special appreciation goes to Addis Ababa Water and Sanitation Infrastructure Development Division Office employee and everyone who helped me get information and data for this project.

Finally, my heartfelt gratitude goes to my beloved wife Semira Abate for her encouragement, patience, and unwavering support in seeing this thesis.

Thank you all.

ABBREVIATION

AAWSA:	Addis Ababa Water & Sewerage Authority
AWSIDDO:	Addis Ababa Water and Sanitation Infrastructure Development Division Office
BAD WWTP:	Bole Arabsa Decentralize Wastewater Treatment Plant
ECIDP:	Ethiopian Construction Industry Development Policy
KWWTP:	Kaliti Wastewater Treatment Plant
L/C:	Letter of Credit
ROW:	Right of way
UNDP:	United Nations Development Programme
WSIDDO:	Water & Sanitation Infrastructure Development Division Office

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Abstract

Delays in the public construction industry are a global phenomenon, and WSIDDO sewerage construction projects are no exception. The objective of this study is to identify factors that cause delays in the construction of sewerage projects. The study used a descriptive research design and a quantitative research approach. A questionnaire survey was conducted to identify the causes of delay from the Client, Consultants, and Contractors. The survey had 47 respondents. The data was analyzed using multiple linear regression. Following that, this study identified the most important causes of delay from a list of different causes of delay and made recommendations to reduce the delay. The most significant causes were right-of-way (ROW) issues, difficulties in accessing Letters of credit/LC, delays in procurement management processes, delays in obtaining permit approval from municipalities, slow decision making, and slow decision making process. To overcome the delays and difficulties caused by ROW issues, the office works with stakeholders and lobbies the Addis Ababa City Government to change its compensation package for displaced citizens. To order to have an effective procurement planning system and efficient construction planning, the implementer devises a mechanism besides the physical and financial plans has to be translated properly and implemented according to the plan. Delays in obtaining permit approval from municipalities, as well as the majority of other delay factors, the client first prepare the work site and appropriate design to ensure proper permission and effective communication with the considered stakeholder. Furthermore, structural responsibility has considered in the organization. Owners have improved make decisions quickly. Waiting for someone, somewhere to make a decision that is preventing the entire project from moving forward. Coordinating actions and approving items quickly can keep construction jobs on time or even ahead of schedule and, in some cases, under budget.

Key words: - Sewerage Construction projects, Project Delay Factors, Causes of project delay.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The construction industry is a crucial component of the economy and has a big impact on the productivity and efficiency of other industry sectors. Ethiopians place a high priority on the industry sector's (21.2 percent) and particularly the construction sector's contribution to the national economy, which is largely fueled by the sector's dynamic performance (ECIDP, 2014; UNDP, 2014).

In these days modern construction projects are characterized by new standards, advanced technologies, multiparty participation, and frequent owner-desired changes. Due to this, there are complexities and uncertainties against the factors of productions deployed on the project processing. The difficult task here is accomplishing the project on the schedule and allocated budget as per the setout project plan. Therefore, it leads to delay of the project that will often make vulnerable to claims on cost compensations and time extensions.

In construction projects, delay could be defined as the time overrun either beyond the contract date or beyond the date that the parties agreed upon for delivery of project outcomes Assaf and Al-Hejji (2006). Delays in construction projects are one of the most common issues, and they have a wide range of negative consequences for both the project and the parties involved. According to Parchamijalal and Shahsavand (2016) construction delays are a global phenomenon that affects not only the construction industry but also the overall economy of countries. As a result, determining the true causes of delays is critical in order to reduce and eliminate them, as well as the consequences.

In Ethiopian construction practice, it is extremely rare for construction projects to be completed on time. According to Ismeal (1996), construction projects in Ethiopia are plagued by delays. According to his research, the majority of projects experience delays ranging from 100 % to 460 % of the original contract time. The study demonstrates how critical it is to investigate and study delay-causing factors in Ethiopian construction projects in order to find solutions to mitigate the effect.

Delays in sewerage projects in Addis Ababa Water and Sanitation Infrastructure Development Division Office (AWSIDDO) appear to be or are thought to be the norm these days. In order to meet the city's needs, AAWSIDDO proposes strategic solutions to increase sanitation coverage from 10% to 100% and wastewater flow from 3,503 m³/day to 640,700 m³/day in 2016 and 2030, respectively (source: AAWSA Long-Term Road Map in 2016) by developing infrastructure in three catchments: Kaliti, Eastern, and Akaki. At the moment, the project development condition in Addis Ababa Water and Sanitation Infrastructure Development Division Office is quite poor, making it difficult to fill the demand gap for sanitary infrastructure in the city. One of the most difficult problems in this situation is completing projects on time and within the budget specified in the project plan. As a result, the project is delayed, leaving it open to claims for cost compensation, time extensions.

In WSIDDO projected that Bole Arabsa Decentralize Wastewater Treatment Plant project would be completed in two years, in 2020, and that it would begin on February 6, 2020, with a two-year completion date. However, the project did not begin until April 30, 2021, and the Bole Arabsa Condominiums housing project was transferred to city dwellers/residents before the treatment plant was completed (Source: WSIDDO's 2020 G.C Annual budget report). The immediate causes of this gap are right of way (ROW), delays in opening letter of credit (L/C), and the inability of the WSIDDO's Project Implementation Unit and coordination problem with Woredas and sub city. As a result, the contractor is now claiming over 300 million Birr in back compensation and a similar time extension. This project delay is likewise true in most sewerage construction projects in Addis Ababa Water and Sanitation Infrastructure Development Division office; however the causes and effects vary.

This, therefore, the purpose of this study is to identify the causes of delays in sewerage construction projects development at the Addis Ababa Water and Sanitation Infrastructure Development Division Office.

1.2 Statement of the problem

A construction delay occurs in most construction projects and the magnitude of these delays varies considerably from project to project; this problem is a global phenomena. Time delays, cost overruns, and quality faults are all common problems in construction projects. According to

Ethiopian Construction Project Management Institute (2018), budget and time overruns on projects were 76 percent and 124 percent, respectively.

According to Mathiwos (2018) it study that the main factors that cause construction delays in water supply sector in Ethiopia are: (1) adverse weather condition, (2) delay in approval of documents, (3) equipment Failure, (4) scarcity of material in the market and (5) poor supervision and also the study focused on water supply construction projects in rural settings.

According to Al-Ghafly (1995), the main causes of delay include finance, delay in agreement and decision-making by owner, variations in the plan and size (project scope), problem in gaining a work permit, and organization and communication problems.

According to Tsegay and Luo (2017) the influential causes of delay are corruption, unavailability of utilities at site, inflation/price increases in materials, lack of quality materials, late design and design documentation, late material delivery, late approval and receipt of completed project work, poor site management and performance, late budget/funds release, and inadequate project planning and scheduling.

According to Abebe (2015) the lack of a programming expert with the customer and contractor, attention to preparation and timely submission, and lack of commitment were all factors that contributed to the project's delay.

According to James et al. (2014) studied the cause and effect of delay on project construction delivery time. The identified effect of the delay were: Time overrun, increase in final cost of project, tying down of client capital due to non-completion of the project, wastage and under-utilization of man-power and resources, abandonment of building the project, reduce profit, disputes between parties involved, litigation and arbitration.

Addis Ababa is the largest urban center in Ethiopia currently with more than 3 million people, the population is likely to approach 6.5 million residents in the near future (source :World Population Review, Addis Ababa Population 2018, 11/22/2017) and one of the fastest growing metropolises in the country with multidimensional developments in all directions of the city. Due to the expansion of various infrastructures, residential areas, commercial and industrial entities the city is expanding to a larger extent requiring high level development plan such as development of sewerage projects to accommodate this multidimensional growth and urban

waste management in line with improved environmental and social well being of the residents. Contrary Delays in sewerage construction projects have been a major problem in the Water and Sanitation Infrastructure Development Division Office /WSIDDO in recent years, as shown in Annex 1 that describes the practical problem of sewerage projects delays.

Construction delays are one aspect of project management problems in Addis Ababa Water and Sanitation Infrastructure Development office construction industry that requires considerable attention, as demonstrated by the above practical problem of sewerage project delays. However, no previous research has addressed the issue adequately. This is the primary reason why the researcher became interested in researching the causes of sewerage construction delays.

In consideration of the above, there is a need for having better understanding of the cause of delay in the construction of sewerage projects in order to avoid or minimize them and complete the project successfully.

Besides with this, none of a study that shows the office's delay context of sewerage projects has been conducted so far at Water Sanitation Infrastructure Development Division Office. Because of the unique features of projects, the causes of project delay may vary for specific project from country to country, region to region, and even project to project.

Assessing the main causes of sewerage projects delay was the main concern of this study as project delay affects to irreparable loss to society and to the economy as whole.

The purpose of this study is thus to assess the major causes of delay in Addis Ababa Water Sanitation Infrastructure Development Division Office Sewerage construction projects and recommend remedies for delay in completion of Sewerage Projects construction. It also aimed to provide an input for the organization's management to learn from this study and then take appropriate measures for future Sewerage construction projects.

1.3 Research Questions

The following would be the research questions:

1. What are the causes of sewerage projects delay in AAWSIDDO?
2. What are the top causes of sewerage project delays in AAWSIDDO?
3. What measures required to avoid or minimized delay in sewerage projects in AAWSIDDO?

1.4 Research Objective

1.4.1 General objective

The main objective of this study is to assess the major causes of delays in sewerage construction projects in case of Addis Ababa Water & Sanitation Infrastructure Development Division Office.

1.4.2 Specific objectives

1. To identify the delay causing factors of sewerage projects that currently exist in AAWSIDDO.
2. To identify the most significant delay causing factors that affect Sewerage projects in AAWSIDDO.
3. To propose action to avoid or minimize delays in the construction of sewerage construction projects in AAWSIDDO

1.5 Research Hypothesis

The hypothesis evolved from the conceptual framework presented at the end of chapter two. The following research hypothesis was identified based on the conceptual frame:

H1: External related factors has a significant positive influence on delay of sewerage construction projects

H2: Finance related factors has a significant positive influence on delay of sewerage construction projects

H3: Material related factors has a significant positive influence on delay of sewerage construction projects

H4: Contractual related factors has a significant positive influence on delay of sewerage construction projects

H5: Design change related factors has a significant positive influence on delay of sewerage construction projects

H6: Equipment related factors has a significant positive influence on delay of sewerage construction projects

H7: Management related factors has a significant positive influence on delay of sewerage construction projects

H8: Labor related factors has a significant positive influence on delay of sewerage construction projects

1.6 Significant of the Study

The occurrence of a delay in the construction projects is common and significantly affects by enormous ways. The finding of this study tries to raise awareness of the importance of completing project with the specify contract period. This study is pertaining to produce a list of delay contributing factors that can benefit to control the Sewerage projects and other future projects of the office and also generate measures to mitigate or eliminate the effects of sewerage construction projects delay. It also for future researchers and academicians the findings of this study may provide useful material for other related researches as well as providing reference material on what factors need to be considered for successful implementation of sewerage projects in city or the nation at large.

1.7 Scope of the Study

The delays cause a significant impact upon the country's economic development and public interest. Therefore, this study is limited to the assess of the main causes of delays of Sewerage Construction Projects in Addis Ababa Water & Sanitation infrastructure Development Division Office.

1.8 Limitation of the Study

Through a questionnaire survey, this study examines the key reasons and implications of delays in the constructions of sewage projects in Addis Ababa. Only the most delayed project was included in the questionnaire survey, as it is difficult to address all contractual parties, contractor's responders, and consultants.

1.9 Definition of key terms

Project: a temporary endeavor undertaken to create a unique product, service or result. The temporary nature of projects indicates a definite beginning and end. The end is reached when the project's objectives have been achieved or when the project is terminated because its objectives

will not or cannot be met, or when the need for the project no longer exists (a Guide to the Project Management Body of Knowledge, 4th ed, p.5)

Project delay:- is time overrun beyond the planned work schedule or it is construction time extended more than agreed upon between the contractor and the project owner (Assaf and Al-hajji, 2006).

A sewerage project: - sewerage projects in this study context refer, a sewerage system, or wastewater collection system, is a network of pipes, pumping stations, and appurtenances that convey sewage from its points of origin to a point of treatment and disposal.

Effects of delay: - Any consequence directly attributed to the project delay based on the perception of the clients, contractors and consultants is taken as effect of delay (Werku and Jha 2016).

1.10 Organization of the paper

This study is divided into five chapters. The first chapter introduces the study's background, problem statement, basic research questions, and objectives, significance, scope of the study, and study limitations. The second chapter presents literature review with general descriptions by different researchers on causes of construction delay. The third chapter deals with the research methodology, design, sources of data, target population, sampling technique and sample size, validity and reliability of instrument and research ethics throughout the data collection and analysis. The fourth chapter presents results and discussion which prevails about the most important and frequently occurring causes of delay. And the fifth chapter encompasses the summary, conclusions and recommendations based on the discussions of the previous chapters.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Theoretical Literature review

2.1.1 Definitions of Projects Delay

Many researchers have characterized delay in various ways, typically with a bias toward the major issue of their studies. Regardless, there are a few precise definitions for the idea of delays.

According to Diyya and Ramya (2015); 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.

According to Dinakar (2014); delay is the slowing down of work without stopping construction entirely and that can lead to time overrun either beyond the contract date or beyond the date that the parties have agreed upon for the delivery of the project.

According to Chabota et al. (2008); delays on construction projects are a common occurrence, and sewage construction projects are no exception. Cost overruns are frequently associated with them. Litigation, arbitration, cash flow concerns, and a general sense of dread towards one another are all devastating effects on clients, contractors, and consultants.

According to Zack (2003), delay was also defined as an act or event which extends required time to perform or complete work of the contract manifests itself as additional days of work. It is rare for a construction project to be finished within the agreed-upon contract duration, budget, and quality standards.

According to Assaf and Al-Hejji (2006) in their work on the Saudi Arabia construction industry observed that only 30% of construction projects were completed on time with an average overrun between 10% and 30%. This leaves a significant proportion of delayed construction projects in Saudi Arabia standing at about 70%. The problem of construction delays is not unique to WSIDDO; practically every project implementing sector office has experienced it.

2.1.2 Types of delays

Delays can be noticed in these four broad categories, according to different researchers. Before deciding the impact of a delay on the extend projects, one must decide whether the delay

is critical or non-critical. As well, all delays are either excusable or non-excusable. Both excusable and non-excusable delays can be characterized as either concurrent or non-concurrent. Delays can be further categorized into compensable or non-compensable delays.

- I. Critical delays and Non critical delays
- II. Non Excusable (Contractor Caused) Delays & Excusable Delays.
- III. Compensable (Owner Caused) Delay & Non-Compensable Delays.
- IV. Concurrent delay & Non concurrent delay

I. Critical or Non Critical

Delays can be analyzed based on the criticality of activities in the program. The baseline master program arranged according to the conditions of contract has a critical path. The critical path is the longest path in the network. Critical delays are those that effect the project's completion or, in certain situations, a milestone date, whereas noncritical delays are those that do not affect the project's completion or a milestone date. If these operations take longer than expected, the project's completion date or a milestone would be pushed back. According to Dinakar (2014); the following factors influence which activities genuinely govern the project completion date:

- a. The project itself
- b. The contractor`s plan and schedule (particularly the critical path)
- c. The requirement of the contract for sequence and phasing
- d. The physical constraint of the project, such that: how to construct the work from a practical point of view.

II. Executable or Non-Executable

Excusable delays are occurrences over which neither the owner nor the contractor has any control example; extraordinary climate conditions, acts of God and other unanticipated future occasions. According to Srdić and Šelih (2015); non-excusable delays are events that are within the contractor`s control or that are foreseeable. Some example of non-excusable delays:

- Late performance of subcontractors
- Untimely performance by suppliers.
- Faulty workmanship by the contractor and subcontractors.

III. Compensable or Non-Compensable

A compensable delay is a delay where the contractor is entitled to a time extension and to additional compensation. It is where contractor is liable for Time Extension & Cost compensation which is caused by the owner like that of late release of drawings from the owner's architect. All compensable delays fall below excusable delays-Whereas, if the contractor is entirely at fault for a delay event, it is termed as non-compensable delay. Non-compensable delays are caused by third parties or incidents beyond the control of both the owner and contractor such as weather, strikes, fire, natural crises etc. However, according to Ahmed et al. (2003) and Mubarak (2005); non-compensable may fall under critical, non-critical, excusable or non-excusable; depending upon the situation it has created and conditions of contract.

IV. Concurrent or Non-Concurrent.

Concurrent or parallel delays happen when there are two or more independent delays throughout the same time period. Concurrent delays are significant when one is an employer risk event and the other a contractor risk event, the effects of which are felt at the same time. When two or more delay events arise at different times, but the effects of the same are felt (in whole or in part) at the same time. In these conditions neither party is accountable to the other for any costs associated with the delay. These delays are those that are normally covered in force majeure clauses – ordinary weather, labor strikes, acts of God, acts of war, etc.

This sort of delay is similar to WSIDDO sewerage projects, and understanding the types or categories into which a delay belongs is vital when studying delays. A detailed understanding of the sorts of delays is required to begin additional mitigation measures and transform it into a merit.

2.2 Empirical review

2.2.1 Causes of Construction delay of pervious study

According to Doloji et al. (2012); the success of construction projects is based largely on the satisfaction of the objectives defined in the project specifications. According to Frimpong et al. (2007) and Bajjou et al. (2017a); a successful project is carried out according to the pre-defined execution time, the budget allocated for the project, the quality requested by the client while respecting the safety condition of the workforce.

There are several causes of delay, according to the various perspectives of project stakeholders. According to Alemayehu (2020), project-related, client/owner-related, contractor-related, consultant-related, design-related, material-related, equipment-related, labor-related, and external-related are some of the causes.

According to Dixit and Sharma (2019) studied 11 significant delay factors from an intensive literature review in high rise projects in India. These were: Inaccurate Material Estimate, Unexpected Weather Condition, Shortage of Materials, Shortage of Equipment, Shortage of Skilled Labor, Inaccurate Productivity Rate calculation, Location Constraint of Project, Lack of Proper Planning, Poor Productivity of Labor, Design Variation and Inaccurate Productivity estimation of Equipment.

According to Mathiwos (2018); the top ten factors causing delay of water supply construction project in Ethiopia were, adverse weather condition, delay in approval of documents, equipment failure, scarcity of materials in the market, poor supervision, poor site management, fluctuation of prices/rising cost of materials, change in subsurface conditions, slowness in decision making process and low skills of labor.

Firdissa claims that (2018), they studied the causes and effects of delays in Oromia roads construction projects relevant to Oromia roads authority road projects and classified the factors into four groups: Group 1 consisted of three project-related factors. Group 2: included 7 owner/client-related factors. Group 3 consisted of 11 Contractor-related factors. Group 4 included seven externalities-related factors.

Tadewos and patel (2018) indicated that, the influential causes of delay investigated are corruption, unavailability of utilities at site, inflation/price increases in materials, lack of quality materials, late design and design documents, slow delivery of materials, late in approving and receiving of complete project work, poor site management and perform, late release budget/funds, and ineffective project planning and scheduling.

According to Tsegay and Hanbin,(2017),the vital causes of delay in the Ethiopian construction project known and ranked are corruption, unavailability of utilities at site, inflation or price increases in supplies, not having worth materials, delayed design and design documents, sluggish delivery of materials, late in approving and receiving of complete project work, poor site

management and performance, late discharge budget/ funds, and unsuccessful project planning and scheduling.

Zidan and Andersen (2017) studied 10 universal delay factors in construction project through an intensive systematic literature study. These top 10 universal delay factors were: design changes during construction/change orders; delays in payment of contractor(s); poor planning and scheduling; poor site management and supervision; incomplete or improper design; inadequate contractor experience/building methods and approaches; contractor's financial difficulties; sponsor/owner/client's financial difficulties; resources shortage (human resources, machinery, equipment); and poor labor productivity and shortage of skills.

Koshe and Jha (2016) state that; they studied causes of delay in construction of Ethiopia and have recognized eighty eight (88) delay causing factors underneath eight broad classes namely: client related, consultant/supervisor related, contractor related, designer related, labor related, material related equipment related and external related. Accordingly, major causes of project delay in Ethiopian construction industry were identified details as follows :difficulties in financing project by contractors are Escalation of materials price, Ineffective project planning, Delay in progress payment for completing work, Lack of skilled professional in construction management, Fluctuating labor availability season to season, Late delivery and shortage of materials, Low productivity of labor, Unqualified/inadequate experienced labor and Insufficient data collection and survey before design.

According to Endale (2016); its study the causes of delay in the construction of 40/60 saving houses project were financial difficulties faced by the contractor, delayed payments to contractors, 21 ineffective planning and scheduling, late design review and approval and slowness in decision making process.

According to Koshe (2016); it had conducted a study on investigating causes of construction delay in Ethiopian construction industries. He has identified the major causes of delay and ranked them and the findings show that the main critical factors that cause construction delays in Ethiopia are: difficulties in financing project by a contractor; escalation of the materials price; scheduling or resource management; Infective project planning; lack of skilled professionals in the field of construction management in the organization; delay in progress payments for

completed works, and fluctuating labor availability season to season /Seasonal labors availability.

As per Kumar (2016); studies on Causes and Effects of Delays in Indian Construction Projects, find out the most significant factors causing delays and conclude that the most significant factors causing delay in the construction are inadequate contractor's work and experience, their poor risk management and ignorance .

Ashraf and Ghanim (2016) studied causes and effects of delay in public construction projects in Jordan and the survey result indicated that contractors, consultants, owner, inadequate contractor experience, financing, payments, labor productivity, slow decision making, improper planning, and sub-contractors are among the top ten significant factors for causes of delay in public construction.

According to Vosoughi et al. (2016); studies on cause and effect in Tehran city in waste water civil projects were the factors causing identified using experts' opinions and related literature that include the seventeen (17) important causes of delay : inflation, failure to properly select contract type to assign projects, failure to pay to contractors, lack of credit and failure to pay contractors' statements, structural problems and bureaucracy in employer organization, financial supply by employer, changes in plan during project implementation, failure to pay to contractors on time, climatic conditions of the site and incidental events, rush in opening projects due to political-social issues and its reverse results, error and defect in plan by consultant, defect in initial studies by consultant, delay in decision making during sensitive periods and necessary cases by consultant, environmental issue such as sanction, unknown underground factors, lack of accordance between balance and inflation and so on, lack of enough experienced human resources regarding implementation method leading to unreal implementation time, land ownership problems, and delay in providing required maps by consultant.

According to Anari et al. (2015); delay in waste water of Yazd city were divided the causes in three (3) groups of internal and management causes, technical causes, and external and urban management causes.

According to Wateno (2015) result of regression analysis indicates that owner related causes have significant influence on dependent variable which is delay in construction project. The source of project owner having strongest correlation and has significant influence on delay in

construction project of Nigeria. The cause of delay of project owner is due to delayed in decision making and lack of expertise and the governmental financial policy.

According to Yahya, Saiful and Muhammad (2013) conducted a study on delays in construction industry of Pakistan. Causes of delay were found to be change orders, labor productivity issues, poor site management and supervision, inspections/audits, poor cost estimation and control, inadequate project scheduling, defective design, inefficient construction methods, delayed payments, and incomplete construction drawings.

In a related study of the causes of delay in Malaysia construction industry Hamzah, Khoiry, Arshad, Tawil and Che (2011) found poor site management, inadequate experience and poor subcontractors among the main causes of time delays on construction projects.

The construction industry in many countries faced with challenges when it comes to construction project delivery and this may be due to various factors, which are identified in the research. Memon, et al (2010), categorized the challenges faced in the construction industry as; delays in completing projects on time, expenditure exceeding budgets as well as poor quality.

According to Al-Kharashi, Adel and Skitmore (2009);its conduced to study causes of delays in Saudi Arabian public sector construction projects, it is found two that the most influencing current cause of delay is the lack of qualified and experienced personnel – attributed to the considerable amount of large, innovative, construction projects and associated current undersupply of manpower in the industry.

Alaghbari, et al. (2007) studied the significant factors causing delay of building construction projects in Malaysia and found out that the major causes of delay were: owners' financial difficulties and economic problems, contractors' financial problems, late supervision and slowness in making decisions, consultants' slowness in giving instructions, and lack of materials on market.

According to Sambasivan and Soon (2007); identified 10 most important causes of delay as: (1) contractor's improper planning, (2) contractor's poor site management, (3) inadequate contractor experience, (4) inadequate client's finance and payments for completed work, (5) problems with subcontractors, (6) shortage in material, (7) labor supply, (8) equipment availability and failure, (9) lack of communication between parties, and (10) mistakes during the construction stage.

According to Assaf and Al-Hejji (2006); in the study entitled the causes of delay in large construction projects concluded as following: The importance index of each cause is calculated as a product of both frequency and severity indices of each cause seventy three (73) causes of delay were identified through the research study and the identified causes are combined into nine groups, the field survey included 23 contractors, 19 consultants, and 15 owners.

Abdo (2006) made a survey on delays in public building construction projects in Ethiopia. The result of the research indicated that 94% of the 52 surveyed public building projects have encountered delays. Moreover, the time extension ranges from 10% to 367% and the average delay is found to be 89.9%. The most frequent causes of delay were found to be necessary variations, delayed payments, scarcity of materials, late material supply, less emphasis to planning, sub-surface condition, changes in design, material and labor price escalation, unrealistic time schedule and failure to update schedules on time.

As per Chan and Kumaraswamy (2002); they investigation in 11 countries causes of delay in projects are identical in developing countries. Like improper planning and estimation, weak project management and lack of materials are of the most important delay causes. However, delay causes in developed countries such as the United States and Britannia are justified delay factors like unfavorable weather and human resources performance.

According to Mansfield (1994); it's conducted to study the Causes of delay and cost overruns in Nigerian construction projects, it's identified 16 major factors that caused delays and cost overruns in Nigeria. They presented that the causes of delay and cost overruns in Nigerian construction projects were attributed to finance and payment arrangements, poor contract management, shortages in materials, inaccurate estimation, and overall price fluctuations.

2.3 Mitigating Measure of Construction Delays

As mentioned above, a construction project is commonly classified as successful when the objectives of the project are attained that is the project is efficiently and effectively completed within the specified time and budget without compromising quality. Mitigation or elimination of construction project delays entails limiting or eliminating those unfavorable or negative variables that can obstruct or serve as threats to project completion on time, within budget, and with good quality.

According to Abdelnaser (2005) cited that implementation of adequate planning during the inception and design phases of the project can be a strong measure of avoiding delay during the construction phase.

In another survey was conducted Nguyen (2004) in an attempt to establish measures to minimize delay in large construction project in Vietnam. He suggested five key measures: adequate resources, a multidisciplinary or competent project team, competent project managers, correct first cost estimates, and accurate initial time estimates.

According to Aibinu and Jagboro (2002); found out two major ways of avoiding construction delays (time overrun) to be acceleration of site activities and contingency allowances.

According to Koushki et al. (2005), time delay and cost overrun mitigation were also studied. They emphasized the need for substantial and easily available financial resources till the project is completed, as well as the selection of highly skilled consultants and trustworthy and professional contractors to complete the project.

For successful projects, it required realistic project schedules and cost estimates and they should be mentioned throughout the project. Further they stated that when a project is behind the schedule, the project team accelerate the subsequent activities to catch up the delays, but in most case failed to make up for lost time due to mainly the deficiency in project management procedure of clients. And all of these efforts involve increase in cost to the contractor and only for the client responsible cost increase will be paid. Normally 5-10% contingency margin is included in the construction contracts as a provision for unforeseen variances.

2.4 Conceptual frame work of the study

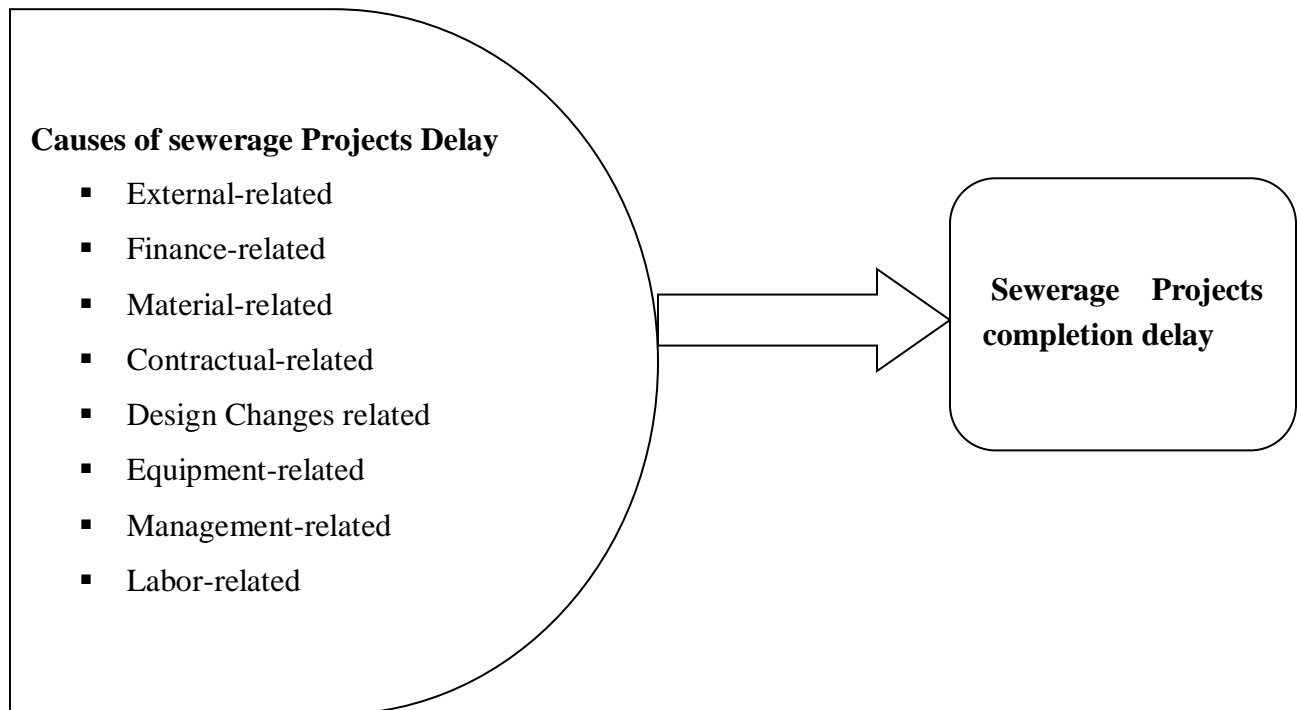
Delays occur when critical activities are not performed timely as per the schedule and are caused by the contractor, the owner or third party/force majeure.

By different author review causes of delays vary from country to country, even project to project due to prevailing situations and uniqueness of projects. Some of the main sources of project delay factors include: contractual relations, environmental and site conditions, resources availability, bureaucratic approval procedures, the lack of qualified and experienced personnel, contractor's improper planning, contractor's poor site management, inadequate client's finance and payments for completed work, problems with subcontractors, lack of communication

between parties and poor supervision. This is therefore very important to assess causes of delay for specific projects in order to devise a mechanism to mitigate the problems that would otherwise face by the construction projects.

This therefore, from broad-spectrum idea of the past studies and existing situation of WSIDDO revealed that there are different factor causing the delay of construction projects and it's important to set a conceptual framework to this study proposal. According to Kothari (2008), conceptual frameworks are made up of a collection of broad concepts and theories that aid researchers in accurately identifying the topic they're studying, frame their questions and find suitable literature. A conceptual framework is used at the commencement of most academic research since it aids the researcher in clarifying the study questions and objectives. Based on literature review I used the conceptual framework from works of Mathiwos (2018) who categorized delay causing factors in eight groups: design changes, material, labor, equipment, finance, management, contractual and external related factors.

Figure 2.1: Conceptual frame work.



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Approach

In this study quantitative research methods were employed. For this purpose a questionnaire was developed to assess the perceptions of client, contractors and consultants on the causes of delays in Sewerage Construction Projects in Addis Ababa Water and Sanitation Infrastructure Development Division Office to the existing situation. Quantitative data were obtained through questionnaire.

3.2 Research Design

The plan and structure of an inquiry that is designed to answer research questions is known as research design. The plan refers to the research's general design or program according to Robson (2002).

This study used a descriptive research design, in which data was gathered from respondents via a questionnaire. The possible causes of delays were identified from the literature reviews and implanting organization perspective.

3.3 Target Population & Sample

3.3.1 Target population

The target population of this study being comprises experts from three sources namely client, consultants and contractors which are directly and indirectly involved in the construction of Sewerage projects. This has helped the researcher in collecting quality and more relevant data which is reliable and is competency based.

3.3.2 Sampling Techniques

In this study, respondents were selected based on their experience and involvement in the construction of sewage line system and treatment plant components, as well as their knowledge of the reasons of sewerage project delays in Addis Ababa. For this study non-probability sampling type was chosen, namely the Judgment or purposive sampling technique. Judgment sampling begins with a goal in mind, and the sample is then selected to include people of interest while excluding those who do not. Moreover, it is useful for this research since the focus was on

a particular subset of people (Project Coordinator, Engineers, Surveyors, Planning specialists, and Contract Administrators who worked on Sewerage construction projects and related).

3.3.3 Sample size

The total population size was sixty (60) people divided into three groups: client, consultants, and contractors. Because it would be impractical to consider all target demographics as a sample in practice, scientific procedures must be used to establish the suitable and representative sample size. The target group is twenty-five (25) client, twenty (20) contractors, and fifteen (15) consultants who are closely associated to the research concept.

3.4 Data Type and Source

In relation to the topic under discussion, both primary and secondary data were used. The term "primary data" refers to information gathered by the researcher firsthand. The survey used questionnaires to collect information. The questionnaires were hand delivered to respondents and collected in the same manner once completed. The secondary data used in this study are findings from a literature review on construction project delays. A literature review was conducted to improve understanding of theory in relation to the research problem. Books, articles, magazines, the internet, journals, documents, and other research papers are examples of materials used in literature reviews. The relevant information was used as a baseline against primary data collected to support the research.

3.5 Data Collection Method and Procedures

Data collection methods used in this research was literature review and questionnaire survey. The information is derived from primary and secondary sources. Structured questionnaires are used to gather primary data. Secondary data is gathered from a variety of sources, including literature reviews, yearly reports, contract documents, follow-up and inspection reports, quarterly and annual performance reports, and individual project files.

Due to the fact that project teams have been transferred to other locations, questioners were distributed primarily via the internet using their email addresses to consultants and contractors who responded. On the other hand, questioners were distributed in tripartite in person for projects in progress. A questionnaire survey was created to get feedback and knowledge from

experienced respondents on project implementation delays. The questioner is divided into two categories:

1. PART 1: General Information
2. PART 2: Causes of Sewerage Project Delays

PART 1: General Information

The researcher attempted to collect information from the respondents in this area. The following items are included in the questionnaire: an overview of the organization, its activities, and its status; Years of experience working on sewage and associated projects, as well as educational background and presence of delay and occurrence of delay.

PART 2: Causes of Sewerage Project Delays

The purpose of this part is to assess the factors that contribute to the causes of sewerage project implementation delays as identified in the previous literature research. There are in total of eight groups of causes for delay in sewerage construction projects: External-related, Finance –related, Material related, Contractual-related, Design change- related, Equipment- related, Management – related, and Labor-related.

The questionnaire is mostly based on a 5-point Likert scale that ranges from 1 to 5 in terms of contribution level.

SD=Strongly disagree (1), D=Disagree (2), N=Neutral (3), A=Agree (4), SA=Strongly Agree (5)

3.6 Data Analysis

In this study, data was analyzed using statistical tools such as descriptive analyses and multiple regressions. Descriptive analyses were also used for demographic factors such as gender, educational level, length of employment, and organization membership. Following that, multiple regression analysis was carried out using the statistical package for social science (SPSS) version 24 method to validate the relationship between the independent variable, i.e. delay factors, and the dependent variable, delay. However, before implementing the types of multiple regression analysis to be used, the dependent variable in both cases was checked to see if it was normally distributed. As a result, the dependent variables in both cases were normally distributed, and the standard multiple linear regression analysis was used to test the hypothesis. A regression model

is a mathematical equation that predicts the value of the dependent variable based on the known values of the independent variables. The following multiple linear regression models was used for this study:

$$De_s = \beta_0 + \beta_1 ER + \beta_2 FR + \beta_3 MatR + \beta_4 CR + \beta_5 DCR + \beta_6 EqR + \beta_7 ManR + \beta_8 LR$$

Where, De_i = dependent variable; delay of sewerage construction projects

ER= External related factor

FR = Finance related factor

MatR = Material related factor

CR = Contractual related factor

DCR = Design change related factor

EqR = Equipment related factor

ManR = Management related factor

LR = Labor related factor

β_k = k^{th} population parameters to be estimated

The developed hypotheses were tested in multiple regression analysis using the above mathematical model, taking the significance level of each constant parameter into account.

3.7 Validity and reliability of research instruments

Selection of the research instruments was based on their validity and reliability to achieve the objectives of this study. Questionnaires were the main research instruments used to collect information for this study.

3.7.1 Validity of the Instrument

Questionnaires instruments were given for data collection. These were the administration of questionnaires with tripartite as instruments for data gathering. Questionnaires reduce biasness because the researcher's own opinions does not influence respondent to answer in a certain manner.

In order to achieve the required degree of validity of the research instruments of data collection that is questionnaires their design was formulated in such a way that clarity of the objectives of this study proposal is achieved.

3.7.2 Reliability of the Instrument

Since all eight sets of elements related to delay were tested, the instrument's reliability was confirmed through questionnaire testing as an indication of the scale's acceptability for future investigation. Apart from the overall reliability test, the items under each of the causes of delay are also checked to see if they measure the same outcome. The result of the consistency test for all parameters exceeded 0.7. Internal consistency approach was utilized to ensure that reliability measures exceeded the normal recommendation of $\alpha = 0.70$. Cronbach's alpha reliability coefficient, calculated using SPSS software, is the most widely used internal consistency reliability estimate, with a value of 0.70 or higher deemed "good" in most social science research scenarios Nassiuma and Mwangi (2004). The reliability and consistency of the research instrument were determined by data analysis. As a result, the instrument was utilized to generate the study report's results.

Table 3.1:-Reliability Test results

Variable	Cronbach's Alpha	N of Items
External Related Factor	0.767	5
Finance Related Factor	0.804	5
Material Related Factor	0.714	4
Contractual Related Factor	0.800	6
Design Change Related Factor	0.768	4
Equipment Related Factor	0.806	4
Management Related Factor	0.815	10
Labor Related Factor	0.783	5
Total	0.967	43

Source: Survey result, 2022

3.8 Ethical consideration

While the information was evaluated, the respondent's perception was respected. While taking full responsibility for safeguarding the confidentiality of respondents' opinions and the consistency of the rest of the data, makes every effort to acknowledge items mentioned. In addition, the highest level of scientific research accountability was maintained.

CHAPTER FOUR

DATA ANALYSIS & DISCUSSIONS

4.1 Profiles of Respondents

Respondents were divided into three categories: clients, consultants and contractors who work for implementation organizations. A total of 60 questionnaires were distributed to a sample of workers. However, only 47 questionnaires were properly completed and returned to the researcher, implying that the study's overall response rate of 78% was reasonable according to Sekaran (2001), a response rate of 30% is acceptable for most studies. Table 4.1 includes the number of participants as well as their percentage rates, which are shown below.

Table 4.1: Response rate of the structured questionnaire

Respondents in Category	Participants in number	No. of responses per responding category	Response in Percentage
Client	25	20	80
Consultant	15	12	80
Contractor	20	15	75
Total	60	47	78

Source: Survey result, 2022

4.2 Description of respondents' characteristics

A frequency analysis was also conducted for the profiles related to the general information about the respondents and projects. This information includes the gender of the respondents, education level, working experience in sewerage construction and related.

Table 4.2: Frequency and Percentage of Respondents' Demographic Characteristics

Item. No	General Information	Category/Classification	Response in Number	Response in percentage
1	Sex	Male	41	87%
		Female	6	13%
2	Educational Level	Diploma	5	11%
		First Degree	16	34%
		Master	25	53%
		PhD.	1	2%
		Consultant	12	26%
		Contractor	15	32%
3	Positions Held by Respondents Participants	Project Coordinator	10	21%
		Engineer	22	47%
		Contract Administrator	6	13%
		Surveyor	4	9%
		Planning specialists	3	6%
		Other	2	4%
4	Experience in sewerage construction and related	3-6 years	3	6%
		7-10 years	6	13%
		11-15 years	28	60%
		16-21 years	8	17%
		Above 21 years	2	4%

Source: Survey result, 2022

As shown in the table above, the survey results revealed that out of the total collected valid responses of 47 (100%), 41 (87%) are male and the remaining 6 (13%) are female.

According to the survey results, 5(11%) of the respondents have a diploma, 16 (34%) have a first degree, 25(53%) have a master's degree, and 1(2%) has a PhD.

In terms of the positions held by respondents participants, 10 (21%) are Project coordinators, whereas 22 (47%), 6 (13%), 4 (9%), 3 (6%), and 2 (4%), respectively, are engineers, contract administrators, surveyor Planning specialists, and others. This gave a dependable data because the respondent were known to be involved in managing affairs of the company and therefore have the way in to all relevant data to answer the questionnaires effectively.

With regard to the work experience of the respondents, the data implies that out of a total of 47 respondents 3, 6, 28, 8 and 2 of them have experiences in the sewerage construction with different companies from 3 to 6, 7 to 10, 11 to 15, 16 to 21 and above 21 years respectively. Here with the same principle of validity and reliability, respondent. Here with the same principle of validity and reliability, respondent profiles and experiences suggest that they have had sufficient or significant exposures to the required data.

4.3 Causes of delay in WSIDDO Sewerage Construction Projects

Before prioritizing the reasons of the delay of construction projects in WSIDDO, the respondents are empowered to reflect their perception first whether the delay itself is existed on the office’s construction undertaking. Due to this, 12(25.5%), 19(40.4%), and 12(25.5%) of the total respondents have assured as the happening of delay at the office moderate, high & very high respectively. This finding is consistent with what Chabota et al. (2008) discovered: construction project delays are common, and sewage construction projects are no exception.

Table 4.3:-Respondent’s conclusion on the possibility of the occurrence of sewerage construction delay

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Moderate	12	25.5	27.9	27.9
	High	19	40.4	44.2	72.1
	Very high	12	25.5	27.9	100.0
	Total	43	91.5	100.0	
Missing	System	4	8.5		
Total		47	100.0		

Source: Survey result, 2022

4.4 Ranking the major causes for the delay in Sewerage projects

The survey data, which included forty three (43) causes of delays, was analyzed and classified into eight major categories: external, finance, material, contractual, design change, equipment, management, and labor-related.

SPSS 24 was used to calculate the mean of distribution of each factor to analyze the results of the causes of delay in the construction of a sewerage project in the Addis Ababa Water & Sanitation Infrastructure Development Division Office. The factors were then ranked according to the frequency with which the respondents responded. The factors with the highest mean were identified as major factors and played an important role in causing sewerage construction delays. The table below illustrates this.

Table 4.4: Causes of Delay in Construction of Sewerage Project according all items

Causes of Delay	Mean	Std. Deviation	Rank
Right off way (ROW)Problem	4.32	0.755	1
Difficulty in accessing Letter of credit/LC	3.83	0.816	2
Delay in procurement management processes	3.77	0.813	3
Delay in getting permits approval from municipality (Plan commission, Land management ,utilities line ,Road Authorities)	3.60	0.851	4
Slow decision making	3.45	0.583	5
Slowness in decision of all process	3.40	0.712	6
Delay in delivering site project to contractor	3.09	0.747	7
Unrealistic contract duration and cost estimation	2.94	0.639	8
Poor communication & coordination	2.91	0.503	9
Lack of communication between parties	2.85	0.691	10
Ineffective planning and scheduling of project	2.85	0.625	11
Inappropriate organization management	2.70	0.858	12
Fluctuation of prices/rising cost of material	2.62	0.768	13
Materials supply imported delay	2.60	0.742	14
Financial difficulties faced by the contractor	2.57	0.801	15
Delayed payments to Contractors, suppliers	2.47	0.687	16
Inadequate contractor experience	2.45	0.746	17
Unexpected surface and subsurface conditions	2.43	0.651	18
Poor site management and supervision	2.38	0.795	19
Delay in performance of contractor	2.26	0.943	20
Low motivation and morale of labor	2.17	0.670	21
Inadequate consultant experience	2.13	0.741	22

Low productivity level of labor	2.06	0.639	23
Financial difficulties (shortage) by client	2.06	0.673	24
Delay in approval of documents	2.04	0.624	25
Escalation of material prices	1.96	0.751	26
Mistakes and discrepancy in specification, drawing and BOQ	1.94	0.485	27
Design change in the scope of the project	1.94	0.734	28
Slow mobilization of labor	1.91	0.620	29
Underestimation of the complexity of the project	1.91	0.620	30
Change in specification, drawing and BOQ	1.91	0.654	31
Adverse weather condition	1.91	0.717	32
Low skill of labor	1.85	0.589	33
Shortage of material in market	1.81	0.825	34
Slow mobilization of equipment	1.74	0.530	35
Major disputes	1.72	0.800	36
Changes in government Laws and regulations	1.57	0.500	37
Shortage of labors	1.57	0.617	38
Poor quality of materials	1.45	0.583	39
Low efficiency of equipment	1.40	0.496	40
Equipment breakdowns	1.34	0.600	41
Shortage of equipment and hiring delays	1.28	0.615	42
Delays in producing construction drawings	1.21	0.463	43

Source: Authors' based on survey data (2022)

Among the several significant factors causing delays in the construction of sewerage construction projects in Addis Ababa Water & Sanitation Infrastructure Development Division Office were the six(6) listed factors that respondents frequently assumed: - Right of way problem, which was ranked first by all respondents with a mean score value of = 4.32 and SD value of 0.755, was followed by Difficulty in accessing Letter of credit/LC with a mean score value of = 3.83 and SD value 0.816, Delay in procurement management processes with mean score value equal to = 3.77 and SD value 0.813, Delay in getting permits approval from municipality with mean score value equal to =3.60 and SD value 0.851, Slow decision making with mean score value equal to = 3.45 and SD value 0.583 and Slowness in decision of all process with mean score value equal to = 3.40 and SD value 0.712.

Table 4.5:- The ranking of the Category of causes of delay factors

Code	Category of Causes of Delay	N	Mean	Std. Deviation	Rank
ER	External Related	47	2.7660	0.47971	1
ManR	Management Related	47	2.7489	0.46432	2
FR	Finance Related	47	2.7106	0.51551	3
CR	Contractual Related	47	2.5603	0.56511	4
MatR	Material Related	47	1.9521	0.51509	5
LR	Labor Related	47	1.9149	0.46764	6
DCR	Design Change Related	47	1.7500	0.40714	7
EqR	Equipment Related	47	1.4415	0.33869	8

Source: Own Survey (2022)

As a result, the data in Table 4.5 below shows a ranking of the delay-causing factors calculated using SPSS to reveal the most influential factors within each category of causes and from all causes in general. The respondents (External related, Management related, Finance related, and Contractual related) prioritized the causes of delay from the set of causes in order of importance; the remaining factors, on the other hand, have shown a slight occurrence.

4.5 Discussion of Causes of Delay

The most important causes of delay factor of sewerage projects were analyzed and tabulated using a questionnaire survey in Addis Ababa Water and Sanitation Infrastructure Development Division Office. The six most significant causes of delay factor were identified based on the results and will be discussed further below.

a. Right of way problem

Respondents determined and ranked right of way (ROW) issues as the first and most influential factor of construction project delay in Addis Ababa Water and Sanitation Infrastructure Development Division Office. This finding is consistent with what Firdissa (2018) revealed, who discovered that the most contributing factors to delays, as well as the top ranking delay causing factor, were: delay in delivering the site (right of way problem) in Oromia roads construction projects relevant.

Recently, ROW issues in WSIDDO have not been completed in advance due to various reasons and opportunities. Most ROW issues are not finalized before the project is awarded to the Contractor to avoid the risk of project site changes later or double costs for conducting related tasks, or due to the arrival of new and unplanned projects that are expected to meet incidental shortcomings. Similarly, during the construction process of sewerage projects, due to site topography difficulty and technical issues such as slope, which is not workable for alignment primarily, project site change may occur, resulting in advance completion of ROW issues not experienced in WSIDDO. Furthermore, excavation is a requirement for sewerage projects. Excavation activities at the site for pipelines, underground manholes, or other components of wastewater treatment plants are frequently required. Deeper and wider excavation projects consume a significant amount of project time and money. Boring logs, rock cores, foundation investigation reports, topographical maps, and other subsurface data provide insight into underground conditions and anticipated excavation requirements. The discovery of unaccounted for rock, structures, or anomalies below grade, on the other hand, can drastically alter project dynamics. It could lead to more alignment and right-of-way issues, as well as higher costs and other issues. Every now and then, we see such unexpected subsurface conditions becoming a major issue and adding to project complexities in Addis Ababa's special inner city. As a result, poor community (settled at the project site) awareness, low compensation packages for displaced citizens, too lengthy governmental office bureaucracy as characterized by complicated corruption, others in the city's makes ROW issues time consuming, and these become a serious influential factor in the delay of sewerage projects in Water and Sanitation Infrastructure development division Office.

b. Difficulty in accessing Letter of credit/LC

The second influential factors of project delay as assured by respondents here was the difficulty in accessing Letter of credit/LC. Absence of foreign currency permission is one of the significant and tedious problems for Letter of Credit (L/C) opening in the office. For instance, the documents review of this study also reveals that about one project for which the office signed with; Bole Arabsa Decentralize Wastewater Treatment Plant project signed on December 5th, 2019 between AAWSA Water & Sanitation Infrastructure Development Division and CGCOC Group CO. Limited JV with Anhui Guozhen Environmental Protection TEC. Joint Stock CO., LTD, these projects have been waiting for L/C opening since the previous two year back due to

the absence of foreign currency permission. It is obvious that most developing nations are suffering from shortage of foreign currency yet the existing conditions of our country is somewhat looking unique and in fact the government was approaching to privatize its giant organization like Addis Ababa Water Sanitation Infrastructure Development Division Office, which are remained under the hands of government control for a long period of time.

Similarly to the above finding, Alemyehu's (2020) study on the causes and effects of water supply and sanitation project delays: the case of 15 town's Water Supply and Sanitation project in Ethiopia found that material import delays were the causes that most significantly influenced the project's completion among delay factor causes. It is extremely difficult to open a letter of credit for the purchase of construction materials from abroad, such as pipes, fittings, electromechanical equipment, and so on. This result was in line with Iyer and Jha (2005) as availability of resources as planned through project duration is an important factor for construction projects. This is because resource availability as specification and schedule can improve timely performance of projects.

c. Delay procurement management system

The third influential factors of project delay as assured by respondents here was the delay procurement management this is not only in WSIDDO but also country's procurement system is under questions. According to YonasDubale (2014), who conducted the study on "Evaluation of procurement process at AAWSA", also investigates as the there is no departmental strategy, policies or guidelines at AAWSA for its procurement process smoothing and also concludes as it is too lengthy and kept bureaucratic red tape. Hence, both sources express as the lengthy procurement system delay is one of the significant factors for project dalliance in AAWSIDDO.

d. Delay in getting permits from the municipality

According to respondents, the fourth most influential factor in project delays was a delay in getting permits from the municipality. The main study is intended for the sewerage component permit processes, where numerous stakeholders' decision needs and paperwork for obtaining permits in the complex municipal environment result in long wait times for applicants and lengthy permit application review for officials. Delays in issuing sewerage construction permits and occupancy permits harm the economy. The time elapsed between project conceptualization and a potential construction start date frequently exceeds the construction period itself. The total

number of approval processes is very high, particularly in plan commission and land management. Aside from the involvement of numerous stakeholders in planning and decision-making processes for obtaining permit approval, is problematic in terms of coordination and delivery. The review of the planning commission reveals a lack of coordination among the various city administration offices such as Sub City and Worada, as well as the stakeholders, so bridging that gap remains a significant challenge for delay permits.

This finding can be agreed with what was found by Aydin and Mihlayanlar (2018); according to the study's findings, the ten most important factors causing delays in construction projects in Edirne city center are listed together with the names of groups of factors, and as a result of the rank based on RII, the three most important reasons for the delay are; delay in obtaining permits from the municipality, change in government regulations and laws and difficulties in financing project.

Similarly, the most important factors in the study Vosoughi et al. (2016) were identified and ranked using Expert choice Software. According to the research findings, the most important factors are the employer's failure to pay the contractor on time, the employer's failure to obtain the necessary permissions before allowing the contractor to proceed, and the employer's uncertainty and purchase of the project site.

e. Slow decision making and slowness in all process decisions

Slow decision making and slowness in all process decisions, as assured by respondents here, were Contractual and Management related. According to the respondent, this is due to the negligence of all tripartite client, Contractor, and consultants staffs or a lack of qualified contract administration and management staff, a long chain of bureaucracy such as: taking a long time to approve bid evaluation, payment approval, variation approval, design approval, and other related contractual and management .The main reason noted during work participation is a lack of sufficient experience and unqualified staff assigned to this work.

According to Alemyehu's (2020), as perceived by the owners, the most important cause or delay factor for 15 towns water supply & sanitation project is slow decision making that is owner related. According to the respondents, the main reason for this delay cause is due to the negligence of client staffs or a lack of qualified contract administration staff, as well as a long chain of bureaucracy.

4.6 Result and Discussion of Inferential Statistics

Inference is the objective of statistics, especially in decision making and prediction plays important role in individual life. Therefore, the objective of statistics is to make inference about a population based on the information of the sample. Since, population is characterized by numerical descriptive measures called parameters.

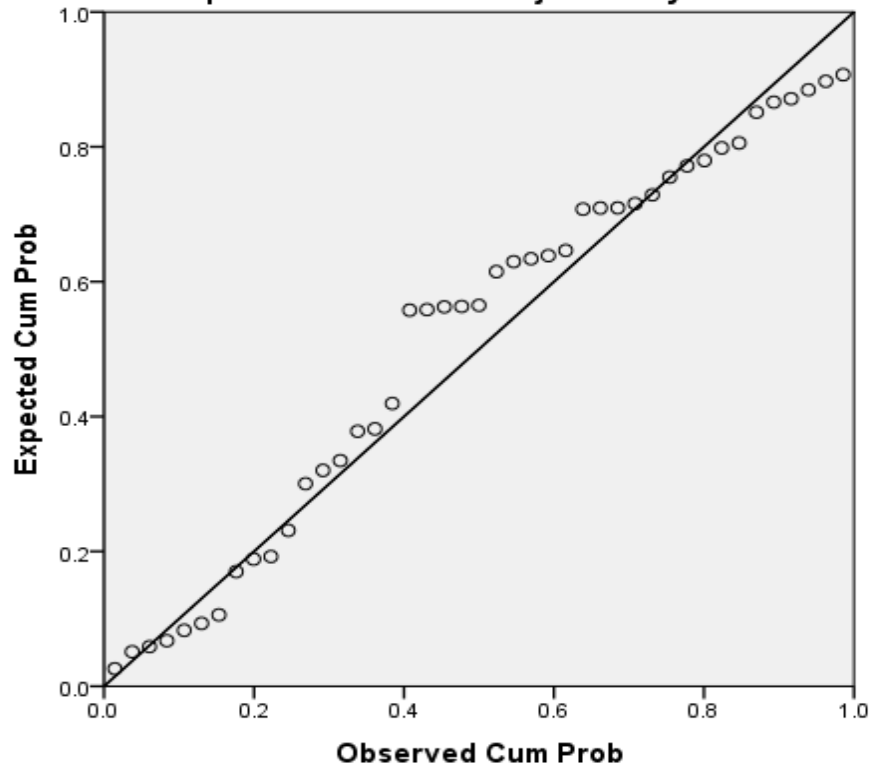
4.6.1 Testing Assumptions of Multiple Linear Regression

According to Julie (2005), before presenting the regression analysis estimation results, the model was diagnosed for problems with normal distribution, linearity, and multicollinearity, and the Multiple Linear Regression testing assumptions were as follows:

4.6.1.1 The linearity test

Linearity refers to the degree to which the change in the dependent variable is related to the change in the independent variables. To determine whether the relationship between dependent variable (delay in the construction of sewerage Projects) and the independent (External Related Causes, Financial related causes, Materials related causes, Contractual related causes, Design Change related causes, Equipment related causes, Management Related Causes ,and Labor related causes) is linear; plots of the regression residuals through SPSS software had been used. Therefore, figure 4.1 showed the linearity result indicates that the residual distributions are close to the mean zero.

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Project Delay



Source: Survey result, 2022

4.6.1.2 Normality Test

The Shapiro-Wilk test results show below table 4.6 that all of the variables had a p-value greater than (0.05), indicating that the variables in the study have a normal distribution; thus, it can be concluded that the residual variables are normally distributed, and the regression analysis procedures have been met.

Table 4.6 :-Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
Studentized Residual	0.167	43	0.004	0.939	43	0.024

a. Lilliefors Significance Correction

Source: Survey result, 2022

4.6.1.3 Multi collinearity test

According to Pallant (2007), tolerance indicates the extent to which the independent variables do not explain much of the variability of a specified independent variable, and the value should not be small (less than 0.10) to indicate the absence of co-linearity. Furthermore, VIF, the inverse of tolerance value, should be less than 10 to avoid any co-linearity concerns (Pallant, 2007).

Table 4.7:- Test for Multicollinearity

Model		Unstandardized Coefficients	Collinearity Statistics	
		B	Tolerance	VIF
1	(Constant)	-6.518		
	External Related	0.390	0.848	1.179
	Finance Related	0.249	0.743	1.347
	Material Related	0.230	0.533	1.876
	Contractual Related	0.605	0.568	1.761
	Design Change Related	0.233	0.654	1.529
	Equipment Related	0.555	0.606	1.650
	Management Related	0.756	0.615	1.627
	Labor Related	0.621	0.556	1.798

Source: Survey result, 2022

As a result, the values in Table above 4.7 indicate low co-linearity because all Tolerance values are greater than 0.1 and all VIF values are less than 10. As a result, these tests show that the variables used in the study are not multi-collinear. Then the researcher proceeds to the regression analysis.

4.6.2 Multiple Linear Regression Analysis and Hypothesis Test Result

According to Table 4.8, the value of Adjusted R Square is 80.6% of the variation indicated by the response variable is explained jointly by the independent variable, and the remaining 19.4% is determined by other unknown explanatory variables not covered in this study.

Table 4.8 :- Multiple regression analysis of the model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.918 ^a	0.843	0.806	0.33325	1.712

a. Predictors: (Constant), Labor Related, External Related, Contractual Related, Design Change Related, Management Related, Finance Related, Equipment Related, Material Related

b Dependent Variable: Project Delay

Source: - Authors' own analysis result (2022)

According to table 4.9, the beta coefficients assigned for each independent variable in the multiple linear regression equation are given under the coefficients the unstandardized coefficients. The standardized coefficient, on the other hand, expresses the extent to which each independent variable contributed to the dependent variables. Simultaneously, the P values of each independent variable, denoted by (sig) in the tables below, determine whether or not to reject the null hypothesis (H0) of each independent variable hypothesis being tested in both cases. As a result, because this is a sig. (1-tailed) test, if P is 0.05, the hypothesis is statistically significant, and the null hypothesis can be rejected.

Table 4.9: Hypothesis Testing

Coefficients ^a					
Model		Unstandardized Coefficients		Standardized Coefficients	Sig.
		B	Std. Error	Beta	
1	(Constant)	-6.518	0.877		0.000
	External Related	0.390	0.149	0.193	0.013
	Finance Related	0.249	0.183	0.108	0.182
	Material Related	0.230	0.136	0.157	0.101
	Contractual Related	0.605	0.134	0.407	0.000
	Design Change Related	0.233	0.181	0.108	0.207
	Equipment Related	0.555	0.203	0.238	0.010
	Management Related	0.756	0.198	0.330	0.001
	Labor Related	0.621	0.168	0.336	0.001
a. Dependent Variable: Project Delay					

Source: SPSS Output, 2022

The hypothesis testing for the study was based on β and P values. As a result of those coefficient results, the proposed hypotheses for this study were tested as follows.

a. Hypothesis 1: External related factors has a significant positive influence on delay of sewerage construction projects

The first hypothesis investigates the relationship between "External Related Factors" and "Delay" in sewerage construction projects. Table 4.9 summarizes the regression results. It has been discovered that External Related Factors have a positive impact on the completion of sewerage construction projects. Furthermore, the relationship has Beta (β) a value of 0.39 and is significant at the 95% level of confidence. According to reports, one unit change in "External Related Factors" causes a 39% increase in "Delay" in the completion of sewerage construction projects. The P value for "External Related Factors" is 0.013, indicating a positive relationship between the dependent and predictor variables. As a result, Hypothesis 1 is accepted.

b. Hypothesis 2: Finance related factors has a significant positive influence on delay of sewerage construction projects

The second hypothesis of study investigates the relationship between "Finance Related Factors" and "Delay" in sewerage construction projects completion. The analysis reports that the relationship is not significant, i.e. there is no impact of Finance Related Factors on project delay. The β value stands at 0.25; however the affect is not significant which leads to the rejection of the hypothesis 2. This relationship stands for the sample of this organization selected for current study; however previous studies identify significant relationship between the variables. Although earlier research assigns Finance Related Factors to be significantly related with project delays, none of these studies calculate regression weights for the impact of Finance Related Factors on project delay.

c. Hypothesis 3: Material related factors has a significant positive influence on delay of sewerage construction projects

The third hypothesis of study investigates the relationship between "Materials Related Factors" and "Delay" in sewerage construction projects completion. The result of the multiple regressions revealed that $P = 0.1$ and thus, $P < 0.05$ which is not significant. There is no impact of Material Related Factors on project delay. The Beta (β) value stands at 0.23; however the affect is not

significant which leads to the rejection of the hypothesis 3. This relationship stands for the sample of this organization selected for current study; however previous studies identify significant relationship between the variables. Although earlier research assigns Material Related Factors to be significantly related with project delays, none of these studies calculate regression weights for the impact of material Related Factors on project delay.

d. Hypothesis 4: Contractual related factors has a significant positive influence on delay of sewerage construction projects

The results of multiple regressions, as presented in Table 4.9 above, revealed that Contractual related factor had a positive and significant effect on project completion with values ($\beta=0.605, p=0000, p < 0 .05$). Thus, the proposed hypothesis was accepted. Here also the beta coefficient implies that if Contractual related factor is changed by one %, by keeping the other variables constant its project delay would increase by 60 %. Therefore, Contractual related factor had a positively and significant effect on project delay.

Hypothesis 5:

e. H5: Design change related factors has a significant positive influence on delay of sewerage construction projects

The fifth hypothesis of study investigates the relationship between “Design Change Related Factors” and “Delay” in sewerage construction projects completion. The result of the multiple regressions revealed that $P = 0.207$ and thus, $P < 0.05$ which is not significant. There is no impact of Design Change Related Factors on project delay. The Beta (β) value stands at 0.233; however the affect is not significant which leads to the rejection of the hypothesis 3. This relationship stands for the sample of this organization selected for current study; however previous studies identify significant relationship between the variables. Although earlier research assigns Design Change Related Factors to be significantly related with project delays, none of these studies calculate regression weights for the impact of Design change Related Factors on project delay.

f. Hypothesis 6: Equipment related factor has a significant positive influence on delay of sewerage construction projects

The sixth hypothesis of the study measures the effects of equipment related factors on delay in construction projects. Multiple linear regression model reveals the coefficient at 0.555 for this

relationship significant at 95% confidence level. It is found that equipment related factors cause significant variance in delay of sewerage construction projects. Thus it is reported that breakdown and Low efficiency of equipment, Slow mobilization of equipment, and Shortage of equipment and hiring delays increase the construction delay significantly which leads to the acceptance of hypothesis 6.

g. Hypothesis 7:Management related factor has a significant positive influence on delay of sewerage construction projects

The seventh hypothesis investigates the relationship between "Management Related Factors" and "Delay" in sewerage construction projects. Table 4.9 summarizes the regression results. It has been discovered that Management Related Factors have a positive impact on the completion of sewerage construction projects. Furthermore, the relationship has Beta (β) a value of 0.756 and is significant at the 95% level of confidence. According to reports, one unit change in "External Related Factors" causes a 75.6% increase in "Delay" in the completion of sewerage construction projects. The P value for "Management Related Factors" is 0.001, indicating a positive relationship between the dependent and predictor variables. As a result, Hypothesis 7 is accepted.

h. Hypothesis 8:Labor related factor has a significant positive influence on delay of sewerage construction projects

The eighth hypothesis of the study measures the effects of Labor related factors on delay in construction projects. Multiple linear regression model reveals the coefficient at 0.621 for this relationship significant at 95% confidence level. It is found that equipment related factors cause significant variance in delay of sewerage construction projects. According to Sweis et al. (2008), a lack of skilled, semi-skilled, and unskilled labor also causes construction projects to be delayed. In the same vein, Sambasivan and Soon (2007) concluded that Malaysian labor supply ranks seventh out of twenty-eight delaying factors. This demonstrates that labor-related delaying factors play a significant role in delaying a construction project. Thus, it is reported that labor shortages, slow mobilization of labor, low labor productivity, low labor motivation and morale, and low labor skill significantly increase construction delays, leading to the acceptance of hypothesis 8. Generally the results of multiple regression analysis supported the five hypotheses constructed to test a positive and significant influence that each determinant have on project delay and while three hypotheses is no significant influence.

CHAPTER FIVE

CONCLUSION & RECOMMENDATIONS

5.1 Summary of Findings

Delays were a major issue in the construction of sewerage projects, and they were costly for the tripartite Client, Consultant, and Contractor. An investigation into this problem area is required in order to better manage and mitigate delay situations. According to Chan and Kumaraswamy(1997), the vast majority of project delays occur during the construction phase, where many unforeseen factors are always present.

The primary objectives of the study were to determine how external, financial, material, contractual, design change, equipment, management, and labor-related factors influenced sewerage construction projects. Subsequently, the study implied that the above delay factors had adversely impacted the project. In order to make sure these factors truly delayed the project, the integrity and reliability of the analysis was checked. Hence as it can be seen from Table 3.1, the questioner used was reliable and acceptable based on the Cronbach's Alpha result of each category.

Before prioritizing the causes of construction project delays in WSIDDO, respondents were asked to reflect on whether the delay is due to the office's construction undertaking. As a result, 12(25.5%), 19(40.4%), and 12(25.5%) of the total respondents have assured that the occurrence of office delays is moderate, high, and very high, respectively.

The major reasons for the delay in the construction of the Addis Ababa Water Sanitation Infrastructure Development Division Office's right of way was ranked first by all respondents, followed by Difficulty in accessing Letter of credit/LC, Delay in procurement management processes was ranked third, Delay in getting permits approval from municipality was ranked fourth, Slow decision making was ranked fifth, and Slowness in decision of all a process was ranked sixth.

A ranking of the delay-causing factors calculated with SPSS to reveal the most influential factors within each category of causes and overall. The respondents (External related, Management related, Finance related, and Contractual related) prioritized the causes of delay in order of importance; the remaining factors, on the other hand, have shown a minor occurrence.

Before presenting the regression analysis estimation results, the model was checked for normal distribution, linearity, and multicollinearity issues. The results of the tests confirmed that the regression models passed all of the diagnostic tests.

Finally, a multiple regression analysis was performed to test the hypothesis. Table 4.8 depicts the outcomes of multiple regressions in this regard. The adjusted R square 0.806 indicates that the model tested is significant. This value indicates that the eight independent variables included in the regression account for 80.6% of the delay. Other unknown explanatory variables determined the remaining 19.4%. Regarding the hypothesis, as shown in Table 4.9, because the beta coefficients were found to be significant, the five hypotheses in the study were accepted, while the remaining three hypotheses were rejected. Furthermore, the findings revealed that management-related factors were the most influential in determining Addis Ababa Water Sanitation Infrastructure Development Division Office's sewerage project delay.

5.2 Conclusion

Construction delays were common in many countries and situations. Avoiding construction delays is critical for stakeholders and project participants. First, identify and label any major factors that may cause a delay as critical success factors. Once these factors have been identified, appropriate preventive measures can be put in place to avoid the negative consequences of their occurrence.

According to the findings of this study, the top six potential causes of sewerage construction project delays were right of way problem, difficulty in accessing Letters of credit/LC, delays in procurement management processes, delays in getting permits approval from municipalities, slow decision making, and slowness in decision making process.

A proper understanding of these causes of delays and their consequences will assist relevant project professionals in better managing delay situations in sewerage project construction.

Furthermore, the results of multiple regression coefficients show that management-related factors were the most influential in determining sewerage project delay. In addition, five of the study's hypotheses were accepted, while the other three were rejected.

5.3 Recommendations

The objective of this paper was to identify the underlying causes of sewerage construction delays at the Addis Ababa Water and Sanitation Infrastructure Development Division Office. Given the right of way issue, difficulty in accessing letters of credit/LC, delays in procurement management processes, delays in obtaining permit approval from municipalities, slow decision making, and slowness in decision making process as major factors in these AAWSIDDO sewerage construction projects, the following methods for reducing project delays are recommended for the office:

- ✚ To overcome the delays and difficulties caused by ROW issues, the office should better lobby Addis Ababa's City Government to change its compensation package for displaced citizens and collaborate with stakeholders. It is suggested that the office implement a sewerage disposal system for local residents in order to foster a sense of ownership of various sewerage projects in the heart of the communities settled at the project's site. When inquiring, the office better request a special undertaking from the government of Addis Abeba in order to have the land immediately set collaborate without bureaucracy.
- ✚ It was suggested that the office maintain close contact with the relevant governmental officials in order to obtain the necessary foreign currency permission for L/C opening in a timely manner. Furthermore, one of the office's responsibilities should be to pay special attention to and strengthen the Procurement Support Process in order to reduce the impact of project delays. Before the bid is floated, there should be a way to finish the tender document preparations with clarity.
- ✚ The implementer may devise a mechanism in order to have an effective procurement planning system and effective construction planning. To avoid procurement process delays, physical and financial plans should be properly translated and implemented according to plan. Construction materials should not be delivered late to a job site in order for work to be completed in the order planned.
- ✚ Delays in obtaining permit approval from municipalities, as well as the majority of other delay factors, can be reduced with effective communication. During each phase of construction, proper communication and coordination channels should be established between various parties. Any breakdown in communication can lead to major misunderstandings and project delays. The client should first prepare the work site and

appropriate design to ensure proper permission. To revoke such a permit, proper/effective communication channels, as well as a timely progress review of project performance, are required. Furthermore, structural responsibility should be taken into account in the organization.

- ✚ Owners better make decisions quickly; everyone has played the dreaded waiting game at some point in their careers. Waiting for someone, somewhere to make a decision that is preventing the entire project from moving forward. Coordinating actions and approving items quickly can keep construction jobs on time (or even ahead of schedule) and, in some cases, under budget. In addition to the real-time accessibility, timely data, and powerful functionality that modern, cloud-based, integrated construction software provides, contractors can automate tasks and streamline workflows to ensure the right people see the right information at the right time.

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RESEARCH QUESTIONNAIRE

St. Mary's University

School of Graduate Studies

DEPARTMENT OF PROJECT MANAGEMENT

Appendix I: Research questionnaire

Dear participants,

The purpose of this questionnaire is to gather information about the *causes of sewerage project delays: In the case of Addis Ababa Water and Sanitation Infrastructure Development Division Office*. This questionnaire must be filled out with as many exact relevant facts as possible. In this regard, your response is extremely valuable. All data included in this questionnaire will be used only for academic research and will be kept strictly confidential, and the findings of this study will be used only for academic purposes.

With regards,

Bedru Aliy

St. Mary University

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Part I: General Information

Please specify the choice that belong to you below, please tick (√) in the box provided.

1. Please specify your Sex: Male Female

2. Education: Diploma First Degree Master Degree PhD

3. In what organization do you currently work?
Client Consultant Contractor

4. What is your present position in your company or office?
Project Coordinator Engineer Contract Administrator
Surveyor Planning specialists Other

5. Year of experience in sewerage construction and related project work?
3- 6 7-10 11-15 16-21 Above 21 years

6. Do you believe that there is a delay of sewerage construction projects in AAWSIDDO?
A. Yes B. No

7. If your answer for question no.6 is **Yes** please tick the occurrence of construction delay using the following scale:
Moderate High Very high

Part II- Causes of Delay in Sewerage projects

Please mark (√) and rank the following delay-causing factors in terms of how frequently they occur in a project.

SD=Strongly disagree (1), D=Disagree (2), N=Neutral (3), A=Agree (4), SA=Strongly Agree (5)

Category of Cause of Delay	Main cause of delay	SD	D	N	A	SA
		1	2	3	4	5
1. External related	Delay in getting permits approval from municipality (Plan commission, Land management ,utilities line ,Road Authorities)					
	Changes in government Laws and regulations					
	Right off way (ROW)Problem					
	Adverse weather condition					
	Unexpected surface and subsurface conditions					
2. Finance related	Financial difficulties (shortage) by client					
	Delayed payments to Contractors, suppliers					
	Financial difficulties faced by the contractor					
	Difficulty in accessing Letter of credit/LC					
	Fluctuation of prices/rising cost of material					
3. Material related	Poor quality of materials					
	Materials supply imported delay					
	Escalation of material prices					
	Shortage of material in market					
4. Contractual	Delay in delivering site project to contractor					
	Delay in approval of documents					
	Lack of communication between parties					
	Slowness in decision of all process					
	Delay in performance of contractor					
	Major disputes					

Category of Cause of Delay	Main cause of delay	SD	D	N	A	SA
		1	2	3	4	5
5.Design change related	Design change in the scope of the project					
	Change in specification, drawing and BOQ					
	Mistakes and discrepancy in specification, drawing and BOQ					
	Delays in producing construction drawings					
6. Equipment related	Equipment breakdowns					
	Low efficiency of equipment					
	Slow mobilization of equipment					
	Shortage of equipment and hiring delays					
7. Management related	Delay in procurement management processes					
	Poor site management and supervision					
	Unrealistic contract duration and cost estimation					
	Inappropriate organization management					
	Ineffective planning and scheduling of project					
	Inadequate contractor experience					
	Inadequate consultant experience					
	Underestimation of the complexity of the project					
	Poor communication & coordination					
	Slow decision making					
8. Labor related	Shortage of labors					
	Slow mobilization of labor					
	Low productivity level of labor					
	Low motivation and morale of labor					
	Low skill of labor					

- a. Please specify here if you have any comments about the causes of the delay and/or their significance:

Thank you

Annexes 1

Sewerage Construction Projects schemed contract days & delay

S.no	Project Name	Date of contract signing	Handover date	Total Contract Period /days	Total allowed Time extension duration /days	% of delays	Remark
1	Bole Arabsa Decentralize Wastewater Treatment Plant (BAD WWTP)	12/5/2019	1/16/2020	720	720	100%	All projects are delayed
2	Kaliti Wastewater Treatment Plant (KWWTP)	10/20/2014	1/29/2015	540	495	92%	
3	Kaliti Sanitary Sewer Trunk Mains Rehabilitation and Expansion Project	10/20/2014	1/29/2015	540	1032	191%	
4	Koye-Fetche Condominium Decentralized Waste Water Management System Project (Lot III WWTP3)	8/20/2015	8/5/2015	365	704	193%	
5	Package Wastewater Treatment Plant EM Supply and Civil Work Construction Lot-1	9/15/2014	8/31/2014	150	870	580%	

Source: Plan Achievement Report of WSIDDO

