ADDIS ABABA UNIVERSITY

SCHOOL OF COMMERCE

PROJECT MANAGEMENT DEPARTMENT

DETEMINANT FACTORS AFFECTING COST OVERRUNS ON WATER/SEWERAGE CONSTRUCTION PROJECTS: THE CASE OF OROMIA WATER AND ENERGY BUREAU PROJECTS

BY

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Project work submitted to the School of Commerce of the Addis Ababa University in Partial fulfillment of the requirements for the award of Master of Arts Degree in Project Management (MAPM)

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APPROVED BY BOARD OF EXAMINERS

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Dean, Graduate Studies	**Signature**
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DECLARATION

I, Abrhame Hailu, declare that the study entitled "Determinant Factors Affecting Cost Overruns on Water/Sewerage Construction Projects: The Case of OROMIA WATER AND ENERGY BUREAU PROJECTS" is my original work that is done under the guidance and input of my advisor, Dr. Worku Mekonnen (PhD).

This study will be done in partial fulfillment for Master of Arts in Project Management

Declared by:

Name: _____

Signature: _____

Date: _____

CERTIFICATION

This is to certify that Abrhame Hailu has carried out his research work on the topic entitled "Determinant Factors Affecting Cost Overruns on Water/Sewerage Construction Projects: The Case of OROMIA WATER AND ENERGY BUREAU PROJECTS".

This study has been submitted to Addis Ababa School of Commerce, School of Graduate Studies for examination with my approval as a university advisor.

Advisor: **Dr. WORKU MEKONNEN (PhD)**

Signature: _____

Date: _____

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Table of Contents

Lists of Tables

List of Figures

ACRONYMS

FI	*Frequency Index*
II	*Importance Index*
SI	*Severity Index*
SPSS	*Statistical Package for the Social Sciences*
SOW	*Statement of Work*
RFP	*Request for Proposal*
MIS	*Mean Likert Scale*

Abstract

The construction industry in Ethiopia in general has been found to be among the main consumers of resources and energy.. Also the industry is known for carrying major infrastructure movement and accounts for major employment segment as a nation. However this massive industry has prominent problems that hinders its vibrant contribution and maintain its contribution to the society. One of the major problems the industry faces is cost overrun. It is very normal for most construction project to have cost higher than the expected budget of the project. This is one of the major project management aspects that contract administration is going through this days. Thus this study was conducted to identify the major causes of cost over run and rank their severity taking the case of Oromia Water and Energy bureau projects of water and sanitation construction works. The study used purposive sampling of taking samples of the major stakeholders of the project parties and study to the major cost overrun causes from their perspective. The project has taken samples of 60 sample representatives of major 3C (Client, consultant and Contractor) of the stakeholders involved in the project. Using the sampled 60 practitioners involved in the project, and the major factors sorted from other literature reviews, factors were sorted and ranked accordingly. The findings of this research indicate that this major 10 factors were indentified and ranked. These are underestimating time requirements, Poor project control (cost, schedule and quality), Contractual claim (extension of time), Delay in construction, Inadequate supply of raw materials and equipment by contractors, Delays between design and procurement phases, Lowest bidding procurement procedures, inflation, Design error and omissions and Inadequate preconstruction study. The ten top factors were the highest impacts on the performance of project cost overrun from the client's, consultants' and contractors' perspective. In conclusion poor project and poor resource management were the significant factors for cost overrun in OWEB projects.

Key Words: ***Cost Overrun, Construction, water Projects***

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The problem of not being able to finish projects on time and on budget is still present and getting worse. S. Azher, M. Castillo, P. Kappagantula, and S. Ahmed. Cost overruns occur frequently globally, but Azhar and Farouqui claim that they are particularly severe in developing nations (2008). Professionals, customers or end users, and lawmakers have been debating ways to lessen or do away with building delays and cost overruns for some time. Several nations use money from the building sector to control their economies. Planning and budgeting challenges exacerbate as the building sector expands. This study's goal is to pinpoint the elements responsible for cost overruns on Oromian water and sanitation building projects.

The most crucial elements for a project's success are time and budget, according to research. The most important causes impacting project cost overruns and delays are changes in the owner's needs, unforeseen site conditions, evolution of the design philosophy, and design or budget faults (Harold K.2009). Even if a project is finished in other ways, it might not be regarded as a success. The completion of any project is not regarded by the project owner as a kind of success. The most crucial ones include finishing the project within the estimated cost, achieving the project's completion date without fail, creating high-quality work, and causing no health and safety hazards. For the client or project owner, the success of a project is decided by numerous aspects.

Ethiopia has a significant construction sector. It continues to be extremely important for the nation even though it is not operating to its full potential. Because it is one of the main employers in the nation and a crucial gauge of Ethiopia's economy, growth in this sector is essential for national income growth.Cost and timing concerns are a common problem in many developing nations, with expense overruns being particularly noticeable. an a number of a number of rum by the, the a number of a number of This document will make an effort to pinpoint the primary reasons behind cost overruns in the building of Oromian water and sanitation systems and will act as a manual for subsequent work addressing these overruns.

The primary causes of project cost overruns in the development of water and sanitation systems in the Oromia Region are poorly recognized. In order to determine the reasons behind cost overruns in water and sanitation building projects in the Oromia Region, this study was carried out.

1.2 Statement of the Problem

The construction industry contributes significantly to a country's development by delivering projects and other related activities that generate income for individuals and businesses. This contribution is considered greatly enhanced when project delivery meets the stated performance parameters. However, neither nationally nor internationally, this is widely accepted (Monyane 2013). It is not uncommon for a construction project to fail to meet its objectives within the budgeted time frame. Cost overrun is a very common phenomenon that is associated with almost all construction projects.As a result, completing a project is not a sign of success for the project owner. For the client or owner of the project, the success of a project is determined by a variety of factors, the most important of which are finishing the project within the budgeted cost, meeting the project's completion date without delay, producing high-quality work, and causing no health and safety issues. The majority of the water and sanitation building projects do not finish within the allocated money and schedule, which is essentially the assumption issue statement for this study. According to George and Garfas (2010), each project is unique, and there is no single cause for cost and schedule overrun. The main reasons for delay and cost overrun in water and sanitation development projects are not well recognized. Thus, the assumed problem statement for this study states that “water and sanitation construction projects are prone to and experience cost overruns that propagate amirage of problems in the water and sanitation construction projects organization in Oromia.

1.3 Research Question

In order to achieve a practical and credible conclusion the study tries to answer the following questions:

- What are the major factors that lead to cost overrun in water and sanitation construction projects in oromia?
- How the identified factors will be analyzed?

- What order should they come based on their frequency, level of severity and
- What is the important index of cost overrun on the projects?
- What should be recommended to reduce or eliminate cost overruns?

1.4 Research Objective

1.4.1 General Objective

- The general objective of the study is to assess the factor that lead to cost overrun on Oromia Water and Energy Bureau projects.

1.4.2 Specific Objective

- To identify various factors that influence cost overrun in water and sanitation projects in Oromia.
- To analyze and rank the identified factors based on their frequency of occurrence
- To identify level of severity and the important index of the causes of cost overrun.
- Finally, to forward recommendations about minimizing or avoiding cost overrun, provide suggestions to reduce cost overrun.

1.5 Significance of the Study

There has not been much research undertaken to establish the reason of cost overrun causes. Hence, through this study can be enlighten and motivate people about the source of cost overruns in the building business. The advantages of this research included create the statistical result and it may be the guideline or reference to the project manager, consultants and client, to help them identify well essential sources of cost overrun. Hence, the findings of this study would be advantageous to the project manager, consultants, and clients in construction project.

The study can also be important for the sector pioneers:

- In making strategic plan towards those determinants
- Reorganizing projects to achieve a better project performance
- Adjust future projects in making a successful delivery (on time and on budget)

The study has significance for other researchers in a way

1. It sets standard on how to evaluate cost overrun thus those researchers studying performance evaluation can use the determinants set here

2. Researchers can also modify this result and use this study as a cornerstone for further determinants.

As a result, the importance of this study is to identify strategies, processes, and methods that may be utilized to reduce or eliminate water construction project expense overruns.

1.6 Scope and limitation of the Study

The purpose of this study, which is limited to the water and sanitation construction project in Oromia, is to identify the cost overrun factor, analyze and rank the categories of the relevant responsible parties to the causes of cost overrun, and determine the importance of the causes of cost overruns as perceived by the three main parties, namely clients, contractors, and consultants. In order to conduct this study, 60 respondents who were clients, contractors, and consultants for water and sanitation projects were chosen, and questionnaires were delivered.

1.6.1 Limitation of the Study

During the project work, there were bottlenecks in the research limits. One of the challenges in completing this research was the lack of time. Because the time available for the research is limited, data collection via questionnaires and interviews is complex. Some respondents were not cooperative, especially from the client and contractor side.

The study's main limitation is that it concentrates on the causes of affecting the cost overruns in the OWEB west Guuji project site work project, which is a limitation. The last limitation of the study is the unwillingness of the three parties to submit comprehensive and accurate information.

1.6.2 Thematic Scope

The subject matter of this study focuses on determining the factors that causes the cost overrun of the projects of Oromia Water and Energy, water supply projects. The delimitation of the study encompasses rank of the factors determined, parameter the severity and the importance factor of causes identified.

1.6.3 Geographical Scope

The study area focuses on the projects of Oromia Water and Energy projects, more specifically the west Guji zone Projects.

1.7 Organization of the Study

The research report was divided into five chapters as chapters and references. The first chapter presented above discusses the study's background, problem statement, objective, fundamental research questions, the significance of the investigation, scope of the study.

A review of relevant literature will be the subject of the second chapter. The third chapter will detail the research design and methodology used to conduct the study. The fourth chapter focuses on the study's results and discussion, as well as the study's primary findings and debate. The fifth chapter concentrates on case studies on specific initiatives, and the final chapter provides conclusions and recommendations.

The study is generally divided into five main chapters:

Chapter 1: Introduction to the study. This provides a background to the study, statement of the Problem, research questions, objectives, and significance of the study and limitations.

Chapter 2: Literature Review. The chapter discusses theories relevant to the study and provides Literature previously done by other authors on the factors influencing cost overrun in water construction projects.

Chapter 3: Research Methodology. This chapter discusses the research design, sampling Procedures, data collection methods and analyses that would have been used in the research.

Chapter4: This chapter presents and discuss the results in relation to the research Questions.

Chapter5: Conclusions Recommendations and. The findings will be summarized and

Recommendations and conclusions given based on the results.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 General concepts of cost overrun

An effective building project requires a coordinated effort from people with various backgrounds. Through this work, the project will be finished according to schedule, budget, and quality specifications. In the construction industry, especially in developing countries, project success is rare for a variety of reasons, including delays and cost overruns. There are many factors that can cause delays and cost overruns in construction projects. Many studies have found a range of features, including project kind, geographical location, and project size, depending on the underlying issue that each study is focused on.

This chapter's major goal is to thoroughly identify the factors that contribute to construction project cost overruns by a thorough analysis of prior research conducted by a variety of researchers in diverse construction environments. This review of the literature is particularly significant since it contributes significantly to the lists of factors to be taken into account for the research and the creation of a conceptual framework for the design of the research method.

The cost overrun of building projects is briefly discussed, certain fundamental terms and phrases used in the study are explained, and a thorough evaluation of the literature is provided in the following parts.

Cost Overrun

Cost overruns happen when "the project's actual cost exceeds the original budget or projection" (Avotos, 1983). Nonetheless, as the project is being carried out, the estimate or starting budget is continually altering. For this reason, it is crucial to use caution when using the budget to determine the project's overrun (Avotos, 1983). Some authors believe that when the decision to start constructing is made, the initial budget is created (Flyvbjerg, et al., 2002; Odeck, 2004).

On the other hand, some other authors uphold the idea that cost overrun should be found comparing the original contract value with the final cost of the project at the time of completion.

The magnitude of cost overruns that have been reported throughout time may vary depending on how cost overruns are defined. (Love, etal., 2012).

Le-Hoai,etal.(2008)Also take into account that the size, location, and nature of the project, as well as its scope, may have an impact on the amount of cost overruns. For instance, (Eden et al. 2005) noted that although though there is more information available about cost overruns in public projects, this does not imply that there are none in the private sector. In fact, the authors support the notion that private sector initiatives frequently experience greater cost overruns. On the other hand, (Koushki, et al. 2005) stated that cost and time overruns occur frequently in both big and small, straightforward projects.

Frimpong, et al. (2003) also addressed this topic and noted that overruns are more common and significant in large projects than small projects. (Gkritza and Labi 2008) backed up this assertion and stated that lengthy projects also tend to have higher cost overruns. Nevertheless, (Odeck 2004) refuted this assertion. He believed that because managers devote more time to the administration of large projects than they do to small projects, large projects experience fewer cost overruns.

Construction cost overruns differ between the actual project completion cost and the contract budget amount. They are calculated using the initial projected cost and the ultimate completion cost incurred throughout the project commissioning. The positive difference between a construction project's completion cost during commissioning and the contract amount agreed upon by the relevant parties during contract signing and project start-up is characterized as cost overrun in this context.

- The difference between the signed or agreed contract sum and the total project cost is calculated as follows:

$$\text{Cost ratio(CR)} = \frac{\text{Completion cost}}{\text{Contract Amount}} \qquad (2.1)$$

When the ideal C.R. exceeds the value of 1.0, it is referred to as "cost overrun."

- To convert the above value to a percentage, use the equation below (Equation 2.2).

$$\text{Cost ratio(\%)} = \frac{\text{Completion cost} - \text{Orginal Contract cost}}{\text{Original Contract Amount}} \qquad (2.2)$$

When the ideal C.R. surpasses the value of 1.0 in a construction project, it is referred to as "cost overrun". Cost overruns occur for various reasons, which are discussed in detail in the following paragraphs. Poor contract management, price fluctuation, material shortages, frequent design changes, weather, financing, and late issuing of payments are stated as causes of cost overruns in building projects by Nigerian researchers (A. Omoregie, 2006).

Similarly, in a study conducted in Ghana, the client's financial difficulties, delays in payment of completed works, design variations, a lack of communication plans, poor feasibility and project analysis, poor financial management on site, and material price fluctuations were all factors affecting cost overruns(Samuel Famiyeh, 2015).

Generally, Cost overruns can be caused by various factors, including the consultant, contractor, and client, as shown in the table below.

Table 1: Common factors of cost overrun (Samuel Famiyeh, 2015)

Cause of Cost overrun		
Contractors	***Consultant***	***Client***
-Poor site management and supervision -Incomplete subcontractors - Schedule delay - Inaccurate time and cost estimation - Poor coordination and communication b/t contractor and other parties -Poor financial control mechanism - Often changing sub-contractors	- Lack of sufficient experience of consultants - Delay in reviewing the design documents - Project design complexity -Poor coordination/ communication between consultant and parties - Slowness in giving instruction - Conflicts amongst consultants with other parties - Delay in reporting the progress of works done	-Delay in progress payments -Delay in delivering the site to the contractor -Delay in delivering the site to the contractor -Unrealistic contract duration -Work suspension by client -Poor financial control mechanism

The cost overrun dilemma

The lifeblood of the majority of firms, according to (Kerzner H. 2009), is a constant flow of new goods or services. Due to the word "new," historical information may be scarce, and cost overruns are anticipated. A typical range of overruns is shown in Figure 1. Rough order-of-magnitude (ROM) estimates are frequently employed in the project initiation phase and are produced using "soft" data, which can lead to a variety of overruns. The accuracy of the estimates increases and the range of the overruns decreases when we transition from soft data to hard data and begin the planning phase of a project. The project manager searches for ways to save expenses when overruns happen.

Reducing scope is the easiest strategy. Finding items that are simple to cut is the first step in this process. The items that were underestimated because they weren't fully understood during the estimation phase are the ones that can be cut the quickest. Project management supervision, line management supervision, process controls, quality assurance, and testing are examples of components that are frequently eliminated or scaled back.

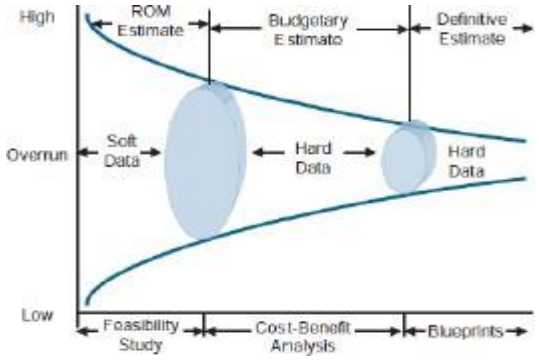

Figure 1 Range of cost overrun

Cost escalations can happen at any stage of a project's development. Cost overruns are most frequently caused by proposal phase Underestimating time requirements, underestimating internal capabilities, and not understanding client expectations. Omissions during the planning phase, inaccurate WBS, incorrect estimation methods, incorrect information interpretation, failure to identify and concentrate on key cost components, and failure to analyze and account for risks are all examples of planning phase errors.

Procurement cost ceilings, a negotiation team that must "win this one," and a negotiation phase that forces a quick compromise. Contracting stage Contractual inconsistencies between the SOW and the RFP's specifications, and between the proposal team and the

project team. drafting stage Accepting client requests without getting management's permission, Issues with customer communications and data, and Issues with design review meetings manufacturing stage Unacceptable specifications, excessive material costs, and a difference of opinion between engineering and manufacturing (Kerzner H.2009).

Project development phase

Proposal phase

A project proposal is a detailed description of a series of activities aimed at solving a certain problem. The proposal should contain a detailed explanation of the: Justification of the project; Activities and implementation time line; Methodology; and Human, material and financial resources required. The project proposal should be a detailed and directed manifestation of the project design. It is a means of presenting the project to the outside world in a format that is immediately recognized and accepted. (Besim2002)

Planning Phase

This is a crucial step in the cost management process since poor planning can consign a project to ongoing stress and compromise, leaving neither the client, the end user, nor the design team fully satisfied at the project's conclusion. Using historical data at this point without accounting for the numerous variables that influence building costs, such as project size, location, price increases, delivery method, overall quality of the project envisioned, etc., is a common mistake. (Bill,et al, 2006).

Early cost estimates are used in the planning stages of a proposed project to match the needs of the owner, expressed as documented programmatic requirements, with the budgetary restrictions in order to determine the project's overall scope and quality expectations. Value engineering ought to be taken into account at this point. Any program adjustments made at this early stage have very little, if any, impact on the schedule and redesign costs, but the advantages in terms of program solidification and setting project objectives might be enormous.

The majority of owner and designer cost control issues arise during the project planning phase. At this point, client needs may be exaggerated to support a project. The majority of the time, client needs are oversimplified because they are not properly understood. (DonaldE.Parker,1984)

Negotiation phase

The negotiating phase's major goals are to agree on the specifics of the work that will be done in accordance with the grant agreement and within the allocated budget, as well as to establish the legal and financial data required to establish the grant agreement. The project negotiation process is divided into two primary parts: technical (scientific) negotiations and financial and legal negotiations.

Technical (scientific) negotiations

Here, deciding on the final content of the work to be done throughout the course of the project is the main goal. The proposal could need to be modified during this stage of the negotiations to take into account the evaluation's recommendations, as stated in the negotiation mandate.

The whole project work schedule, the tasks that must be completed by each beneficiary, and any potential future consortium extension must all be described in sufficient detail. It will be necessary to come to an understanding regarding the list of deliverables, their substance, timing, and degree of dissemination, as well as the project milestones and their evaluation standards. Last but not least, if not already specified in the grant agreement's special conditions, a rough timetable for the project reviews must be set. Ideally, this timetable should coincide with the reporting periods.

Financial and legal negotiations

Here, the emphasis is on coming to an agreement on financial concerns, including the budget for the entire project's duration and the budget breakdown for the various project periods, as well as matters involving subcontracting and third parties. Also, concerns pertaining to the determination of the initial pre-financing amount, the timing of project phases, and reviews are resolved here. The examination and assessment of the consortium's ultimate composition, any unique provisions needed for the project, and other details like the project start date are all included in the legal negotiations.

The total costs, total eligible costs, and the maximum Community financial contribution will be determined during this phase of the negotiation process. Additionally, a table with an estimated budget breakdown and Community financial contribution for each activity that will be carried out by each beneficiary will be established. Also, the amount of pre-

financing, the start and end dates of the project, the timing of the reporting intervals, and the coordination coordinator's management skills are all set and confirmed.

Contractual phase

Construction contracts govern the distribution of risk among the numerous parties involved as well as acting as a tool for pricing construction. The owner of the project has the only power to decide what sort of contract should be utilized for a specific facility to be created and to lay forth the parameters in a contractual agreement. It's critical to comprehend the contractor risks connected to various building contract forms.

Lump Sum Agreement Under a lump sum agreement, the owner has virtually transferred all risk to the contractor, who will likely request a higher markup to cover unanticipated occurrences. In addition to the agreed-upon set lump sum payment, the contractor will frequently make additional promises in the form of submittals, such as to adhere to a particular schedule, a management reporting system, or a quality control program.

Unit Pricing Agreement With a unit pricing contract, the contractor is no longer at danger of estimating uncertain quantities incorrectly for some crucial jobs. When a contractor finds significant differences between its estimates and the owner's estimates of these quantities, they can nevertheless submit a "unbalanced offer." A contractor may slightly increase the unit costs on the jobs that were underestimated while lowering the unit prices on other tasks, depending on how confident the contractor is in its own estimations and how risk-averse it is. As payments are based on the actual number of activities completed, if the contractor's evaluation is accurate, it can significantly enhance its profit; but, if the opposite is true, it could suffer a loss.

Price plus Fixed Percentage Agreement The owner may be required to shoulder complete risk of cost overruns for specific building types that involve cutting-edge technology or urgent requirements. The contractor won't have much motivation to keep costs down because they would only receive the actual direct task cost plus a set percentage. Moreover, paying employees overtime is frequent and will drive up the cost of the job if there are urgent needs to finish the project. The owner shouldn't employ this kind of contract unless there are strong grounds, such as the necessity of building military sites.

Contract for Cost Plus Fixed Fees The contractor will receive the real direct job cost plus a fixed fee under this sort of contract, and since its price is fixed regardless of how long the project takes, they will have some incentive to do it promptly. Yet, if the project takes longer than projected, the contractor may run the danger of seeing its earnings erode. The owner still bears the risk of direct job cost overruns.

Contract with a variable cost plus Under this kind of contract, the contractor consents to a fine if the real cost is more than the predicted job cost or a bonus if the actual cost is lower. The contractor is permitted a variable percentage of the direct job costs as payment for assuming the risk on its own estimate. Also, the length of the project is often predetermined, and the contractor is required to meet the completion date. This style of contract transfers major risk for cost overruns to the owner, but also gives incentives to contractors to decrease costs as much as feasible.

Target Estimate Agreement This is a different kind of contract that stipulates a fine or bonus for the contractor depending on whether the actual cost is more or lower than the predicted direct job cost. Typically, the contract specifies the project duration as well as the savings or overruns that will be split between the owner and the contractor in predetermined percentages. Several project completion dates may be specified, along with rewards or penalties.

Contract with a guaranteed maximum cost. Since the project's scope is well specified, the owner may decide to ask the contractor to assume all the risks related to the project's real cost and duration. As performance standards are communicated to the owner at the beginning of construction, any work change orders from the owner must be exceedingly modest, if any at all. The maximum project cost guaranteed by the contractor is agreed upon by the owner and the contractor. Further clauses to divide any savings, if any, could or might not be included in the contract. Turnkey operations are best suited for this kind of contract.

Design Phase

Once an initial budget has been established, the scope set and the quality expectations documented, it is important to monitor the estimated cost of the project by employing a series of increasingly precise cost estimating techniques that coincide with further development of design and construction details. Estimates are used throughout the project

design development process as a part of continuous cost management and as a way to compare competing options.A constructability assessment of the drawings and specifications is also necessary. At this step, the construction documents are examined for completeness, activity coordination, cost-effective designs, and general code compliance. It's also a good idea to check the specifications to make sure the overall standards aren't too stringent (e.g. working hours, noise restrictions and so forth).

Construction Phase

Drawings have to be almost all finished at the time of bidding, but frequently this does not happen, necessitating the issuance of addenda to explain specifics, settle disputes, or finish the design. Another key component of a comprehensive cost management strategy is the production of the bid documents. Contract provisions governing changes to the work and how they will be valued, markups that can be applied to changes by different levels of contractors and subcontractors, notice requirements for delays, the use of unit prices for changes, and any other provisions that could have an impact on the project's final cost should all be taken into account.

Predictive cost estimating is typically less important during construction than reactive cost control of any modifications to the activity. Unexpected events, owner-generated changes, drafting errors and omissions, code problems, contractual claims, etc. are only a few of the sources of changes. Moreover, adjustments may result from ongoing proactive cost management that is produced by the consultant,

When one of the parties suggests a superior value alternative, it may be suggested by the client or by the contractor.

2.2 Causes of Cost overrun in construction project

Understanding the primary reasons for cost overruns is the goal of this section. This is why it includes some of the findings of several studies that have been conducted over the years on cost overruns in various kinds of building projects across numerous nations. Throughout the project's estimating phase through its conclusion, the elements that affect cost overruns are typically present (Baloi and Price, 2003). Understanding the primary causes of cost overruns is crucial because it can assist to reduce their effects and develop a strategic strategy to deal with uncertainties at every stage of the project. (ReicheltandLyneis, 1999).

2.3 Existing Studies of Cost Overrun in Construction Projects (case studies)

In the past, to determine the causes of cost overruns, (Subramani, et al. 2014) conducted a desk study in addition to a questionnaire survey. Thirty completed questionnaires were gathered from Indian clients, consultants, and contractors. The writers' major goal was to comprehend the primary causes of cost overruns. They came to the conclusion that the main causes of cost overruns were slow decision-making, poor schedule management, increases in material and machine prices, poor contract management, poor design/delay in providing design, rework due to incorrect work, issues with land acquisition, incorrect estimation/estimation method, and long time between design and time of bidding/tendering. Thus, the list of the primary reasons for cost overruns discovered by (Subramani, etal.2014)can beseen inTable1.

Table 2: Main causes of cost overruns in construction projects in Indian

Main causes of cost overruns in construction projects in Indian
Slow decision making
Poor schedule management
Increase in material/machine prices
Poor contract management
Poor design/ delay in providing design
Rework due to wrong work
Problems in land acquisition
Wrong estimation/estimation method
Long period between design and time of bidding/tendering

Similar research was done in South Africa by Ramabodu and Verster (2010), who sought to pinpoint the main causes of cost overruns in the country's Free State Province's construction industry. 25 construction industry experts, including architects, engineers, quantity surveyors, project managers, and contractors, received the survey. The many occupations and each respondent's role in the project were taken into consideration while analyzing the data. The five crucial criteria that the respondents believed to be important for cost overrun are depicted in Figure 2 with importance values ranging from 65% to 85%, the authors determined.(Ramaboduandverster 2010).

Table 3 Critical factors for cost overrun

The research made by Ramabodu and verster 2010. Used as a foundation for additional research in South Africa throughout the ensuing years. In 2011, Lucius and Michiel developed a new questionnaire, taking into consideration the points raised by (Ramabodu and verster 2010). 60 questionnaires were given out to clients, contractors, and consultants as part of this study. Furthermore, (Lucius and Michiel 2011) highlight the shortage of competent personnel, increase in material costs, inaccurate material estimations, and client's late contract award as the primary causes of cost overruns. The following year, (Nafkote 2015) delivered questionnaires to consultants, clients, and contractors working on office development projects in South Africa's eThekwini Municipality.

The author backed up the primary factors mentioned by earlier authors (Lucius and Michiel, 2011; Ramabodu and Verster, 2010, 1988); however, the author added that contractor cash flow issues, delays in progress payments by the client, poor site supervision and management by the contractor, ineffective quality control by the contractor during construction leading to rework due to errors, and contractor's difficulties in financing the project, can also be factors. The table below shows some of the outcomes of these research in terms of causation.

Table 4 Main causes of cost overrun

Main causes of cost overruns	Ramabodu and verster (2010)	Lucius and Michiel (2011)	Nafkote (2015)
Change in scope of work on site	✓		
Incomplete design at time of tender	✓		
Contractual claim (extension of time with cost)	✓		
Lack of cost planning and monitoring of funds	✓		
Delay in costing variation and additional work	✓		
Increase in material cost		✓	
Inaccurate material estimates		✓	
Shortage of skilled labor		✓	
Clients late contract award			✓
cash flow problems			✓
delay in progress payments			✓
poor site supervision and management			✓
inefficient quality control			✓
difficulties in financing the project			✓

Source: (Adapted from Ramabodu and verster, 2010; Lucius and Michiel, 2011; andNafkote2015)

Emmanuel, et al. (2017) stated that due to comparable issues in construction projects around the world, including Ghana, the construction industry has experienced challenges over the years with cost and time overruns. Additionally, this claim is supported by (Nida, et al. 2008), who contributed to the survey questionnaire. In order to identify the primary causes of cost overruns in projects of this nature, forty-two (42) factors were short-listed and representatives from local general contracting firms in Pakistan were asked to participate in the survey.

According to the authors, the main causes of cost overruns in Pakistan are fluctuating raw material prices, unstable manufactured material costs, expensive machinery, lowest bidder procurement procedures, poor project (site) management, poor cost control, delays between the design and procurement phases, inappropriate cost estimation methods, additional work, improper planning, and unsupportive government policies. Roya and Jose' Manuel's (2014) study, which sought to understand the reasons behind cost overruns in the development of gasoil projects in Iran, produced findings that were comparable to those of another study conducted in a developing nation.

This paper uses Iran's Gas-Oil construction sector as a case study for developing countries by presenting the findings of a questionnaire that was used to identify and assess the relative importance of the important factors influencing it. The findings indicated that the primary causes of overruns in Iran are comparable to those in other emerging nations.

Improper planning, frequent design changes, a lack of skilled labor, rising costs for labor, raw materials, and transportation, price fluctuations for raw construction materials, inappropriate contract policies, a lack of cost estimation methodology, lack of coordination between the design team and the general contractor, a deficient preconstruction study, mistakes made during construction, and inappropriate government policies were some of these factors (Emmanuel, 2003).PWC(2014)The Capital Projects and Infrastructure project team created an industry-standard questionnaire that was used to interview key participants in the infrastructure sector, including donor funders, financiers, governmental agencies, and private businesses throughout East, West, and Southern Africa. The principal infrastructure was the main focus of the survey, which also covered the following industries: water, transportation and logistics, energy (power and oil & gas), mining, social infrastructure, telecoms, and real estate.

The fulfillment of commercial agreements, government approval procedures, and client decision-making delays were all cited by respondents as causes of cost overruns. Insufficient project preparation and other project management problems, such as inadequate planning or design work, were also mentioned by respondents as causes of delays. Together with economic issues like inflation, currency depreciation, and currency exchange controls, project changes like failure to attain a design freeze or changes in design after commencement were also noted as key causes of cost overruns.

Cost overruns' primary causes differed by region: In East Africa, respondents mentioned lack of internal capacity and lack of skills as the key causes. In West Africa, economic factors were the main cause of cost variations, whereas in Southern Africa, project management issues were the most common culprit. Generally, across all regions, the issue of cost overruns is typically caused by a lack of project cost estimation, commercial management, and project management abilities. Some survey participants mentioned inadequacies in project management, including poor planning, poor technical decision-making, insufficient risk assessments, a lack of effective controls, and insufficient project monitoring.

Studies Concentrated on Ethiopia

Several studies of cost overruns have been conducted out in Ethiopia. The purpose of a study done in 2008 by Fetene was to determine why building projects wind up costing more than expected. This is why the author was gathered. Using both descriptive and inferential statistics, a total of 42 surveys from clients, consultants, and contractors as well as a desk study of 70 finished public building construction projects in Ethiopia were looked at and analyzed. According to the findings, 67 out of 70 projects for new public buildings ran over budget.

Additionally, he noted that the most significant causes of cost overruns in construction projects in Ethiopia were inflation or an increase in the cost of construction materials, poor planning and coordination, change orders due to enhancements required by clients, and excess quantity during construction. Yet, a more recent study (Abubekir 2015) supplemented this one.

(2010) dispersed Abubekir A desk study of 10 finished road building projects in Oromia was conducted, and 94 questionnaires from clients, consultants, and contractors were collected. The findings showed that all road building projects experienced time and expense overruns. Time overrun rates range from 25% to 264.38% of the contract value at the lowest, and cost overrun rates from 4.11% to 135.06% of the contract amount at the highest. 47 reasons for the Oromia case's time and expense overrun were noted by respondents. The most significant factors contributing to time overruns were incorrect planning, financial issues, and delays in furnishing and delivering the site (right of way difficulty).

However, it was discovered that building delays, contractors' insufficient raw material and equipment supplies, design modifications, and incomplete designs at the time of tendering were the main sources of cost overruns. This study found that delays, supplemental agreements, competitive relationships among stakeholders, and project owners' budget shortfalls are the most frequent effects of cost overruns. In the same year (Zinabu and Getachew 2015), a study on the reasons for contractor cost overruns in Ethiopian building projects was also conducted. This study surveyed 140 respondents in order to determine the top five causes of cost overruns. The samples were collected via an efficient sampling technique. Primary information is acquired utilizing the self-administered questionnaires.

While utilizing SPSS version 20 for the analysis, secondary data is gathered by reading relevant materials. The top five factors that lead to cost overruns in building projects, according to the contractor, ranged in severity from medium to high. The top five factors, however, as ranked by consultants and clients, ranged from high to extremely high.

According to the contractors, the top five variables that lead to cost overruns in construction projects are, in descending order, poor planning, fluctuating material prices, low productivity, inflationary pressure, and project financing.

This study answers one of the aims of this research which is "to identify the primary causes of cost overruns in Oromia water and sanitation building projects". Because it is a recent study on building projects in Ethiopia, the results are credible, the response rate is high, and it takes into account the various perspectives of project participants (owners, consultants, and contractors), it may be said to be accurate. It lends this study credibility. Table 4 provides an overview of the causes described by these writers, despite the fact that some of the causes identified by these research were comparable.

Main causes of cost over runs in Ethiopia(Fetene2008, Abubekir2015, Zinabu and Getachew 2015).

Table 5 Main causes of cost overruns in Ethiopia

Main causes of cost overruns	Fetene (2008)	Abubekir (2015)	Zinabuand Getachew (2015)
Inflation or increase in the cost of construction materials	x		x
Poor planning and coordination	x		x
Change orders due to enhancement required by clients	x		
Excess quantity during construction	x		
Delay in construction		x	
Inadequate supply of raw materials and equipment By contractors		x	
Design changes		x	
Incomplete design at the time of tender		x	
Poor planning,	x		x
Fluctuation of price of materials			x
Poor productivity			x
Inflationary pressure	x		x
Project financing in descending order			x

Taking these factors into consideration, this research aims to explore the issues that lead to the majority of water and sanitation development projects in Oromia requiring additional funding above and above the agreed-upon contract pricing. The research also examines who is accountable for the reasons behind cost overruns in water and sanitation building projects as determined by the stakeholders. A thorough literature analysis is conducted to determine a set of factors that are thought to be the most prevalent and often occurring causes in order to achieve these goals and identify the elements driving cost overrun in water and sanitation development projects in Oromia.

From the literature review, more than sixty variables are identified that are known to cause cost overrun of construction projects worldwide. Based on these variables, a questionnaire is created and sent to the main office construction stakeholders (clients, contractors, and consultants) who work in Oromia in order to determine the most significant causes of cost overruns in local construction projects and to suggest potential solutions or fixes.

2.4 Conceptual Framework

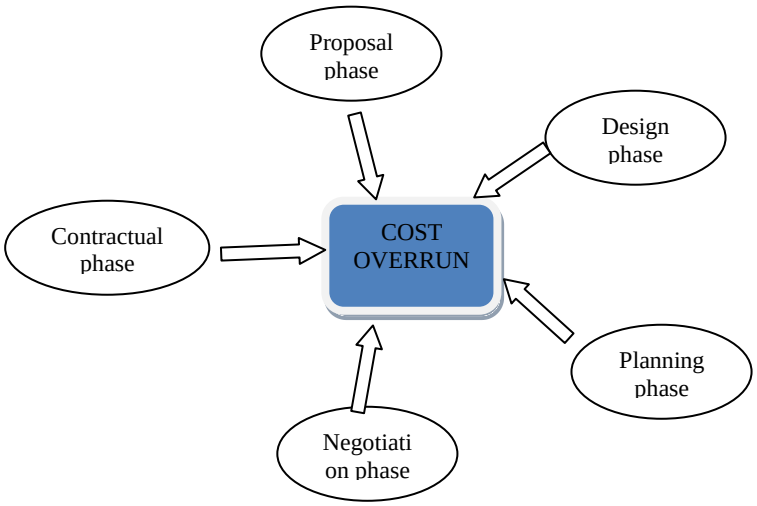

Figure 2 Conceptual Framework

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

Research methodology is the step by step procedure used to determine a solution to a particular problem. The methodology adopted in this research provides the procedures that are necessary for obtaining the information needed to structure the research questionnaire, collect data, analyze the collected data, and interpret and present the results. The methodology followed in this research outlined in the following sections.

3.2 Research types

Research could be descriptive or exploratory. Exploratory research is a research used to explore or search through a problem or a situation to provide insights and understanding. Descriptive research is to portray an accurate profile of persons, events or situations (Malhotra 2004). This research which deals with investigation of the practical problem cost overruns is undertaken on the basis of observation of construction projects. The research questions were designed to explore the causes of project cost overrun. A research can be categorized as exploratory and descriptive type. The research is exploratory because it is initiated from practical problems and investigates whether the causes of cost overrun exist. It is also descriptive because it tries to describe the causes of cost overrun in the water and sanitation construction projects in Oromia. The descriptive research method adopted in this study is to reveal an accurate picture of the respondents' (professionals) opinion that might help to assess the dominant causes and identify possible and practical measures for minimizing cost overruns in water and sanitation construction project in Oromia

3.3. Research Approaches

There are two basic approaches to research: quantitative and qualitative (Leedy et al. 2005). The former involves the generation of data in quantitative form which could be subjected to accurate quantitative analysis in a proper and rigorous manner and in the form of a data base from which to realize characteristics or relationships. In quantitative research, samples of a population are studied (observed or questioned) to establish its characteristics, in short, a quantitative approach attempts to produce "real answers" from

“hard data”, whereas a qualitative approach is concerned with subjective evaluation of opinions, behavior and attitudes. Research in such a situation is a purpose of the researcher's insights and impressions, and the techniques involved are projective techniques, focus group interviews and depth interviews. Qualitative methods are not good at giving direct answers, but are good at developing more questions, because of consistent use of “soft data” (Higgins, 2009). Therefore in this research quantitative approach is used.

3.4. Research Design

The strategy follow in this research were started with problem identification which has been done through unstructured literature review, and informal discussion with colleagues and professionals in the sector; and then the research design was formulated. Then data and information sources were determined based on the formulated research design. On the basis of the data and information sources the research instruments were decided; and available documentary sources relevant to the research were reviewed. The review includes books, journals, internet sources and other documents. After an in-depth literature review and desk study a questionnaire listing the various causes of cost overrun were distributed to reputed construction contractors, clients and consultants to get their professional opinion based on experience. Upon obtaining the desired data, checking and sorting of data were done. The data then analyzed for cross-checking the validity and conformity of the information obtained through the overall research work. This was followed by thorough discussions in order to draw a conclusion and to forward recommendations based on the findings of the study. An objective type survey design was used for this research. It was attempted to collect data from relevant population to rank the causes of cost overrun on the basis of importance. This survey-based research design has selected as it is useful in demonstrating the prevalence of the problem throughout the population. Once the distribution of the problem has determined and major causes identified, it may be possible to get hints on how to prevent the problem. It also helps to identify differences among groups and to recommend possible remedies to be taken by respective stakeholders.

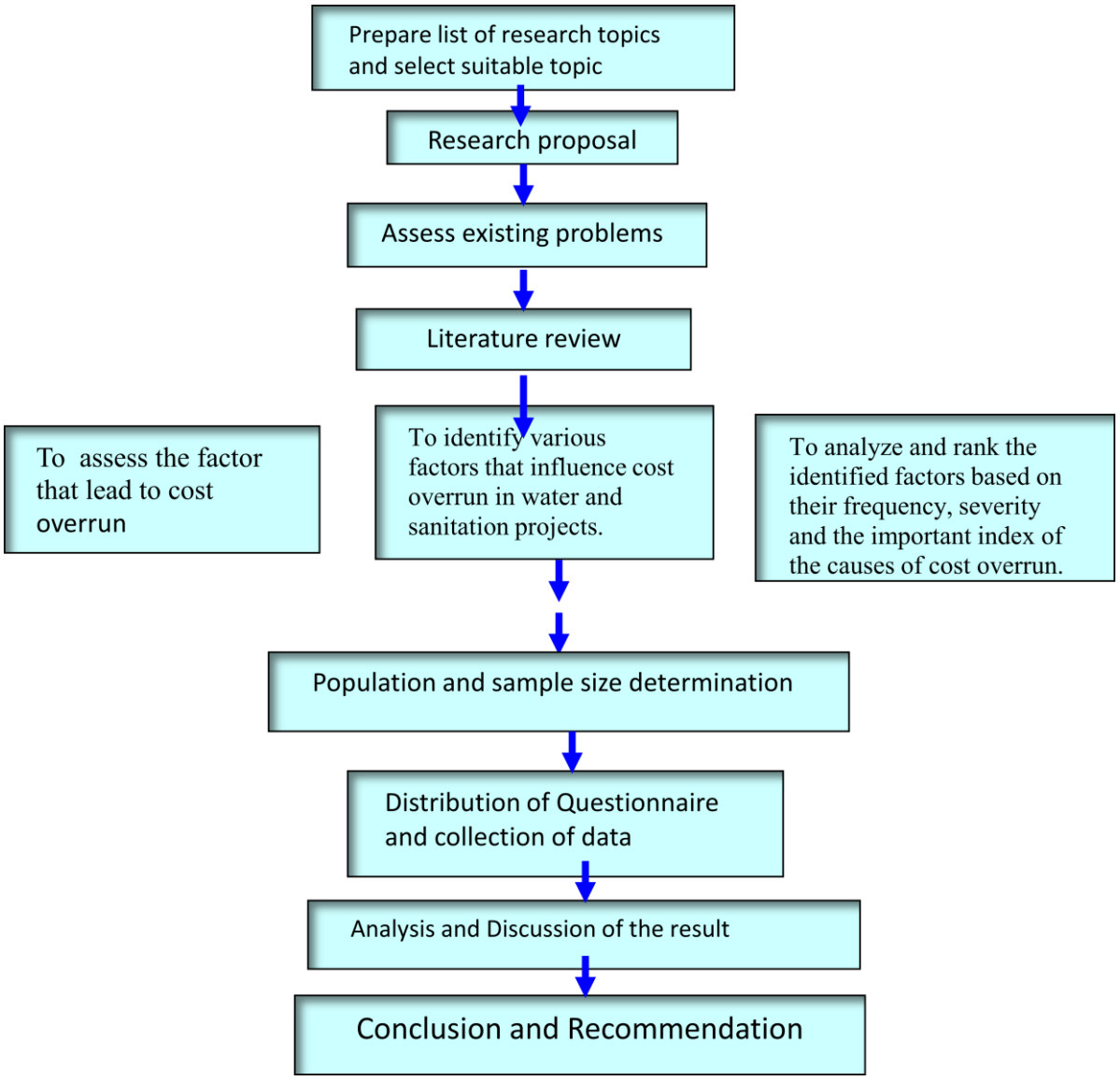

Figure 3: Methodologies followed in executing the Project work

3.5 Population and sample

The research samples were taken from stakeholders in the water and sanitation construction industry which are clients (project owners), contractors and consultants, that were selected depending on their direct exposure to water and sanitation construction activities. Project owners were selected from Oromia water and sanitation project office. Consultants were selected based on their class categories and their lists were taken from water and sanitation project office

The researcher identified clients, consultants and contractors as the target groups for the effective conduct of this research, 60 respondents comprising of twenty clients, twenty consultants and twenty contractors were be randomly selected using purposive sampling

technique as a type of probability sampling in order to give everyone that falls into any of these identified target groups equal and independent chance of being included in the sample.

According to the selected project.

The following Equation (equation 3.2) used(COCHRAN, 1977) and (Kothari, 2004) to determine sample size (n) with the required degree of precision for total project participants and the participant's variable (p) in this study:

$$n = \frac{Z^2 PQ\ N}{e^{2(N-1)+Z^2 PQ}} \qquad (3.2)$$

Where, **n**=sample size of the participants unit

P=proportion of success =80%

$\boldsymbol{Q} = 1 - p$= Proportion of fail=20%

$\boldsymbol{e}$= Standard error=5%

N = Total participant unit=200

Z = standard normal variable and value that corresponds to 95% confidence limit, which is equal to 1.96

d = Allowable error (0.05 or 5%)

By inserting the variables in the above equation (Equation 3.2),

$$n = \frac{(1.96)^2 * .8 * 0.2 * 200}{0.05^{2(}65 - 1) + (1.96)^2 * 0.8 * 0.2}$$

n=43.7

n ~ 44

- Approximately, the sample size was calculated to be 44.

3.6 Data Source and data collection

There are two types of research data collection, namely: primary and secondary data collection. When the data is collected either through survey or through experiment, it is defined as primary data. If the researcher performs an experiment, one can observe a number of quantitative measurements or data that help to examine the truth contained in the hypothesis. But when a survey is undertaken, data can be collected through observation, personal interview, telephone interview, by mailing of questionnaires and other methods.

Secondary data can be collected by the user or someone other than the user. It is rapid and can be relatively inexpensive to collect if available through open source channels. It plays an important role in the literature survey assessment, helping to define the key issues. The secondary data was used in this research from water and sanitation construction project annual report. The primary data also used in this study and collected through a questionnaire survey. A questionnaire designed from extensive literature review of various causes of cost overrun in construction projects and from secondary data sources were distributed to the main office construction stakeholders (clients, contractors and consultants) that operate in and around water and sanitation construction project in Oromia so as to identify the most important factors that cause cost overrun in construction projects in the area and come up with possible solutions/recommendations to the problem.

The reasons of construction project delays (time and expense overruns) were assessed using a five-point Likert scale based on the identified variables in the literature.

The adopted scales were as follows:

Table 6: Five points of the Likert scale to access the cause of cost overrun

Extremely Unlikely	Unlikely	Neutral	Likely	Extremely Likely
1	2	3	4	5

The five-point scale was transformed to mean item score (MIS) for each of the factors of causes of cost overruns as assessed by the respondents. The indices were then used to determine the rank of each item. The ranking made it possible to cross-compare the relative importance of the things perceived by the respondents. This method was used to analyze the data collected from the questionnaire survey.

The Likert scale was converted to a mean item score (MIS) for each component of cost overrun reasons as determined by the respondents. The indices were then used to compute each item's rank, allowing for a cross-comparison of the items' relative importance as assessed by the respondents. The data collected from the questionnaire survey were analyzed using this method.

For each item, the mean item score (MIS) was computed as follows;

$$MIS = \frac{1n_1+2n_2+3n_3+4n_4+5n_5}{\sum N} \qquad (3.1)$$

Where,

n_1= Number of Respondents for extremely unlikely;

n_2= Number of Respondents for unlikely;

n_3= Number of Respondents for neutral;

n_4= Number of Respondents for likely;

n_5= Number of Respondents for extremely likely;

N= Total Number of Respondents

3.7. Data analysis

For each of the variables that cause cost overrun, respondents were requested to indicate the degree of impact (or severity) and frequency of occurrence. The degree of impact was categorized into five scales. The responses given by each of the respondents was summarized and counted in their respective categories separately for client, consultant and contractor.

The Severity Index (SI) for each of the variables is computed with the formula:

$$1.\ SI\% = \frac{\sum_{i=1}^{5} Ai\ Ni}{5\sum_{i=5}^{5} Ni}$$

Where A is the constant expressing the weighting given to each response, it ranges from 1 for none to 5 for very high; N is the frequency of the responses.

b) Similarly, the Frequency Index (FI) for each of the variables is computed with the formula:

$$2.\quad FI\% = \frac{\sum_{i=1}^{4} Ai\ Ni}{4\sum_{i=4}^{4} Ni}$$

Where B is the constant expressing the weighting given to each response, it ranges from 1 for never to 4 for high; N is the frequency of the responses.

c) Importance Index (II) for each of the variables is computed as a product of both severity and frequency indices. It is given by:

3. II (%) = (FI (%) * SI (%)/100%

3.8 Variables of Cost Overruns in Construction Projects

There is no consensus in the literature on the identification of factors which affect cost of a construction project, as each independent research views the subject from different perspectives. This may be the project type, size, location, type of contract, etc. The global nature of the construction cost overrun problems meant that most ideas from other researchers' findings would be relevant to water and sanitation construction projects in Oromia. The purpose of this section is therefore to screen the factors identified from literature review that are relevant to the conditions of water and sanitation construction projects in Oromia.

3.9 Validity of Research Instruments

Mugenda (2003), define validity as the degree to which results obtained from the analysis of the data actually represent the phenomenon under study. To achieve this, both internal and external validity of research instruments has to be ensured. Internal validity refers to the instrument's ability to measure what is intended to be measured while content validity refers to the extent to which the questions provide adequate coverage of the subject matter. According to Mugenda and Mugenda (2003), determination of validity is primarily judgmental and intuitive. It can also be determined by using a panel of persons who shall judge how well the measuring instrument meets the standards, but there is no numerical way to express it.

Validity of this study was verified using experienced professionals in research who assessed and reviewed the suitability of the instrument in measuring the intended variables and its comprehensiveness in content using best and Kahn's two-step method of demonstrating evidence of validity. The method requires that, first the universe of content that could be included in the test be defined followed by ensuring that the test items are representative of the universe.

3.10 Reliability test result

Alpha reliability is regarded as a measure of internal consistency of the mean of the items at the time of administration of the questionnaire. Cornbrash's Alpha is a reliability coefficient that indicates how well the items in a set are positively related to one another (WWW.Wikipedia.com). It is computed in terms of the average inter correlations among the items measuring the concept.

Reliability is calculated in such a way that it represents the reliability of the mean of the items, not the reliability of any single item. So, the alpha reliability of 10 items would be higher than that of 5 similar items. This coefficient can hold a value of 0 to 1

The result of 0.7 and above implies an acceptable level of internal reliability. The result of reliability test for the questionnaire is shown in the following table. As it is indicated in the table, the test result is 0.89 and 0.94. Therefore, based on the test, the results for the items are reliable and acceptable.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter describes the results and discussion of questionnaire survey concerning cost overruns from contractors, consultants and owner viewpoints in OROMIA WATER AND ENERGY BUREAU and focuses on describing the respondent's characteristics in addition to the discussion of the factors that influence cost overruns. The principal purpose of the survey is to rank the already identified variables of OROMIA WATER AND ENERGY BUREAU projects cost overruns and then to find out the critical factors that are required to be given due attention in order to substantially minimize cost overrun problems in OROMIA WATER AND ENERGY BUREAU projects.

4.2 Questionnaire Response Rate

Hand-to-hand delivery is preferred to improve the response rate and to encourage respondents Moreover, phone calls are frequently made to remind respondents to complete the questionnaire. A total of 60 questionnaire sets were aimed to be distribute to individuals; i.e., 20 professionals working for the client, 20 for consultants and 20 for contractors, however only 15 questionnaires could be distributed to the client due to extended holiday and Kaizen training.

Table 7. Questionnaire distribution and response

Description	Number distributed	Number of respondent	% of responses received	% of response from total
Client	20	13	65%	28%
Consultant	20	19	95%	40%
Contractor	20	15	75%	32%
Total	60	47	78%	100%

Source: own survey 2023

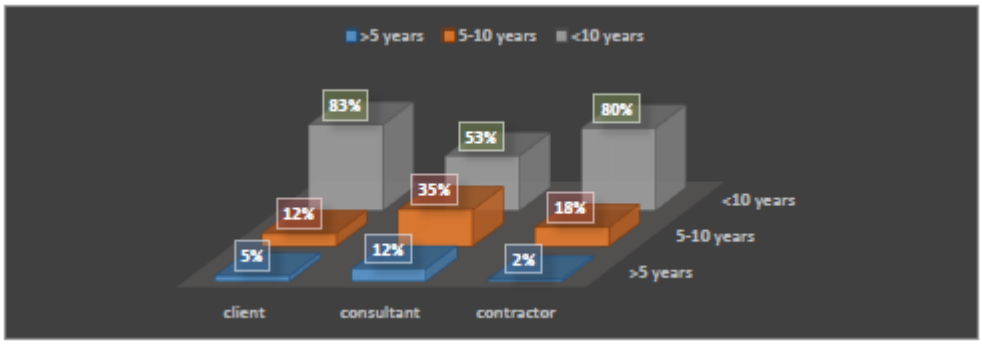

Figure 4.1: respondent category and year of expirience

From the total of 60 questionnaires distributed, 47 responses are received (Table 3). These are 13 (28%) from the client, 19 (40%) from consultants and 15 (32%) from contractors. The overall response rate is 78% (Table 3). As compared with that of the contractors and consultants, the response rate from the clients (65%) seems to be on the lower side, most likely because of their busy schedule and training. However, the client's response rate for this survey is considered to be adequate for data analysis. According to Moser and Kalton (1993), in order for data to be acceptable for analysis, the response rate should be as much as possible above 40% and if the response rate is lower than 30%, the data fails to be representative and the result of the analysis are of little value for further interpretation.

Figure 4.2: respondent category by profesion

4.3. Population characteristics

This part mainly designed to provide general information about the respondents in terms of the types of organization, experience of their organization, work experience and position in their organization.

4.4 General Characteristics of Respondents

The demographic characteristics of the respondents surveyed in this research that is their organization's experience in OROMIA WATER AND ENERGY BUREAU projects, the types of organization and the position of the respondents within their organization are presented in below.

Table 8. Demographic Results of Respondents

		Frequency	Percent
Gender of respondents	Male	32	71%
	Female	13	29%
	Total	45	100%
Age of respondents	18-27	2	4.44%
	28-37	5	11.11%
	38-47	20	44.44%
	48-57	16	35.56%
	58 and above	2	4.44%
	Total	45	100%
Work Experience	1 – 4 Years	3	6.67%
	5 – 8 Years	7	15.56%
	9 – 12 Years	24	53.33%
	12 & Above	11	24.44%
Educational Level	Diploma	9	20.0%
	First Degree	23	51.11%
	Masters	10	22.22%
	PHD & Above	3	6.67%

Figure 4.1. The range of experiences of the respondents' organization involved in this research survey

Source: own survey 2023

As shown in Figure 4 the percentage of respondents from the clients side work for organizations (companies) having the following experience: 5% of them work for organizations having less than 5 years' experience, 12% work for organizations having experience between 5 to10 years and 83 % work for organizations having more than10 years' experience. additionally , 12% of the respondents from the consultant's side work

for firms that have less than five years' experience, 35% work for firms having between 5 to 10 years of experience and 53% work for firms having more than 10 years of experience. Likewise, 2%, 18% and 80% of respondents on the contractors' side work for companies having less than five years, between 5 and 10 years and more than 10 years of experience respectively.

Data Analysis Approach

For each of variables of cost overruns respondents are requested to indicate the degree of impact (or severity) and frequency of occurrence of these variables. The degree of impact is categorized into five scales and the frequency of occurrence into four scales. Before the start of the analysis, weightings have been assigned to each of the categories. For degree of impact the weightings assigned are 5 for very high, 4 for high, 3 for moderate, 2 for neutral, and 1 for none. Similarly, the weightings for frequency of occurrence are 4 for high, 3 for medium, 2 for low, and 1 for never. Then the responses given by each of the respondents are summarized and counted in their respective categories summaries of responses are reported in Appendix B.

Research Findings and Results

Analysis of the data is undertaken using SPSS and the statistical methods outlined in chapter three. The analysis illustrates the findings and results of the survey for the severity, frequency and importance indices of all the variables cost overruns; and also for the six major categories of causes of cost overrun.

Severity of the causes of cost overruns

Severity indices of all the variables of cost overruns are computed using equation (1) for both of the three parties' client, consultant and contractor and the results are presented in table below

Table 9. The most severe causes of cost overrun identified in this research

Rank	Client	Consultant	Contractor
1	Delays between design and procurement phases	Excessive material costs	Poor project control(cost, schedule and quality)
2	Inadequate supply of raw materials and equipment by contractors	Delay in construction	Incomplete design at the time of tender
3	underestimating time requirements	Inadequate supply of raw materials and equipment by contractors	Delay in construction
4	Problems in land acquisition	Poor project control(cost, schedule and quality)	Late design and/ poor project Definition
5	Contractual claim (extension of time)	underestimating time requirements	underestimating time requirements
6	Poor project control(cost, schedule and quality)	Inadequate project preparation, planning and Implementation	Underestimation of cost of projects
7	Incomplete design at the time of tender	Poor risk identification management	Delays between design and procurement phases
8	Lowest bidding procurement procedures	Poor risk identification management	Poor planning and coordination
9	poor site supervision and management	Unanticipated site condition	Lowest bidding procurement procedures
10	Delay in construction	Inadequate preconstruction study	Design error and omissions

The analysis of severity of variables indicates that, with respect to client's opinion the top five most severe causes of cost overrun are:

- Delays between design and procurement phases
- Inadequate supply of raw materials and equipment by contractors
- Underestimating time requirements
- Problems in land acquisition
- Contractual claim (extension of time)

This shows that the top five severe causes of cost overrun are related to: contractual, negotiation and proposal phase related cost overrun problem From the consultants' viewpoint the top five severe causes of cost overruns are:

- Excessive material costs
- Delay in construction
- Inadequate supply of raw materials and equipment by contractors
- Poor project control (cost, schedule and quality)
- Underestimating time requirements

This indicates that the five most severe causes of cost overruns are related to construction and proposal phases of cost overrun problems it is also to be noted that two of these factors are similar to those asserted by the clients and contractors.

According to the contractors' perspective the first five severe causes of cost overruns are:

- Excessive material costs
- Delay in construction
- Inadequate supply of raw materials and equipment by contractors
- Poor project control (cost, schedule and quality)
- Underestimating time requirements

These causes are related to proposal, construction and contractual phase. It is also found that one of the factors, which are "Underestimating time requirements" is commonly identified by the three parties as most severe cost overrun causes.

4.5 Frequency of cost overrun causes

Frequency indices are calculated using equation 2 and the significant frequent causes of cost overrun according to contractors, clients and consultants are shown in table below.

Table 10 Frequency of Cost Overrun

Rank	**Clint**	**Consultant**	**Contractor**
1	Contractual claim (extension of time)	Underestimating time requirements	underestimating time requirements
2	Inflation	Poor project control(cost, schedule and quality)	Inflation
3	Delays between design and procurement phases	Delay in construction	delay in progress payments
4	problems in land acquisition	Contractual claim (extension of time)	Delays between design and procurement phases
5	underestimating time requirements	Inadequate preconstruction study	Inadequate supply of raw materials and equipment by contractors
6	Use of wrong estimating techniques	Lowest bidding procurement procedures	Delay in construction
7	Design error and omissions	Poor planning and coordination	Poor project control(cost, schedule and quality)
8	Lowest bidding procurement procedures	Inadequate project preparation, planning and implementation	difficulties in financing the project
9	Lack of coordination between the design team and the General contractor	Underestimation of cost of projects	Design error and omissions
10	poor contract management	Poor risk identification management	Contractual discrepancies SOW (statement of work) different from RFP(request for proposal) requirements

Source: own survey 2023

The results in Table 4.3. indicate that contractors are realizing that underestimating time requirements, inflation, delay in progress payments, Delays between design and procurement phases, Inadequate supply of raw materials and equipment by contractors, and Poor project control(cost, schedule and quality)are the highest frequent factors of cost overrun.

Inputs of the client indicate that the more frequent causes of cost overrun are allied to the planning, negotiation and contractual phases. Like Contractual claim (extension of time), Delays between design and procurement phases, problems in land acquisition, Underestimating time requirement, Use of wrong estimating techniques and inflation.

Unlike the contractors and clients, the consultants point out that the most important frequent cost overrun causes are related to proposal and construction phases. The results also indicate that underestimating time requirements, Poor project control(cost, schedule and quality), Delay in construction, Contractual claim (extension of time), Inadequate preconstruction study and Lowest bidding procurement procedures are the most frequent causes of cost overrun.

4.6 Discussion

This part focuses on discussion of results obtained in data analysis and answer how cost overruns could be substantially minimized in OROMIA WATER AND ENERGY BUREAU projects. The critical factors have already been identified and it is deemed that mitigating these factors would substantially minimize the problems of cost overruns in OROMIA WATER AND ENERGY BUREAU projects. Accordingly, and the results of the data analyses are discussed, interpretations and mitigating solutions are provided under the respective categories of cost overrun causes.

4.7 Proposal related causes of cost overrun

The major category “Proposal related cost overrun causes” includes causes 1-3 of Table 3.1. Out of the tree variables underestimating time requirements is the only one identified important variable by both the contractor, client and consultant in the 20 most important cost overrun causes. This shows that underestimation of time requirement is highly influence the cost of OROMIA WATER AND ENERGY BUREAU Projects. And leads to conflict between the contractor and consultant. Due to this factor the project manager cannot provide the deliverables on time to the need of the project owner. This result is line with the results of Kerziner (2002) agreement show that underestimation at time requirements affect the world wide project of cost overrun.

4.8 Planning related causes of cost overrun

The major category “Planning related cost overrun causes” includes causes 4 -12 of Table 3.1 out of the nine variables poor planning and coordination were the first position with importable Index (I.I 63%) this indicates that the high important of planning and coordination in order to minimize cost overrun poor planning and coordination affect the project works and leads to rework, conflict and may failure to the projects which leads to

cost overrun. This result is consistent with the results of Fetene (2008) and Zinabu and Getachew (2015) the suitable description of this agreement is that poor planning and coordination are not affected by project to project any problems related to poor planning and coordination can lead to project cost overrun.

The second important factor related to planning is " poor risk identification Management" II =62% this is strong indication that poor risk identification and management will lead to cost overrun sometimes the risk of the project will terminate the work of the project or Break works for long period of time which in turn create frustration in the next project phases. This result is not consistent with Abubekir (2015). This may traced to the work of OROMIA WATER AND ENERGY BUREAU project complexity different from Ethiopia Road Authority

"Underestimation of costs of Projects" is the third important factors related to this phase. I.I = 61% the reason of cost over run is one of the clearest factors that causes cost overrun in OROMIA WATER AND ENERGY BUREAU Project underestimation of Project costs can lead to inadequate resource and time and the project team may start off the project this result coincides with results of Emmanues et al (2017) this may linked to underestimation of cost of projects is the futures of developing country.

4.9 Negotiation phase related cost overrun

Table 4.8 shows that negotiation phases are ranked the last factors of causes of cost overrun. It does not include the 20 most important factors in table 4.4 but "problem in land acquisition" is ranked the fourth most important factors identified by the client in Appendix B. This shows that land acquisition is the most important factor of causes of cost overrun related to client and the client take the responsibility. This may be lead to conflict between the client and society around the projects. The result of Fetene (2008), Abubekir (2015) and Zinabu and Getachew (2015) did not coincide with this finding problems in land acquisition is one of the important factor of causes of cost overrun but this is the case in OROMIA WATER AND ENERGY BUREAU Project, where "Problems in land acquisition" is frequently accurse due to the sever political situation and constrains Subramani et al (2014) agree with the result obtained in this research that problems in land acquisition cause cost overrun.

4.10 Contractual Related Cost Overrun

Table 4.4 shows that the "inadequate supply of raw material and equipment by the contractors". As the first factor to cause of cost overrun in this category. There are many possible reasons for inadequate supply of raw material and equipment by the contractor some of the possible reasons are lack of cash at hand, different project site at one time, shortage of foreign currency and one supplier of raw material and equipment this result is similar to Marris (1990) and Abubekir (2015). Inadequate supply of raw material and equipment by the contractor is the problem of cost overrun in the world wide project even different researcher find the same result but the stakeholders could not save this problem.

The second important factor related to contractual cost overrun was "delay between design and procurement phase" (I.I = 68%). This is a strong indication that any delay between design and procurement phase will cause cost overrun. This result shows that the delay design leads to increase the cost of material, rent of machinery cost and also delay of projects. Because of late procurement phase. This result coincide with the results of Roya and Jose (2014) causes of cost overrun in developing country. The third important factor ranked by consultant, contractor and client was high costs of machinery (I.I = 59%) due to different reasons the cost of machinery increase time to time and leads to high cost overrun of projects. This result is similar to Roya Jose (2015) this shows that high cost of Machinery is the problems of developing country. The last important factors related to contractual causes of cost overrun was lowest bidding procedures (I.I =65%) highly ranked by the client this shows that there is dispute between the respondent.

4.11 Design related causes of cost overrun

Table 4.4 Shows that according to respondent "design error and omissions" is the most critical factors in increasing the final costs of the project. This factor is one of the clearest factors that lead to cost overrun through the design change and error due to unskilled manpower, poor planning, project complexity and unforeseen condition which changing the cost estimated in the bill of quantity or estimation cost documents of the project. The results of Fetene (2008), Abubekir (2015) and Zinabu and Getachew (2015) did not coincide with this finding that design error and omission is one of the important factors cause cost overrun.

The research where conducted the place where design error and omissions is not present as road construction project in Addis Ababa, Public Building project in Ethiopia and construction projects in Ethiopia. But this is not the case in OROMIA WATER AND ENERGY BUREAU projects. Where design error and omissions is frequently occurs due to different reasons.

4.12 Cost Overrun related to construction phase

Table 4.4 shows that " poor project control" is the most important factors of cost overrun in OROMIA WATER AND ENERGY BUREAU projects identified by the respondent according to Mostafa (2016) project control has a direct correlation to project progress and stakeholder's expectation. Projects rarely fail because of the one issue Rather, failure is usually a collection of minor items that individual have negative impact in a specific project area, However, when looked at over the life span of a project this minor item can cause significant impact to cost, Schedule, risk and themselves as deviations from the original project plan. This shows that poor project control (cost, schedule and quality) is critical factor for cost overrun. This result consider with Fetene (2008), Abubekir (2015) and Zinabu and Getachew (2015) Mostafa Et al (2016) and other researches that "poor project control" is one major critical factor at cost overrun.

"Delay in construction" was ranked as the second major factor to cause cost overrun in this group. Therefore each day of construction delay cost the contractor additional losses such as overhead, costs of sub-contractors and penalty. The delay of construction works lead to time lost, hence the cost increase. In case of delay the cost of construction may increase than the cost overrun may occur. This result considers with Abubekir (2015) that the "delay in Construction" is one of major factors of cost overrun. Respondents on the questioner believed that the third important factor in this category was "Inflation" with (II = 64%) the majority of the cost overrun related with construction projects are the consequences of financial inflation that increase the price of material, equipment and labor wage between the time when the original prediction was made in Appraisal phase and the time the project was finally constructed.

The fourth major factor in this category is "Inexperienced management team" that cause

cost overrun in OROMIA WATER AND ENERGY BUREAU projects based on the opinion of the respondents. This outcome make clear that the experience of management team in construction project will lot the project team to construct work more cost effective and within budget due to the same reason, It is understandable that the failure of any activity caused by in experienced management team leads to high cost overrun in the project any un successful activities makes the constructor to rework and accordingly increase in the cost of project.

“Poor site supervision and management” has been selected 5th factors that influence the causes of cost overrun in this category. As a result of poor site management and supervision construction errors, delay in buying material for the project in time, improper consideration of the project team, contractors and consultant and inappropriate timing for the beginning and finishing the activities. During construction increase the cost of the project dramatically that leads to cost overrun. The result of Ramabodu and Verster (2010), Feten (2008), Abubakir (2015) and Zinabu and Getachew (2015) did not related with this finding that poor site supervision and management is one of the important factors causes cost overrun. This shows that projects have unique characteristics.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter presents conclusion and recommendation made based on the analysis and findings of the study. Identification of causes of cost overrun is a prerequisite to minimize or to avoid cost overrun in the construction industry. The main objective of this research is, therefore, to identify the critical causes of cost overrun on OROMIA WATER AND ENERGY BUREAU projects. Questionnaire survey was used to identify the causes of cost overrun. Clients, consultants and contractors were asked to identify the variables of cost overrun in the OROMIA WATER AND ENERGY BUREAU project. Frequency of occurrence of the variables of cost overrun, and their impacts on the final cost of the project were also asked. The data gathered from the survey are analyzed using SPSS, severity index, frequency index and important index. The analysis of the results from the open-ended part of the questionnaire was carried out using descriptive analysis.

There are many causes cost overruns in construction projects and several studies have pointed out various factors based on the underlying conditions that their specific study is concerned with. Therefore, this research attempts to investigate the problems particularly for OROMIA WATER AND ENERGY BUREAU projects in Addis Ababa.

The research has been undertaken by reviewing literature, which was used to identify the possible variables causing cost overruns in construction projects as a whole. Then the variables have been scrutinized in line with the water and sanitation construction projects. Fifty four variables for cost overruns have been identified. The variables for cost overruns have been categorized in six major groups based on the sources of cost overruns. These variables are then used to design a questionnaire, which is designed to consist of two major sections. It basically aims to acquire data on the general background information of the respondents and their organization; degree of impact and frequency of occurrence of the identified variables/factors.

After distributing the questionnaire for professionals who have experience in OROMIA WATER AND ENERGY BUREAU projects in oromia area, sufficient responses are collected. With a response rate of more than 78%, which is well above the minimum

required for conducting the analysis. The data has been classified into three groups according to the type of respondents: client, contractor and consultant. From the data retrieved in each group, severity, frequency and importance indices are calculated. Based on the respective importance indices.

With regard to cost overrun variables the 20 most important factors have been identified for each set of ranks. The most important causes identified by the survey, and based on overall results, are: under estimating time requirement, poor project control (cost, quality, and schedule) delay in construction, inadequate supply of raw material by the contractor and delay between design and procurement phase.

Furthermore, the categories of causes of cost overrun with respect to responsible parties are analyzed based on the overall results. The categories of indices of each group are determined by taking the average of the frequency, severity and important indices of the variables under the group in question. The results of the construction categories show the greatest source in project cost overrun as it is highly ranked by all parties.

5.2 Conclusion

The overall result shows that most important of the causes of cost overrun in OROMIA WATER AND ENERGY BUREAU projects in Addis Ababa originate from poor project management (cost, schedule and quality) and poor resources management (technical, human, and materials). In order to minimize these causes, owners should have an available fund for project and pay in time to the contractors according to the agreement. On the other hand, contractors should have strong backing from financial institution and be financially sound. The cost of individual construction projects needs to be accurately estimated and any potential project risks that can lead to cost and time overruns are to be adequately identified and managed accordingly. Moreover, human resources should have good training in managerial and technical aspects of the projects. These programs can update participants to have good practice in planning coordinating, controlling and monitoring of resources in scheduled time and budget. Finally, recommendations are made to substantially minimize the impacts of these critical factors causing cost overruns. The outcome of the analysis indicates that all of the parties are deeply involved in causing the problems due to the overlapping nature of construction events and it is difficult to distinguish what proportion of the overall cost overrun source is which party's

responsibility. Blaming each other on who causes cost overrun is not very helpful and a lot of work is expected to be done by each of the parties in order to minimize the problems of cost overruns in OROMIA WATER AND ENERGY BUREAU.

5.3. Recommendations

The problems of cost overrun are badly affecting the OROMIA WATER AND ENERGY BUREAU projects. All stakeholders (clients, contractors and consultants) should work together to achieve successful projects within the stipulated time and budget, and exceed the anticipated quality standard. Especially competent project team and construction managers' should pay close attention to planning and preventive action to keep the construction project on budget and schedule, and play an important role in preventing projects from extra cost. Therefore, implementing quality management system through skilled, competent and trustworthy project managers is vital, since project managers are the individuals who are engaged in the overall planning, coordination, monitor of risks and control of a project from beginning to completion. In order to minimize the incidences cost overrun in OROMIA WATER AND ENERGY BUREAU projects. The following recommendations are proposed to address completion budget of water projects in OROMIA WATER AND ENERGY BUREAU.

The following recommendations are expected from consultant

- Continuous coordination and direct communication, which will eliminate design discrepancies and errors as well as omissions in design and also provide an opportunity for professionals to review the contract documents thoroughly. This would help in minimizing variations orders resulting from the discrepancy in contract documents
- Adopt efficient information retrieval and distribution systems to guard against communication gaps; respond as quickly as possible to contractor and client questions and requests for clarification to avoid associated delays and confusions which consequentially will lead to cost overrun hence affect implementation process.

- Implement the necessary measures to reduce construction cost, since construction cost has a direct bearing on the smooth project implementation based on the findings earlier stated.

The following recommendations are expected from clients.

- Fulfill contractual obligations, especially as regards to payment of contractor's works duly executed, or settlement of fees accounts of consultants and possession of construction site. Clients should ensure that adequate funds are available before projects are started, so that contractors can be paid in accordance with the contract agreement. This will reduce cost overrun.

- Select suitable contractors not only on the basis of price and time offerings, but also on experience, financial standing, capacity and expertise. Experience contractors tend to have learnt from the past projects and having such contractors will help to reduce cost overrun.

The following recommendations are expected from contractor

- Procure construction materials and other items in collaboration with the client ahead of time. This will ensure short lead time required between different replenishing phases of the construction materials

- Ensure that he employs competent Personnel to ensure the interpretation of drawings is done correctly. This helps in minimizing time wastage and double handling of other related resources. Poor workmanship can result into demolition hence wasting of resources.

- Ensure efficient time management through proper resource planning, duration estimation, and schedule development and control; to avoid cost overrun.

Further studies are recommended to be undertaken in other areas of Ethiopia on various water and sanitation projects in order to come up with a nationwide mechanism for minimizing cost overrun in the general construction industry.

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Questionnaire

Dear Respondent:

I am currently working on a research study entitled the causes of Cost Overruns in Water and sanitation Construction the case of Oromia Water and Energy Projects. This research is aimed to investigate the problem of Water and sanitation projects cost overrun within Oromia, Identify the factors/variables that contribute to cost overruns in water construction projects and rank them in their order of severity have paramount importance to conduct analysis and subsequent recommendation of the possible solutions towards minimizing the problem.

To successfully undertake this research it is mandatory to look into the issues from different perspectives by involving professionals who have experience in the Water and sanitation construction sector.

I would like to confirm that your response will be kept strictly confidential and it will be used exclusively for the purpose of this research. Besides, your quick response is important in order to finalize the research.

Thank you in advance for your cooperation.

Abrhame H.

General Instruction

- It is not necessary to write your name

Part I: Personal Question

1. Gender — Male ☐ Female ☐
2. Age — 18 - 27 ☐ 28 - 37 ☐ 38 - 47 ☐ 48 - 57 ☐ 58 and Above ☐
3. Work Experience — 1 – 4 Years ☐ 5 – 8 Years ☐ 9 – 12 Years ☐ 12 & Above ☐
4. Educational Level — Diploma ☐ First Degree ☐ Masters ☐ PHD & Above ☐
5. Type of organization:

a. Client ---------- ----
b. Contractor----------
c. Client----------

Part II: Assessment of Degree of impact and Frequency of occurrence Factors Causing Cost overrun

	proposal phase cost overrun causes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Failure to understand customer requirements during proposal drafting					
	Unrealistic appraisal of the client capabilities such as the budget of the client for the project, the existing capacity of the contractors, consultant to build the project					
	Underestimating time required to realize the design to build and become a functioning system.					

	planning related cost overrun cause					
	Inaccuracy of the work breakdown structure					
	Misinterpretation of information such as the terrain of the place, weather, and actual design data of the area of construction					
	Use of wrong estimating techniques for some raw data for design					
	Inadequate project preparation, planning and Implementation					
	Underestimation of cost of projects					
	Inappropriate government policies					
	Inadequate cost estimating approach					
	Poor planning and coordination					
	Poor risk identification management					

	Negotiation phase causes of cost overrun					
	Forcing a speedy compromise with either the client body, the areal administration, or contractor					
	Negotiation team that must “win this one” Pointless negotiation					
	Negotiation during off bidding					
	problems in land acquisition, or negotiation during land acquisition					
	bidding phase causes of cost overrun					

	Contractual discrepancies SOW (statement of work) different from RFP(request for proposal) requirements					
	Proposal team different from project team. Thus creating misconception in contract drawing					
	Inadequate supply of raw materials and equipment					
	Weak /ambiguous contract term					
	Unsupportive government policies					
	Delays between design and construction phases, thus leading to inflation of material					
	High cost of machineries due to either inflation of spare parts, fuel price increment					
	Lowest bidding procurement procedures thus least bidder is constantly under financial shortage					
	Contractual phase causes of cost overrun					
	Inappropriate contract policies made in Public Procurement Agency (PPA)					
	Lack of coordination between the design team and the General contractor					
	poor contract management					
	Clients delay in contract award					
	design phases of cost overrun					
	Accepting client's demand without management approval/ on ground existing situation					
	Problems in client/ consultant and Contractor means of communication					
	Problems in design review meetings					
	Late design and/ poor project Definition of the project					
	Incomplete design at the time of tender					
	Design error and omissions					
	construction phases cost overrun					
	Inflation of material cost					
	Cost overrun due to time elapse (time extension of the project)					
	poor site supervision and management					
	delay in payment processing for the contractor					

	Inflation of the country's economy					
	Inadequate preconstruction study					
	Poor project control(cost, schedule and quality)					
	Inexperienced management team					
	Discrepancy of the contractual quantity and the actual quantity					
	Delay in construction					
	Unanticipated site condition (environmental, political situation and cultural stand of the area					
	Errors in contractual specification of the project leading to irrelevant cost of the project					