

***Assessment of the Causes of Project Delay in Rural Water Supply
Construction Projects: The Case of Jimma zone***

***A Thesis Submitted to the School of Graduate Studies of Jimma University in
Partial Fulfillment of the Requirements for the Award of the Degree of Master
of Art in project management and finance (MPMF)***

By

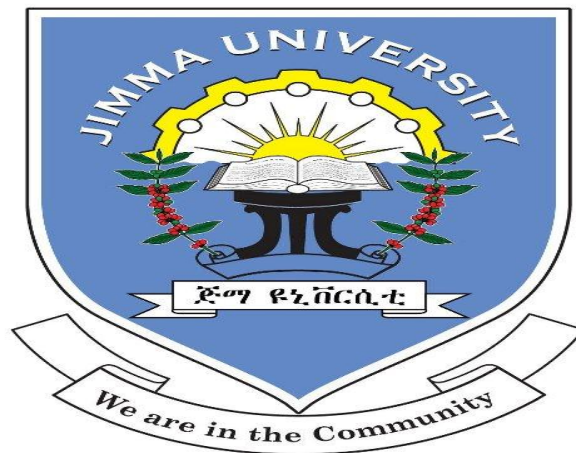
ZAKIR KASSAYE

Under the Guidance of

AREGA SEYOUM (PHD)

and

Mr.ERKO TEFERI



JIMMA UNIVERSITY

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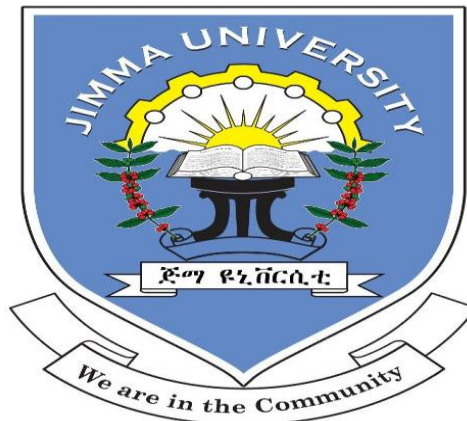
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DECLARATION

I hereby declare that this thesis entitled '*assessment of causes of project delay in rural water supply construction project in Jimma zone*' has been carried out by me under the guidance and supervision of Dr. Arega Seyoum and Mr. Erko Teferi.

The thesis is original and has not been submitted for the award of any degree or diploma to any university or any other institutions.

Researcher's Name

Date

Signature

Zakir Kassaye

CERTIFICATE

This is to certify that the thesis entitles '*assessment of causes of project delay in rural water supply construction project in Jimma zone*', in partial fulfillment of the requirements for the degree award for Master of Art in Project Management and Finance submitted to Jimma University that record of valuable research work carried out by Mr. Zakir Kassaye under our guidance and supervision.

Therefore, we hereby declare that no part of this thesis has been submitted to any university or institution for the award of any degree or diploma.

Main Adviser's Name	Date	Signature
Dr. Arega Seyoum	_____	_____

Co-Adviser's Name	Date	Signature
Mr. Erko Teferi	_____	_____

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I would like to express my appreciation to all organizations and individuals who contributed directly or indirectly to this thesis and furnish the necessary materials and assist for realization of this thesis special thanks are forwarded to contractors, consultants and clients who sacrificed their time in filling the questionnaires

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ABSTRACT

Construction delays are a common problem worldwide. These problems occur frequently during project life time leading to dispute and litigation. Therefore it is essential to study and analyze the causes of construction delay. To obtain expert opinions from the sector, in total fifty five (55) factors were identified and made part of the survey questionnaire and the survey was conducted with stakeholders from contractors, client and consultants. The researcher select 43 respondents based on purposive sampling method and gathered data using questionnaire. In addition interview questions which enable to achieve the objectives of the research were developed and collect data from 5 interviewees, the interviewees are selected based on their long experience in the sector. The research design was based on exploratory survey and descriptive approaches. The survey revealed the top ten ranked factors of causes of rural water supply construction delay in Jimma zone. These are under estimation of complexity of project, political instability, financial difficulty faced by contractors, unrealistic contract duration, clients' financial shortage, escalation of material price, delayed payment to contractor, change in scope of project variation and inaccurate cost estimation. In addition ranking of the factor tested with the use of spearman rank coefficient of correlation the agreement among clients, contractors and consultants and the result of the test shows positive correlation between parties. The study recommended to all parties for mitigating project delay.

Keywords: *Construction Delay, Delay Causes, Top-Ten Delay Factors*

ABBREVIATIONS

PERT - Project Evaluation & Review Technique

CPM - Critical Path Method

RII - relative importance index

SPPSS :- statistical package for social science

CHAPTER ONE

1.INTRODUCTION

1.1 Background of the Study

The building construction project comprises of three stages. They are:-initiation, designing and building. Well-timed completion of projects is an indicator of competent construction industry. Construction timely often serves as a standard for assessing the performance of a project and the efficiency of the project organization. A project is said to be successful on timely completion. The time required to complete construction projects is often more than the specified time in the Contract. These overruns or, time extensions happens due to design error, economic conditions, resource accessibility and performance of project parties. Frequently, majority of project delay occurs during Construction phase, where unexpected factors are always involved. Construction delays lead to increase in overall project cost, hereafter completing projects timely is valuable to all stakeholders involved in projects. Therefore, it is important to find the real causes of delay in order to diminish and avoid the delays and their corresponding expenses.

Delay refers to the time overrun of completion date detailed in a contract or the date that the parties agree upon for delivery of a project. Delay in building construction project is considered most common problems causing a multitude negative effect on the project and its involved parties. Therefore, it is essential to identify the actual causes of project delay in order to lessen and avoid the delays and their effects. Delays in construction can cause a number of changes in a project such as late completion, lost output, increased costs, and contract end. A delay in an activity may not result in the same amount of project delay. A delay affected by a party may or may not disturb the project completion date and may or may not cause damage to another party. A delay may occur concurrently with other delays and all of them may impact the project completion date. Delays caused by the client such as failure to allocate sufficient fund, slow decision making coupled with delay caused by consultant such as late submission of drawings and specifications, regular change orders, and poor site information generates claims from both the key contractors and subcontractors which many times entail lengthy court proceedings with huge impacts.

Delays caused by contractors generally attributed to poor managerial skills, lack of effective planning and poor financial management have led to a failures of the contractors. The impact of construction time delay may consists of time overruns, cost overrun, disputes, litigation and total abandonment (Murali and Yau, 2006). Some studies examine delays; attempt to identify their causes and mitigation ways to eliminate them. Construction project delays have a weakening effect on parties (Owner, Contractor, and Consultant) to a contract in terms of a growth in adversarial relationships, distrust, litigation, arbitration, cash-flow problems, and a general feeling of apprehension towards each other (Assaf and Al-Hejji, 2002)

This study examines the causes of project delay and determines how critical delay causes are most significant in project performance. This will provide proprietors, Consultants and construction organizations participated in construction projects with the foundation on which such strategies can be developed in the future. The proposed study focuses on water supply Construction Projects in Jimma zone. Which the researcher evaluate their causes of delay and provide the recommendations based on the result to advance the project performance within the water supply projects as well as the general construction projects.

1.2 Statement of the Problem

Delays happen in construction project and its magnitude vary from project to project. Some projects delayed for some few days while others for over a year. Lack of achieving targeted time, budgeted cost, design specifications and specified quality result in various unpredicted negative effects on the projects are the reason that delay to occur. Normally, when the projects get delayed, either the delivery time of the project will be extended or the progress of the project will be accelerated heavily in order to deliver it on time. The former will lead to arbitration, litigation, and penalties, etc. and the later will lead to incur additional cost, both will end up with loss of money. In worst case, accelerating the process of the project will also affect the quality of the output which sacrifices client's satisfaction (Hendrickson & Au, 2003). A significant number of international literature discourse that the unfitness to complete projects on time and within budget continues to be a chronic problem worldwide. The success of a construction project is critically affected by the capacity of the implementing firms, nature of the contract and stability of the economic environment (Dean, 2012). There is lack of agreement as to the principal causes of delays.

For instance, Abdo (2006) identified major factors that causes for public building construction in Ethiopia as necessary variation, delay payment, scarcity of material, less emphases to planning,

design change, material and labor price escalation, unrealistic time schedule and failure to update schedule on time.

Werku and Jah, (2017) identified 10 major factors that cause construction delays in Ethiopia as difficulties in funding project by a contractor, escalation of the materials price, Ineffective project planning, Scheduling or resource management, delay in progress payments for completed works, lack of skilled professionals in the field of construction management in the organization, fluctuating labor availability season to season, low productivity of labor with, unqualified/inadequate experienced labor and Insufficient data collection and survey before design.

In this topic several studies were done for several years. However, those studies were done in area specific and not in specific sector related to this topic. Therefore, the relevance of such research in the construction context of Ethiopia specially in water supply construction projects still remains less explored. Despite lack of empirical evidence specific to the sector, the water construction projects also are suffering a massive delay. Most studies on construction delay based mainly in identifying the causes and effect, without developing mitigation for the delay. Delay has an adverse effect on project success in terms of time, cost and quality. Many project experience extensive delay and thereby exceed initial cost estimate in addition to impact of economic feasibility, extensive delay could causes a ground of dispute between owner and contractor, increased cost, loss of productivity and revenue and contract termination. However the aim of this study is to fill the gap by identifying the major causes of water supply construction delay in Jimma zone and propose a mitigation strategy.

1.3 Basic Research Questions

The study is guided by the following research questions:

- i. What are the design change related factors causing construction delay at Jimma zone water supply constructions projects?
- ii. What are the material related factors causing construction delay at Jimma zone water supply constructions projects?
- iii. What are the labor related factors causing constructions delay at Jimma zone water supply constructions projects?
- iv. What are the equipment related factors causing constructions delay at Jimma zone water supply constructions projects?

- v. What are the finance related factors causing constructions delay at Jimma zone water supply constructions projects?
- vi. What are the contractual related factors causing constructions delay at Jimma zone water supply constructions projects?
- vii. What are the management related factors causing constructions delay at Jimma zone water supply constructions projects?
- viii. What are the external/environmental related factors causing constructions delay at Jimma zone water supply constructions projects?
- ix. What are the practices that the implementing organization undertakes to minimize the occurrence of project delay?

1.4 Objective of Study

1.4.1 General Objective

The main objective of this study was to identify the causes of project delay in rural water supply construction projects the case of Jimma zone.

1.4.2 Specific Objectives

The specific objectives of the study are:-

- Identify the major causes of delay in the construction of water supply construction projects
- .To identify the most significant delay causing factors in water supply construction project
- To describe the practice of the implementing parties to undertake the construction project delay?

1.5 Scope of the Study

This research was focuses on the assessment of the major cause of project delay on the water supply construction project in Jimma zone. This study is needed to evaluate the projects not the participating individuals. Clients , contractors and consultants are engaged are included to the study to get the holistic view about the projects. The data analysis used for this study limited to descriptive statistics such as RII and association analysis.

1.6 Significance of the Study

Proper planning, implementation and monitoring will save the life of the project and minimize the risks linked with delay, cost overrun and quality issues. Failure to manage delay causes and factors accordingly hinder the project completion and the stakeholders' correlation. So, this study will give good picture about the major causes of project delays.

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

Thirdly the researcher provide practical mitigation strategy in controlling delays in the water supply construction project and helps all contracting parties to think about its effects during design stage. Therefore, this research will supply to fill the gap related to project delays in the industry, significant for its contribution to the study sheds light on the causes of project delay specific to water supply sector, the study's findings and recommendations are highly important to management of the project implementing organizations because it draws their attention to some of the points where corrective actions are necessary and enable them to make such corrections, the research could be used to establish a framework for subsequent studies that can work with more comprehensive data sets. Furthermore, it could stimulate further research, the findings and recommendations of the study are highly important to policy makers because it draws their attention to some of the points that need corrective measures on their side.

Finally, it add more information on the most frequent and major causes of delay and to undertake the problems as early as possible

1.7 Organization of the Study

This study is organized/ structured into five chapters. The first chapter of the study deals an overview of topics description of background of the study, statement of the problem, the general and specific objective of the study, and significance of the study, scope of the study.

The second chapter contains literature review. The chapter provides an in depth theoretical and empirical study of the causes of construction projects delay along with the type of delay, which is related to topics of the study. The third chapter Research methodology contains Research design, Target population, type and sources of data, methods of data collection, data analysis and

interpretations. The fourth chapter will present the results and discussions of the findings, while chapter five will address the summary of key findings, the conclusions and relevant recommendations

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

This chapter contains literature review related to the study variables. It summarizes the concept of the Cause of the delay on water supply construction Projects. The chapter discusses the empirical and theories that related to the study. Construction projects are now more difficult and complex and hence the construction project team faces unparalleled challenges. The study on causes of construction delay on the project performance is a means of understanding and thus improving the effectiveness of construction projects.

Time delays in construction can affect a number of changes in a project such as delays of project completion, lost output, increased costs, and contract closing before completion of the project. A delay affected by a party may or may not affect the project total completion date and may or may not cause harm to another party. A delay may occur simultaneously with other delays and all of them may impact the project completion date.

The objectives of this study are to identify major causes of delays on water supply construction projects in Jimma zone.

2.1 Theoretical Literature Review

2.1.1 Project Planning

According to (Trauner, 2009) project scheduling is graphical representation of the Contractor's construction plan to completing a construction project that focused on the elements of time and sequence. Construction planning encompasses the selection of technology, the estimate of the needed resources and periods for individual tasks, and the identification of any inter-relationship among the different work tasks (Chris 1998). It is a method to determine "What" we are going to be accomplish, "How" things are going to be done, "Who" responsible to do and "How Much" activities will cost. In this sense planning does not cover scheduling, which addresses the "When" to do, but once planning is completed scheduling can be done (Chitkrara, 2001).

2.1.2 Project Scheduling

Scheduling is the process of developing the work plan to a time border, set date-wise in a logical sequence: it is a time table for action indicating the start and completion of each activity. The scheduling of work elements is the most important step in planning because it is the basis for allocating resources, estimating costs, and tracking project performance. Schedules show the timing for work elements and denote when specific events and milestones take place. Sidney (2002) defines scheduling as a tool that provides participants in the project with an orderly, time related sequence of events to follow in order to effect timely completion of the project.

2.1.3. Scheduling Techniques

Basically there are two types of project scheduling techniques which are used to plan, schedule and control construction projects.

2.1.3.1. Bar (Gantt) Chart

The simplest and most commonly used scheduling technique is the Gantt chart (or bar chart), named after the famous management consultant Henry L. Gantt (1861–1919). He realized that time was a common denominator to most elements of a program plan and that progress could easily be assessed by viewing each element's status with respect to time. His approach used standardized setup and processing times and depicted the relationship between production jobs planned and completed. The Gantt chart became widely adopted in industry and today has many versions and is used in a variety of ways. Ahcom (2004) in his study presented that a Gantt charts are a project planning tool that can be used to represent the timing of tasks required to complete a project. It is a time-phased graphic display of activity durations. The chart consists of a horizontal scale divided into time units; days, weeks, or months and a vertical scale showing project work elements—tasks, activities, work packages, and so forth. Bar chart provides little information about the interrelationship of the voluminous interdependent tasks. These charts carry the risk of schedule slippages, time overrun, improper decision and contractual complications.

2.1.3.2. Network scheduling

Gantt charts indicate the general sequence of work tasks, but they do not explicitly show the relationships among tasks, nor the impact of delaying tasks or of shifting resources. Planning and scheduling methods using networks do not have this inadequacy. They clearly show inter

dependencies among activities and enable planning and scheduling functions to be performed separately. Alternative plans can be analyzed and, afterwards, they can be scheduled according to the availability of resources. The most common network analysis techniques used for planning, scheduling and controlling of projects are Critical Path Method (CPM) and Project Evaluation & Review Technique (PERT). Their common features are that they make use of the network model for depicting the time plan of the project: apply the critical path concept for determining the project duration and identifying critical activities and employ network analysis technique for controlling the project -time objectives.

2.1.3.3. Critical Path Method (CPM)

PERT was developed for application in projects where there is uncertainty associated with the nature and duration of activities. It originated in the late 1950s during the U.S. Navy's Polaris Missile System program. The critical path method (CPM) format is used to develop an as-constructed schedule. Delaying actions are depicted as activities are connected to specific work activities. The critical path(s) are differentiate twice, firstly in the as-planned schedule and secondly at the end of the project. The difference between the as-planned completion date and the adjusted as-built completion date is the quantity of time for which the claimant would request compensation. (Aibinu, 2001) Robert et al. (2007) have indicated that in the context of construction claims, an extension of time or additional compensation is justified for a delay only if it impacts the critical path or the actual end date of the project.

2.1.3.4 Project Evaluation and Review Technique (PERT)

The Project Evaluation and Review Technique (PERT) is working for planning, scheduling and controlling the projects involved doubt (uncertainties). The *Program Evaluation and Review Technique (PERT)* is a network model that allows for variations in activity completion times. In a PERT network model, each activity is represented by a line (or *arc*), and each milestone (i.e. the completion of an activity) is represented by a *node*. PERT incorporates uncertainty by making it possible to schedule a project while not knowing precise details and durations of all activities. John M. Nicola (2004). The time shown for each project activity when creating the network diagram is the time that the task is expected to take based on a range of possibilities that can be defined as:

The optimistic time: - minimum time required to complete the task.

The pessimistic: - maximum time required to complete the task.

The most likely time: - an estimate of how long the task will actually task.

2.1.4 Definition of Delay

A Guide to the PMBOK (2013), define a project as temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates that a project has a definite beginning and end. The end is reached when the project'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.

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

2.1.5 Causes of Delays

Construction delay is considered to the most common problems in the construction industry and it has an adverse impact on project success in terms of cost, time and quality. There are many factors that cause delay in building construction. Delay may be caused by Clients, Users, Consultants, Designers, Owners, Contractors and Suppliers. (Alaghbari, Kadir, Salim and Ernawati, 2007), categorized the factors into four major groups, these are contractor factor, consultant factor, client factors and external factors. Financial problems, shortage of materials and poor site management practices were considered the top most factors. Client related factors included delayed payments, slow decision-making, frequent change orders, bid award for lowest price and contract scope changes. The most important factors by consultant were provision of incomplete design, poor supervision; slowness to give instructions and lack of experience. External causes identified included shortage of materials availability, poor site conditions and lack of equipment and tools in the market. In a related study of the causes and effects of delay in Malaysia construction industry Sambasivan & Soon (2007) found poor site management, inadequate experience' and poor subcontractors among the major causes of time delays on construction projects.

Projects can be delayed for a several number of reasons and usually impact on cost and time. Battaineh et al. (2002) studied causes of construction delay in Jordan. Results of the survey

indicated Contractors and Consultants agreed that Owner interference, inadequate Contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and Sub-contractors are among the top ten significant factors.

2.1.6 Types of Delays

According to the classification of Syed, et al. (2002) delays can be non-excusable delays, excusable non-compensable delays, excusable compensable delays and concurrent delays.

2.1.6.1 Non-excusable delays

Non-excusable delays are caused by lack of performance of the contractor on the construction project such as a contractor failure to provide an adequate material to complete their job. These delays can be caused by underestimates of productivity, improper project planning and scheduling, poor site management and supervision, wrong construction methods, equipment breakdowns, unreliable subcontractors or suppliers. Therefore, it is contractor's responsibilities to continue their work with no entitlement to claim for extension of time or delay damages until they completed the project.

2.1.6.2 Excusable delays

Excusable delay is a delay that is caused due to an unpredictable event beyond the contractor's or the subcontractor's control. Usually, based on common general provisions in public agency specifications, delay resulting from the following events would be considered excusable such as fires, floods, owner directed changes, errors and omissions in the contract drawing, unusually severe weather and etc. Excusable delays can be further classified into excusable with compensation and excusable without compensation.

i) Excusable delays with compensation

Compensation delays are caused by the owner or the owner's agents. An example of this would be the drawings late release from the owner's architect. An excusable, compensable delay normally leads to a schedule extension and exposes the owner to financial damages claimed by the contractor. In this scenario, the contractor incurs additional indirect costs for both extended field office and home office overhead and unabsorbed home office overhead.

ii) Excusable delays without compensation

Non-compensable delay is a delay that is caused by third parties or incidents beyond the control of both the owner and the contractor. Examples typically include: unusual weather, strikes (Trauner et al., 2009), fires, and acts of government in its sovereign capacity, etc. In this case, the contractor is normally entitled to claim extension of time but no compensation for delay damages. According to Ethiopian civil law/code Article 1973, Strikes that are foreseeable at the time of signing the contract are not considered excusable causes of delay.

2.1.6.3 Concurrent Delay

Concurrent delay is a problem that happens on most of the construction industry projects. In this situation, both owner and contractor are responsible for the delay Rubin et al. (1983). Commonly concurrent delays which involve any two or more excusable delays result in extension of time. When excusable delays with compensation and non-excusable delays are concurrent, an extension of time can be issued or the delay can be distributed between the owner and the contractor. Concurrent delay can be categorized in three types of delays: (i) If excusable and non-excusable delays occur concurrently, the contractor can only claim for extension of time, (ii) if excusable with compensation and excusable without compensation delays occur concurrently, the contractor is entitled to claim extension of time but no delay damages, and (iii) if two excusable with compensation delays occur concurrently, the contractor is entitled to claim extension of time and delay damages.

2.1.7 Causes of Project Delay

According to Fugar and Agyakwah, 2010, construction delays are happen in every stage of a construction project and are common problems in construction projects. The actors in the industry (i.e. consultants, clients and contractors) have their own share in the process. There are also other factors that are external to these parties. Studies on the causes of delay in project are reviewed and discussed below.

2.1.7.1 Classification of Delay Causes

Scholars did classify causes of project delay in various ways. Some tried to categorize them by creating a form of group that happen to share similar characteristics while others did it based on the parties who contributed for the causes happen.

2.1.7.2 Classification Based on Delay Categories

The classifications of delays are; - materials, labor, equipment, financing, environment, changes, government action, contractual relationships, and scheduling and controlling techniques.

<p>■ Design Change-relate</p> <ul style="list-style-type: none"> ✓ Change order ✓ Changes in drawing ✓ Changes in specifications ✓ Incomplete contract documents ✓ Decision during development stage ✓ Design Development ✓ Shop drawings approval ✓ Mistakes and discrepancies in design Documents ✓ Change in subsurface conditions ✓ Change in the scope of the project variation <p>■ Material-related</p> <ul style="list-style-type: none"> ✓ Change in subsurface conditions ✓ Late material supply ✓ Scarcity of material in the market ✓ Shortage of labor ✓ Low productivity level of labors ✓ Low skills of labor 	<p>■ Labor-related</p> <ul style="list-style-type: none"> ✓ Shortage of labor ✓ Low productivity level of labors ✓ Low skills of labor <p>■ Equipment related</p> <ul style="list-style-type: none"> ✓ Improper equipment ✓ Equipment unavailability ✓ Equipment Failure <p>■ Management related</p> <ul style="list-style-type: none"> ✓ Poor supervision ✓ Poor site management ✓ Mistakes in construction ✓ Unrealistic contract duration ✓ Inaccurate cost estimation ✓ Not Preparing the method statements ✓ Inappropriate organization management ✓ Less emphasis to planning ✓ Ineffective planning and scheduling ✓ Inadequate contractor experience
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<p>■ Finance- related</p> <ul style="list-style-type: none"> ✓ Delayed payments to contractors ✓ Delayed payments to suppliers and subcontractors ✓ Client’s finance shortage ✓ Financial difficulties faced by the Organization <p>■ Contractual Related</p> <ul style="list-style-type: none"> ✓ Non utilization of professional construction/Contractual management ✓ Delay in delivering site project to contractor ✓ Delay in approval of documents ✓ smooth internal and external communication ✓ Lack of communication between parties ✓ Slowness in giving instruction ✓ Slowness in decision making process ✓ Duration of inspection procedure ✓ Nomination of sub-contractors and supplier ✓ Delay in performance of subcontractors 	<p>■ External</p> <ul style="list-style-type: none"> ✓ Regulatory changes ✓ Laws – regulations ✓ Building Permits Approval ✓ Adverse weather condition ✓ Natural disasters
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2.1.7.3 Classification Based on Major Actors Involved in Construction Sector

(i) Delay factors related to contractor

From all the construction role player, a contractor has the major responsibility to take most of the project activities. As well, if the project is not finished on time and within the budgeted finance then the contractors is take responsibility. In reality, the contracting business is a difficult and demanding profession that contains many complex activities, and, to avoid project delays, the main contractor often holds full responsibility for the work of sub-contractors as well as his own. Basically, how the contractor deals with particular situations depends on the nature of the work and the type of contract (Shi & Arditi, 2001).

The capableness of the contracting party to finish the project according to the planned schedule primarily depends on two things: availability of resources (incorporating money, manpower, materials, and equipment and machinery) and managerial competence. There are two types of sources from which the contractor hires manpower: sub-contract and direct hire. If the sub-contractor causes delay to the construction project then both the owner and the main contractor have the responsibility to look for a solution to the problem. Therefore, it is essential for the contractor to constantly supervise the work performance of sub-contractors in order to maintain a balance between construction activities (Abdul-kadir & Price, 1995). On the basis of the literature review, nine contractor-related delay factors were identified in Table 2.1, but there are many other factors that may lead to project delays, and that can be broadly classified into four categories as follows: Materials, Equipment, Manpower and Project management performance

Table 2-1 Factors of delay related to contractor

Contractor-related delays	Inadequate contractor experience
	Inappropriate construction methods
	. Inaccurate time estimates
	Inaccurate cost estimates
	Poor site management and supervision

	. Improper project planning and scheduling
	Incompetent project team
	Unreliable subcontractor
	Obsolete technology

(ii) Consultant-related delay factors

The main duties and responsibilities of a consultant may be to design the infrastructure of the project, which includes architectural, mechanical, structural, and electrical designs. Some other responsibilities may include the preparation of project related documents such as bills, drawings, specifications, and tender documents (Long et al, 2004). Furthermore, in some cases, consultants also conduct project planning, cost control and estimation, and quality control.

In regular condition, consultant-related delays occur during preparation of drawings, during the adoption of design drawings, while taking design approvals from contractors and client, and when doing inspection procedures. There are many possible reasons behind these types of delays; prominent factors include inexperienced consultancy staff, poor qualifications, inadequate communication and coordination skills, and improper planning (Gunlana & Krit, 1996). Odeh & Battaineh (2002) believe that during the construction processes, the enquiries and inspections of the consultant may slow down the progress of the work. Effective control and command over production on the construction site is a major element that contributes to the success of implementing the project; conversely, hindrances in performing these activities can have severe impacts on a construction project.

(iii) Owner-related delay factors

One of the most crucial decisions that owners need to take at the beginning of the project is to determine the duration of the contract. Many owners prefer fast completion of work but thorough investigations should be conducted to decide the contract duration. Another major factor that delays the initialization of the project is the owner's failure to hand over the site to the contractor. Therefore, the personal involvement and quick decision-making on various matters by the owner in the initial phases of the project may accelerate the project's progress. Kimmons & Loweree (1989) observed that "the working relationship between an owner and a

contractor is one of the most crucial determinants of project success and this relationship also develops trust between the two parties”. The owner must participate in the construction project horizontally and vertically, but without interrupting the contractor’s project plan. In addition, financial matters should also be taken in to account.

2.2 Review of Empirical Studies

Assaf et al. (2006) conducted a survey on time performance of different types of construction projects in Saudi Arabia to determine the causes of delay and their importance according to each of the project participants, i.e. the Client, Consultant and the Contractors. The survey included 23 Contractors, 19 Consultants, and 15 clients. Seventy-three causes of delay were identified during the research. 76% of the Contractors and 56% of the Consultants indicated that Average of time overrun was between 10% and 30% of the original duration. The most common cause of delay identified by all the three parties was “change order”. The Survey concluded that 70% of projects experienced time overrun and found that 45 out of 76 projects considered were delayed.

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

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

Abdo (2006) made a survey on delays in public building construction projects in Ethiopia. The result of the research indicated that 94% of the 52 surveyed public building projects

undertaken by home country Contractors between the years 1995 to 2005 have encountered delays. Moreover, the time extension ranges from 10% to 367% and the Average delay is found to be 89.9%. The most frequent causes of delay which in descending order of criticality were found to be: (1) necessary variations, (2) delayed payments, (3) scarcity of materials, (4) late material supply, (5) less emphasis to planning, (6) sub-surface condition, (7) changes in design, (8) material and labor price escalation, (9) unrealistic time schedule, and (10) failure to update schedules on time.

Abinayasri et al. (2017) assessed 40 causes of delay in construction industry in India and categorized them under 9 groups such as design, equipment, personal, manpower, experience, government, material, finance, and owner. The study summarized projects experienced delay in one or more of the above nine categories. Owner related causes, finance related causes and material related causes were the three categories on the top of the list with 69%, 66% and 63% respectively followed by government related causes and experience related causes with 58% and 53% respectively. The sixth and seventh highest causes in the list were personal related causes and Manpower related causes which accounted for 48% and 42% respectively. Projects that experienced design related causes and Equipment related causes rated as 28% and 39% respectively.

Werku and Jah, (2017) identified 10 major factors that cause construction delays in Ethiopia based on importance ordered series. These factors are: (1) Difficulties in funding project by a contractor with 68.75; (2) Escalation of the materials price with 65.57; (3) Ineffective project planning with 64.53; (4) Scheduling or resource management with 63.05; (5) Delay in progress payments for completed works with 62.57; (6) Lack of skilled professionals in the field of construction management in the organization 60.59; (7) Fluctuating labor availability season to season /Seasonal labors availability with 58.46; (8) Low productivity of labor with 54.93; (9) Unqualified/inadequate experienced labor with 46.89; and (10) Insufficient data collection and survey before design with 46.85

In Ghana, Frimpong et al. (2003) carried out a research on causes of delay and cost overruns in construction of groundwater projects in developing countries. According to the researchers indicated 75% of the projects in Ghana exceeded the Budgeted project schedule. The study discovered that the most important causes of delay were: monthly payment difficulties, poor contract management, material procurement, inflation, and contractor's financial difficulties. In Morocco, Challal and Tkiouat (2012) researched on the causes of deadline slippage in construction projects and found out five major causes of delay were: errors in initial budget

assessment, multiple modifications in architectural and engineering designs, site hazards, and insufficiency or lack of prior study.

Memon (2014) conducted a study on contractor perspective on time overrun factors in Malaysian construction projects and the major factors that causes for delays were: frequent design changes, change in the scope of the project, financial problem of owner, decision making delay, and unexpected ground conditions.

2.3 Summary and Knowledge Gap

There are many studies about the causes of delay in construction industry. But there are few studies in construction delay in developing countries such as Ethiopia. Researchers investigate different factors that cause on construction project delay from planning/scheduling to project execution. When considering delay in context of public construction projects there are additional factors that may affect causes of delay in construction projects; lack of stakeholders engagement skilled project team, inadequate communication process.

Previous studies investigate major factors of the project delays and lists with different categories. These reviews make the researcher of this study to find out the factors that causing delay in the rural water supply construction projects. Therefore the researcher of this study uses the previous studies as a clue for his research.

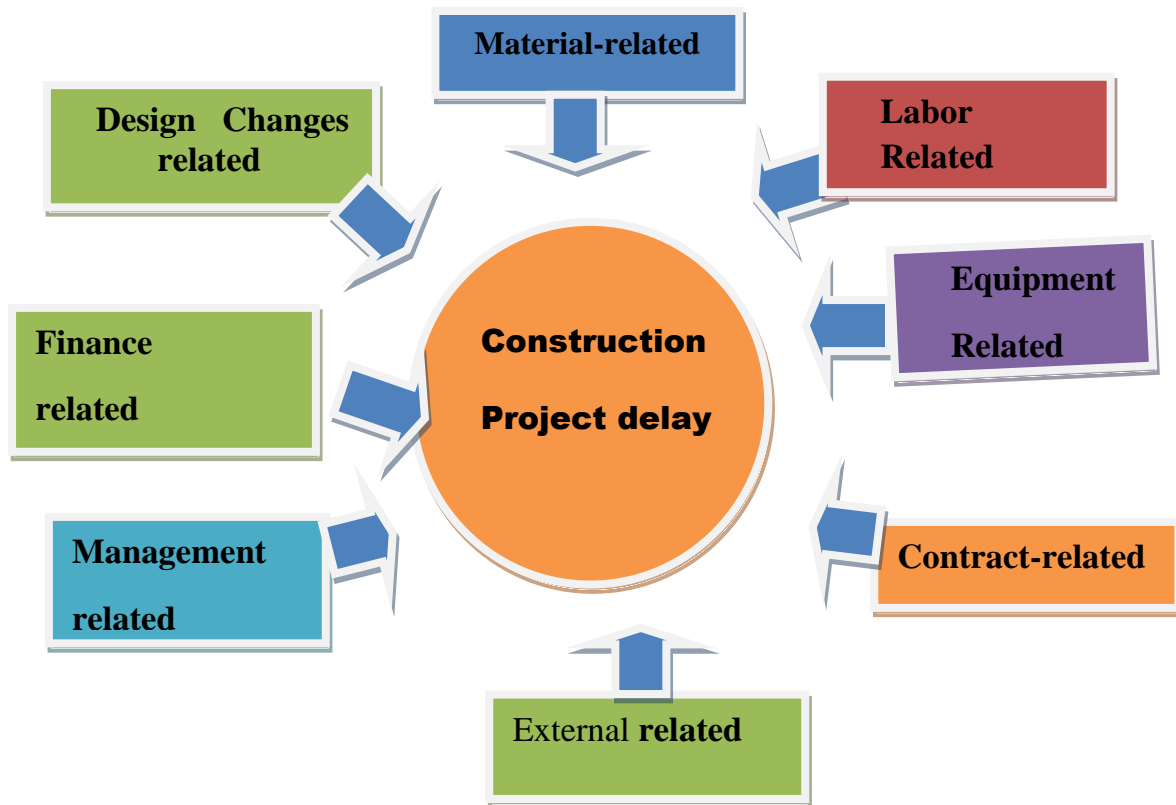
Most of the previous studies used qualitative approach. But the current research was employing both qualitative and quantitative research approaches in order to sufficiently address the research questions. At the same time most of the previous studies emphasized only assessing major causes of project delay. But the current study is designed to assess the major causes of delay in water supply construction projects and the possible mitigation strategies in order to eliminate or reduce the delay problems.

2.3 Conceptual Framework of the Study

The causes of project delay are listed in 8 categories for this specific study. The categories are: design changes-related, material-related, labor-related, equipment-related, finance- related, management-related, contractual-related and external factors. If one or more of these causes may occur the chance it affects the project performance with time overrun, cost overrun, disputes, arbitration, litigation and/or total abandonment would be very high. These effects in

turn leads project into delay. The project manager could apply mitigation exercise but still the delay would be highly likely.

Based on literature review I came up with the following conceptual framework as below.



CHAPTER THREE

3. RESEARCH DESIGN AND METHODOLOGY

3.1 Research Design and Approach

Research design is a master plan specifying the methods and procedures for collecting and analyzing the required data. The choice of research design depends on predetermined objectives that the researchers want to achieve. According to Kotzar et al., (2005), research design is defined as the plan and structure of investigation and the way in which studies are put together. Cooper et al. (2003) also define research design as the process of focusing on the researcher's perspective for the purpose of a particular study. The purpose of this study was particularly intended to assess the major causes of construction project delay in rural water supply construction projects in Jimma zone. In this study descriptive survey method was employed because it is chosen for appropriateness to the nature of the topic, which needs wider description, investigations of facts and information related to construction delay. Descriptive study is helpful when a researcher wants to look into a phenomenon or a process in its natural contexts in order to get its overall picture instead of taking one or some of its aspects and manipulating it in a simulated or an artificial setting. Moreover, in order to achieve the intended objective, both quantitative and qualitative methods were chosen.

3.2 Source of Data

The researcher collected data from both primary data and secondary data. The primary data was collected from the respondents of the employee by using survey questionnaire. The questionnaire was prepared in the form of closed ended and as well-structured interview of data collection was administered in the data collection. Because, these both methods of data collection permit the researcher to gather information within a minimum of time, at the low expense of money and effort, minimize interviewer bias and possible problems on the parts of the respondents which is important to obtain the needed information from the respondent. The secondary sources that were considered include: books, annual reports, manuals and published and unpublished documents and other related materials.

3.3 Target Population

The study population consist only the already completed supply projects undertaken by Jimma Zone Water Service office within the last five years (2015- 2019 G.C).

A total of 27 projects were studied. Target population drawn from persons involved in the implementation of each of the 27 projects in this study as per the projects' implementation teams; that is, the Clients (personnel), Contractors and Consultants.

3.4 Population and Sampling Techniques

Population is a set of elements, services, people, household, groups, or things that are well defined and being investigated in the study. There should be observable characteristics in the population which the researchers will generalize his result on (Mbachu, 2004). The study target populations were 22 clients, 15 consultants and 6 contractors. Therefore a total of 43 individuals were participated Regarding the application of data, the sampling method used in this study was purposive ; the parties included in the survey are mainly project officer, zonal managers and representing clients, consultants and contractors at Jimma zone water service office.

3.5 Methods of Data Collection

Primary data among the selected project stakeholders were gathered by using questionnaire and interview. And desk review was conducted to collect secondary data. As indicated by Sounders (2003) cited in (Annuda, 2016) questionnaires are less costly and less of researcher's time spent. So, to these close ended questions were administered to 43 individuals who are selected as a sample.

The questionnaire was divided into two parts. The first part consists of questions about the general profile, information and background of the respondents. The second part comprises of questions regarding the major causes of construction project.

3.6 Validity and Reliability

Test for Validity and Reliability The accuracy of data collected largely relies on the data collection instruments in terms of validity and reliability (Mugenda and Mugenda 2003). Validity refers to the extent to which results obtained data analysis actually represents the phenomenon understanding. On the other hand, reliability refers to a measure of the extent to which research instruments give consistent results (Mugenda and Mugenda 2003). In

this study, data reliability was guaranteed by pre-testing the questionnaire with a selected sample. Contents of the validity helped the researcher to ascertain whether they included or represented all the content of the research in the study. Test-retest approach enabled the researcher to test consistency among different questionnaires as filled by the respondents (Frankel and Wallen,1993) .

3.7 Study Variable

The main variables of this study were factors related to design change, labor related, equipment related, material related, financial related, management related, contractual related and external related causes are independent variable and Project delay referred as dependent variable.

3.8 Data Presentation and Analysis Techniques

The data was collected from different sources is coded, checked and entered to simple excel program to make the data ready for analysis, then the stated objective of the study was achieved, the collect data was analyzed using descriptive statistics (Mean values, minimum and maximum) for the general trends of the data from the sample of respondents were selected since they are expected to have more experience on the leading activities. The statistical package for social science (SPSS, version 20.0) was used and the data was summarized in frequency tables. The descriptive statistical results were presented by tables, frequency distributions and percentages to give a condensed picture of the data. This was achieve through summary statistics, which includes the means, standard deviations values which was computed for each variable in this study. After data has been collected from the required respondents, it was analyzed quantitatively with appropriate tool of data analysis. Relative important index is used to rank the causes of project delay (Chan & Kumaraswamy 1997: Aibinu & Jagboro 2002: Odeh & Battaineh 2002: Al-Tabtabai 2002). It is used to rank different causes of delays from perspective of clients, and contractors consultants.

This can be represented as $RII = \frac{1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5}{5(n_1 + n_2 + n_3 + n_4 + n_5)}$

$$5(n_1 + n_2 + n_3 + n_4 + n_5)$$

Where, n1 = number of respondents who answered strongly disagree,

n2 = number of respondents who answered disagree,

n3 = number of respondents who answered neutral,

n4 = number of respondents who answered agree, and

n5= number of respondents who answered strongly agree.

In order to decide whether there is significant correlation of the ranking of factors that causes construction delays between the different groups of the respondents (client verses contractor ,clients verses consultant and contractor verses consultant), the Spearman's rank correlation coefficient is used. It is computed as:

$$\text{Rho (cal)} = 1 - \frac{6 \times (d^2)}{N \times (N^2 - 1)}$$

Where:

Rho (rcal) – Spearman rank correlation coefficient

d – The difference in ranking between each pair of factors

N – Number of factors

3.9. Ethical Consideration

The researcher ensured that the information which was collected were handled and treated with utmost confidentiality. The research questionnaire provided freedom for respondents to not indicate the identity of the respondent. The researcher explained the intention of carrying out the research before beginning the process of data

collection and thus the participation in the study had been taken place through voluntary and informed consent. All the respondents had been treated with great respect and courtesy. The researcher informed the respondents that no compensation would accrue from participating in the study and further that the results of the study would be shared upon completion of the study.

CHAPTER FOUR

4. RESEARCH FINDINGS AND DISCUSSION.

4.1. Introduction

This chapter accounts for the analysis of information obtained from the questionnaires. This data was used to achieve the objective of this study by the application of the above methodology. The data was collected through a survey questionnaire which was administered to 43 respondents but had a feedback of 36 respondents. The data analysis method used in this chapter present the statistical analysis of the responses given by the different stakeholders from the survey questions as explained in the research methodology.

4.2. Background of the respondents

Background of the respondent comprises of the analysis of all question in section A of the questionnaire it deals with the various stakeholders participate in this study, their closeness to construction delay, their level of participation in building projects that was delay, their length of work experience in construction industry, the duration of time the project was delayed, and the type of building construction delay they experienced.

4.2.1 Distribution of Respondents by Project Execution Group

Respondents were requested to show the organizations that they worked so as to gauge the magnitude to which the three project execution group were described

Table 4.2.1: Respondent's Organizations

Type of Organizations	Frequency	Frequency (%)	Cumulative Frequency(%)
Client	19	52.77	52.77
Consultant	6	16.67	69.44
Contractor	11	30.56	100
Total	36	100	100

Source :- survey data

As shown in Table 4.1, the resulting distribution of the 36 respondents among the three organization was (52.77) clients, (16.67%) consultants and (30.56%) contractors indicating enough representation of views from the three groups of respondents.

4.2.2. Respondents position in the Organization

Table 4.2.2 Respondents position in the organization

What is your position in the organization	Frequency	percentage	Cumulative percentage
Zonal project manager	1	2.77	2.77
Project officer	18	50	52.77
Project engineer	11	30.56	83.33
Resident engineers	6	16.67	100
Total	36	100	100

Source :- survey data The resulting distribution of the 36 respondents among the three organizations was (2.77%) zonal project manager, (50%) project officer, (30.56%) project engineers and 6(16.67%) are Resident engineers.. These categories of respondents had had practical experience in the construction of the projects under study. It was therefore expected that the information they gave was valid and reliable.

4.2.3 Respondents' years of experience

Respondents were asked to state their years of experience in the field of construction. Average number of years of experience of client respondents was 11 years, average number of years of experience of consultants' respondents was 9 years, average number of years of experience of contractors' respondents was 6 years. All the respondents therefore had experience of more than 6 years which was considered to be adequate in infrastructure project management.

4.2.4. Respondents Closeness with Construction Delay

All respondents were close /familiar/ with construction delay. They responded that all faces project delay. This shows that project delay is a common phenomenon that requires attention.

Table 4.2.3 Respondents familiarity with project delay

Have you been involved in projects that were delayed	Frequency	percentage	Cumulative percentage
Yes	36	100	100

Source: - survey data

4.2.5 Length of time the projects was delayed

Small scale water supply project construction is meant to be accomplished in one fiscal year. However, the study shows projects were delayed 7 months on average.

Table 4.2.4 Length of time of project delay

How long was the project delayed	N	Minimum	maximum	Average/mean
	36	6 months	9 months	7 months

Source :- survey data

4.3 Analysis of Causes of Delay

The entire hypothesized causes of delays of the eight aggregation were analyzed and their result are presented .

4.3.1 Analysis of factors causing delay under each category

The first objective of study related to causes of delays from 58 set of questionnaire have been identified and grouped into 8 major groups. (Design, material, labor, equipment, and management, finance, contractual and external related) These factors were ranked in each group based on Relative Importance Index (RII), measure the association among the three responding parties (client, contractors and consultants) in Spearman's Rank correlation coefficient and test their hypothesis. From the view point of clients, consultants and contractors. The following is a brief description of these factors in each group. All the

hypothesized causes of delays of the eight categories were analyzed and the results of each category are presented one by one below

I. Factors of design /change related cause of delay.

Design change related factors are one of the categories that are causes of delay for the Jimma zone water supply projects Under this category ten / 10 /factors were found as main cause for the project delay. These factors were ranked according to the client, contractor and consultants view respectively and overall scores.

As shown in table 4.3.1 below all respondent parties (client. Contractor and consultant) have mentioned that change in scope of project variation (RII= 0.95) and change order (RII= 0.57) as the most significant design change related factor that affect timely completion of ' water supply construction projects' of Jimma zone.

Table 4.3.1 Result of Stakeholders view on design/change related factors

Factor	Client		Contractor		Consultant		Over all	
	RII	Ran	RII	Ran	RII	Ran	RII	Ran
Change order	0.57	2	0.73	2	0.50	3	0.60	2
Change in drawing	0.42	3	0.45	6	0.59	2	0.49	4
Change in specification	0.42	3	0.42	8	0.36	5	0.40	6
Incomplete contract document	0.21	9	0.27	9	0.33	6	0.34	8
Decision during development stage	0.21	9	0.64	3	0.17	10	0.34	8
Design development	0.26	8	0.20	10	0.33	6	0.26	10
Shop drawing approval	0.32	6	0.64	3	0.33	6	0.43	5
Mistakes and discrepancies in design document	0.42	3	0.64	3	0.50	3	0.52	3
Change in sub surface condition	0.26	7	0.45	6	0.33	6	0.35	7
Change in scope of project variation	0.95	1	0.91	1	1.00	1	0.95	1

Mean relative index	0.404	0.535	0.444	0.468
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II. Factors of material related cause of delay.

This category comprises five (5) factors were found as major cause for Jimma zone rural water supply construction project delay. Table 4.3.2 presents the result of the analysis of the factors under this category by each group of respondents. According to the result, scarcity of material in the market (RII=0.95),late material supply (RII=0.94) and escalation of material price(RII=0.89) for the clients, the scarcity of material in the market (RII=1.00), escalation of material price(RII=0.91) and unreliable supplier(RII=0.91) for contractors and scarcity of material in the market (RII=1.00), quality of materials(RII=0.83) and escalation of material price (RII=0.83) for consultants are the major factors that are ranked from 1 up to 3 by each respondents. It can be generalize from the table that escalation of material price is the highly weighted factor that mentioned by all groups of respondents. This is because the current inflation taking place in the country and the disinflation of dollar on the world market

Table 4.3.2 Result of Stakeholders view on material related factors

Factors	Client		Contractor		Consultant		Average	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Poor Quality of material	0.80	4	0.18	5	0.67	4	0.55	4
Late material supply	0.94	2	0.91	3	0.83	2	0.89	3
Escalation of material price	0.89	3	1.00	1	1.00	1	0.96	1
Unreliable suppliers	0.32	5	0.18	4	0.17	5	0.22	5
Scarcity of material in the market	0.95	1	0.91	2	0.83	2	0.89	2
Mean relative index	0.78		0.636		0.700		0.702	

Source :- survey data

III. . Factors of equipment related causes of delay.

As indicated in the table 4.3.5 below the clients has ranked equipment unavailability, improper equipment and not having modern equipment as the major equipment related factors that affect timely completion of water supply construction projects of Jimma zone. Contractors on their side rank unavailability of equipment and frequent equipment breakdown are the major causes for the delay of project regarding equipment related causes . On their side consultants claim that out of all factors, insufficient number of equipment, which are allocated for projects by the contractor, frequent break down of equipment and not having modern equipment are the top three causes of delay in this category.

Table 4.3.3 Result of Stakeholders view on equipment related factors

Factor	Client		Contractor		Consultant		Average	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Improper equipment	0.79	2	0.63	4	0.56	5	0.66	4
Equipment unavailability	0.99	1	0.80	2	0.87	1	0.88	1
Equipment allocation problem	0.39	5	0.41	5	0.66	3	0.49	5
Frequent Equipment breakdown/failure	0.67	4	0.96	1	0.63	4	0.75	3
Not having modern equipment	0.77	3	0.72	3	0.83	2	0.77	2
Mean relative index	0.722		0.704		0.71		0.71	

Source :- survey data

IV. Factors of Labor related causes of delay

Under this category four /4/ factors of labor related causes of delays are given weights and ranked by the respondents and the results are presented in table 4.3.4. The result of the analysis shows that Shortage of skilled labor (RII=0.87) and Low productivity level of labor (RII=0.78). are the most important and highly ranked labor related delay

causes agreed by all responding parties in the water supply construction project of Jimma zone

Table 4.3.4 Result of Stakeholders view on labor related factors

Factors	Client		Contractor		consultant		Average	
	RII	rank	RII	rank	RII	rank	RII	rank
Shortage of skilled labor	0.80	1	0.92	1	0.94	1	0.87	1
Low productivity level of labor	0.65	2	0.81	2	0.88	2	0.78	2
Labor injuries	0.46	3	0.24	3	0.32	3	0.34	3
Personal conflict among labor	0.26	4	0.14	4	0.20	4	0.2	4
Mean relative index	0.5425		0.5275		0.585		0.5475	

V. Factor of finance related cause of delay

indicated in the table 4.3.5 below the clients has ranked delay payment to contractor (RII = 1.00), financial difficulties by contractor (RII = 0.99) and clients financial shortage (RII =0.98) as the major finance related factors that affect timely completion of water supply construction projects of Jimma zone. Contractors on their side rank delay payment to contractor (RII = 0.99), clients financial shortage (RII =0.98)and financial difficulties by contractor (RII = 0.96) are the major causes for the delay of project regarding finance related causes

Table 4.3.4 Result of Stakeholders view on labor related factors

Factors	Client		Contractor		Consultant		Average	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Table 4.3.5 Result of Stakeholders view on Delayed payment to contractor	1.0	1	0.99	1	0.90	4	0.96	3
Delayed payment to supplier and subcontractor	0.82	4	0.80	4	0.93	3	0.85	4
Client's financial shortage	0.98	3	0.98	2	0.97	2	0.977	2
Financial difficulty faced by contractor	0.99	2	0.96	3	0.99	1	0.98	1
Difficulty in accessing credit	0.61	5	0.44	5	0.65	5	0.57	5
Mean relative index	0.88		0.834		0.888		0.8674	

Source: - survey data

VI. Factors of management related causes of delay

According to table 4.3.6 of analysis result, slow poor supervision (RII =1.00), unrealistic contract duration (RII= 0.99) and underestimation of complexity of project (RII= 0.99) are clients' most significant factor for project delay

However, from the contractors point of view underestimation of contract duration (RII= 0.99) ,unrealistic contract duration (RII =0.98)and poor supervision (RII = 0.98) are savvier factor causing delay. Considering the mean relative indexes on table below, it can be generalized that these category have been highly weighted by all groups of respondents. The poor supervision, underestimation of complexity of project and unrealistic contract duration are the top factors that cause delay under this category from all respondents view.

Table 4.3.6 Result of Stakeholders view on finance related factors

Factor	Client		Contractor		Consultant		Average	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Organizational change	0.40	12	0.73	10	0.61	12	0.53	12
Poor supervision	1.0	1	0.98	2	0.99	1	0.99	1
Poor site management	0.91	7	0.8	6	0.80	7	0.84	6
Mistake in construction	0.79	9	0.80	5	0.78	8	0.79	8
Unrealistic contract duration	0.99	2	0.98	2	0.96	3	0.97	3
Inaccurate cost estimation	0.97	5	0.96	4	0.92	4	0.95	4
Not preparing the method statement	0.60	10	0.77	8	0.73	9	0.7	10
Inappropriate organization management	0.60	11	0.66	12	0.65	11	0.64	11
Ineffective planning and scheduling	0.98	4	0.78	7	0.83	5	0.86	5
Inadequate construction experience	0.93	6	0.77	8	0.82	6	0.84	6
Underestimation of complexity of project	0.99	2	0.99	1	0.98	2	0.987	2
Many provisional sums and prime	0.80	8	0.72	11	0.72	10	0.75	9
Mean relative index	0.828		0.83		0.815		0.821	

Source :- survey data

VII. Contractual of management related causes of delay

According to table 4.3.7 of analysis result, slowness in decision making (RII = 1.00), lack of communication between parties(RII= 0.98) and non-utilization of professional contractors /contract management(RII= 0.80) are clients' most significant factor for project delay. From the contractors point of view duration of inspection procedure (RII= 0.98), slowness in giving instruction (RII =0.96)and lack of communication

(RII = 0.94) are the most important factors causing delay. As the view point of consultants lack of communication (RII = 0.96) , slowness in decision making (RII= 0.94) and duration of inspection procedure (RII = 0.93) are the most important project delay factors . Lack of communication , slowness in decision making and duration of inspection procedure are the top factors that causes delay under this category from all respondents view.

Table 4.3.7 Result of Stakeholders view on management related factors

Factor	Client		Contractor		Consultant		combined	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Non utilization of professional construction/contractual management	0.80	3	0.84	7	0.91	4	0.85	5
Delay in delivering site project to contractor	0.37	10	0.58	9	0.41	9	0.45	10
Delay in the approval of document	0.56	9	0.78	8	0.38	10	0.57	9
Lack of communication between parties	0.98	2	0.94	3	0.96	1	0.96	1
Slowness in giving instruction	0.79	5	0.96	2	0.87	5	0.87	4
Slowness in decision making process	1.0	1	0.93	4	0.94	2	0.96	1
Duration of inspection procedure	0.79	4	0.98	1	0.93	3	0.90	3
Nomination of subcontractor and supplier	0.60	8	0.86	6	0.57	8	0.68	7
Delay in performance of subcontractor	0.75	6	0.89	5	0.77	7	0.80	6
Problem with subcontractor	0.71	7	0.44	10	0.82	6	0.66	8
Mean relative index	0.743		0.82		0.756		0.77	

Source: - survey data

VIII. External related causes of delay

Under this topic external factors were ranked according to the client, consultant and contractors view respectively and overall scores. Under this group analysis, there is no most significant cause of project implementation delay that affect smooth running of projects. the only factor that hinder the timely completion of water supply construction project of Jimma zone is political instability (RII = 0.98).

Table 4.3.8 Result of Stakeholders view on external related factors

Factor	Client		Contractor		Consultant		combined	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Regulatory change	0.58	2	0.46	3	0.36	4	0.47	4
Building permit approval	0.57	4	0.44	4	0.44	3	0.48	3
laws- regulation	0.58	2	0.40	5	0.31	5	0.43	5
Adverse weather condition	0.44	5	0.96	2	0.98	1	0.79	2
Natural disaster	0.15	6	0.11	6	0.10	6	0.12	6
Political un stability	0.99	1	0.98	1	0.96	2	0.98	1
Mean relative index	0.552		0.558		0.525		0.545	

Source :- survey data

4.3.2 COMBINED VIEW OF TOP TEN DELAY CAUSES

In this study the top ten causes of the combined perception of the groups (clients , contractors and consultants)are stated .According to the combined view as shown in the below table , all responding parties are agreed upon ‘Poor supervision, Underestimation of complexity of project and Political instability’ are among the ten most significant factors causing time overrun

Table 4.3.9 Combined view of top ten delay causes

No	Causes of delay	RII	Rank	category
1	Poor supervision	0.99	1	management
2	Underestimation of complexity of project	0.98	2	management
3	Political instability	0.98	3	external
4	Financial difficulty faced by contractor	0.98	4	finance
5	Unrealistic contract duration	0.97	5	management
6	Client's financial shortage	0.97	6	finance
7	Escalation of material price	0.96	7	material
8	Delayed payment to contractor	0.96	8	finance
9	Change in scope of project variation	0.95	9	Design change
10	Inaccurate cost estimation	0.95	10	management

Source :- survey data

4.3.3. Analysis of General groups of causes of delay .

In this section the analysis of the cumulative effect of the each factor were analyzed. And the mean of relative importance index was calculated for each factors of the eight major categories as presented on table below. Each category is ranked with the accordance of the value of the mean relative importance index for each group of respondents.

As the below table ,table 4.3.10 show that the all responding parties financial related cause , management related causes and contractual related causes are the first, second and third ranked causes of project delay respectively.

Table 4.3.10 perception of client ,contractor and consultant to categories of dela

No	Causes of delay category	Client/owner perception		Contractor perception		Consultant perception		Combined perception	
		RII	Rank	RII	Rank	RII	Rank	RII	Rank
i.	Design change	0.404	8	0.535	7	0.444	8	0.468	8
ii.	material	0.780	3	0.636	5	0.700	5	0.702	5
iii.	equipment	0.722	5	0.704	4	0.710	4	0.710	4
iv.	labor	0.542	4	0.527	8	0.585	6	0.547	6
v.	finance	0.88	1	0.834	1	0.888	1	0.867	1
vi.	Management	0.828	2	0.830	2	0.815	2	0.821	2
vii.	contractual	0.743	4	0.820	3	0.756	3	0.770	3
viii.	External	0.552	6	0.558	6	0.525	7	0.545	7

4.4 Tests for Agreements on Causes of project delay Among Stakeholders.

One of the purposes of this thesis is to investigate whether there is agreement or not on the attitudes of stakeholders(clients , contractors and consultants) towards the causes of water supply construction project delay in Jimma zone. Hence in this section respondents' response will be tested for correlation using Spearman rank correlation coefficients, to see if there is difference in ranking between two groups of respondents; these are Clients versus Contractors; Contractors versus Consultants; and Clients versus Consultants, on the variables of project delay and their rate of occurrence. The tests also helped to evaluate whether consensus of opinions exist among respondents.

The Null Hypothesis (H₀) is: There is no agreement in the ranking of causes of cost overrun between two groups of respondents

The Alternative Hypothesis (H_A) is: There is agreement in the ranking of causes of cost overrun between two groups of respondents

In order to make decision whether to accept or reject the null hypothesis, the level of significance 95% ($P = 0.05$) is used. If the calculated value of r_s is greater than the critical value, H₀ is rejected, this means. there is grounds of a statistically significant consensus between the groups. If the calculated value of r_s is less than the critical value, H₀ is accepted, it means that there is no evidence of a statistically significant consensus between the two groups.

Table 4.3.11 correlation test on ranking of causes of project delay

Respondent	Rho(r_s)	critical value	Significance < 0.05	Reject/accept null hypothesis
Client vs contractor	0.965	0.364	significant	reject
Client vs consultant	0.987	0.364	significant	reject
Consultant vs contractor	0.969	0.364	significant	reject

Source: - survey data

As above table shown a significance level of 95% ($P = 0.05$), the calculated value of r_s for all the three group cases are greater than the critical values of r_s , so the null hypothesis is rejected and the alternative hypothesis shall be accepted.

From the above table there is strong correlation between perspective of respondents (clients, contractors and consultants). Hence the null hypothesis is rejected and the alternative hypothesis shall be accepted. This implies that most of the respondents are similar perception

4.5. Discussions for Interview Results.

In addition to the questionnaire, interview was employed to gather data from seven respondents. The following paragraphs discussed the responses obtained.

- What are the factors that causes for the delay of rural water supply project construction in Jimma zone ?

Respondents also forwarded the following delay causing factors with interview besides the ranking factors. These are: having more than one project at a time led the contractors lose their capacity, that in turn lead to delay in projects, technical competency of client to administer contract, and project managers, shortage of cash flow of contractors, limited budget of client, shortage of resources, (finance, human, water, material), design problem, weather condition are highly emphasized Improper planning, poor communication between contractor and client, client and consultants, Lack of commitment of client to alleviate decision making procedure, forward alternative solution, Change order, that arise due to design problem and additional work order, Suspension of payments was among the main causes that contribute to delay according to the respondent's point of view.

- What are the factors to reduce delay ?

Strong cash flow, by the owner to the contractor, refer bid to suitable contractor not to lower price, complete clarity in drawing and bill of quantities and contractor, strong and enough financing by the contractor, use suitable system to following required work and fast and strong response from owner party to variation order are the factors that reduce delay .

- What are the negative impact produced from delay ?

Time overrun in completion of project that reflected from the perspective of project participating parties are :- stumbled exceed company, disable the interest of the owner, late delivery the project and exceeded required cost , lack of truth between the parties, leading to the occurrence of despite and conflict

- What are the practice that your organization undertaking to minimizing delay ?

Respondents were unable to point out mitigation practices required to minimize the occurrence of causes of project delay.

CHAPTER FIVE

5. SUMMARY OF MAJOR FINDINGS, CONCLUSION AND RECOMMENDATION

5.1. Summary of major findings

This summary of major findings started by identifying 55 possible factors that causes for water supply construction project delay in Jimma zone. The causes were categorized into 8 groups, these are:- design change, labor, material, equipment, finance contractual ,management and external related factors. Respondents of the questionnaires of this study are contractors, consultants and clients of the project. The data analyzed by frequency and relative importance index. The factors for each group are weighed and ranked by their relative important index. The strength of agreement among main parties on cause of delays are tested by spearman rho correlation coefficient. The result of the finding indicate that among all categories of delay causes finance related cause are the most important cause of water supply construction project followed by management and contractual related causes.

In this study the top ten causes of water supply construction project delay causes are identified. The top ten causes are described as their descending order, Underestimation of complexity of project, Political instability, Financial difficulty faced by contractor, Unrealistic contract duration, Client's financial shortage, Escalation of material price, Delayed payment to contractor, Change in scope of project variation and Inaccurate cost estimation.

Respondents are unable to forward what types of mitigation mechanism that they adopt to reduce the occurrence of delay in water supply project construction in Jimma zone.

5.2 Recommendation

On the bases of the result the researcher recommend some critical points to reduce delays.

- ✓ Clients should give special attention to the following factors: Pay progress payment to the contractor on time because it impairs the contractor's ability to finance the work, minimize change orders during construction to avoid delays, avoid delay in reviewing and approving of design documents than they anticipated, check for resources and capabilities, before awarding the contract to the lowest bidder.
- ✓ The client should make ready the site of work along with appropriate design before all and make ready for the proper planning, and allocate appropriate budget, that align with the schedule of the construction contract. Client and contractor should avoid suspension of work that lead for additional time. While selecting contractors, clients should not select contractors based only on the lowest bid. It should rather look for their working experience, key personnel, works executed similarly in nature, equipment holding, with a good reputation, financial capacity, work load and experience in modern construction technology before choosing a contractor.
- ✓ Appropriate communication channel and coordination between the stake holders must be adopted by the contracting parties to ensure smooth flow of information to avoid unnecessary delays or wrong instruction. In this regard, since Consultant serves as an intermediary between client and contractors their communication skill is essential to aid smooth flow of information to other contracting parties.
- ✓ Realistic duration and cost must be set for project. Client, Contractor and consultants should plan for their work considering weather condition of the project vicinity.
- ✓ Consultants should assign a qualified technical staff to manage the project in a good manner, answer any question raised by contractor, and in order to be able to overcome any technical or management problems that may occur.
- ✓ The contractor should have a master plan/work program comprising of resources schedule, plant and equipment schedule and Should prepare clear and accurate material procurement plan based on considering market inflation

❖ **Future research direction**

For further researchers it is better to choose other research design rather than the design that used this researcher. Also, due to certain limitations, this study was restricted to Jimma zone. Therefore, other researcher studies as a nation.

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APPENDIX

JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

COLLAGE OF BUSINESS AND ECONOMICS

The aim of this questionnaire is to gather information about the Assessment of Causes of Delay in water Supply Projects Construction. This questionnaire is required to be filled with exact relevant facts as much as possible. All data included in this questionnaire will be used only for academic research and will be strictly confidential. After all questionnaires are collected and analyzed, interested participants of this study will be given feedback on the overall research results. Please respond to each question by adding a tick in the appropriate response or filling in the relevant information

SECTION A- Background and Knowledge of Respondents on construction delay

1. What is the Name of the Project Site? _____

2. Which of the stakeholder are you? (Please choose one).

Contractor [] Consultant [] Client []

3. What is your position in the organization? _____

4. What is your length of experience in construction of water supply projects?_____

5. Have you have been involved in projects that were delayed? _____

6. How long was the project delayed? _____

SECTION B – Causes of construction delay

Please tick the causes of the delay on the performance of the project you have been working on.

Using the following scale: 1 very low; 2 Low; 3 Average; 4 High and 5 very high.

Category of Causes of delay	Main causes of delay	Very low	Low	Average	High	Very high
Design Change related	Change order					
	Change in drawing					
	Change in specification					
	Incomplete contract document					
	Decision during development stage					
	Design development					
	Shop drawing approval					
	Mistakes and discrepancies in design document					
	Change in sub surface condition					
	Change in scope of project variation					
Material-related	Poor Quality of material					
	Late material supply					
	Escalation of material price					
	Unreliable suppliers					
	Scarcity of material in the market					
Labor-related	Shortage of skilled labor					
	Low productivity level of labor					

	Labor injuries ¹					
Equipment related	Improper equipment					
	Equipment unavailability					
	Equipment allocation problem					
	Frequent Equipment breakdown/failure					
	Not having modern equipment					
Finance- related	Delayed payment to contractor					
	Delayed payment to supplier and subcontractor					
	Client's financial shortage					
	Financial difficulty faced by contractor					
	Difficulty in accessing credit					
Management related	Organizational change					
	Poor supervision					
	Poor site management					
	Mistake in construction					
	Unrealistic contract duration					
	Inaccurate cost estimation					
	Not preparing the method statement ⁶					
	Inappropriate organization management					

	Ineffective planning and scheduling					
	Inadequate construction experience					
	Underestimation of complexity of project					
	Many provisional sums and prime					
Contractual related	Non utilization of professional construction/contractual management					
	Delay in delivering site project to contractor					
	Delay in the approval of document					
	Lack of communication between parties					
	Slowness in giving instruction					
	Slowness in decision making process					
	Duration of inspection procedure					
	Nomination of subcontractor and supplier					
	Delay in performance of subcontractor					
	Problem with subcontractor					

External	Regulatory changes					
	Laws – regulations					
	Building Permits Approval					
	Adverse weather condition					
	Natural disasters					

APPENDIX
JIMMA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
COLLEGE OF BUSINESS AND ECONOMICS
Interview Questions

The following interview questions are prepared for representatives of contractor, consultants and clients.

Dear Respondent,

The main objective of this interview is to collect data for conducting research on the Assessment of Causes of Delay in rural water Supply Projects Construction: *A case study of Jimma Zone*, to undertake a study in Partial Fulfillment of the Requirement for MA Degree in Project Management and Finance.

Therefore, all the information collected from this interview will be treated for academic purposes only and not otherwise.

Thank you so much for your willingness!

- 1) What are the factors that causes for the delay of rural water supply project construction in Jimma zone?
- 2) What are the factors to reduce delay?
- 3) What is the negative impact produced from delay?
- 4) What are the practice that your organization undertaking to minimize delay?