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MSc. THESIS ON: - ASSESSMENT OF PROJECT COST MANAGEMENT METHODS: THE CASE OF PUBLIC BUILDING CONSTRUCTION IN ADDIS ABABA

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AUTHOR'S DECLARATION

I hereby declare that, the work which is being presented in this thesis entitled "**Assessment of project cost management methods: The case of public building construction in Addis Ababa.**" in partial fulfillment of the requirements for the master degree of science in Construction Technology and Management is an authentic record of my own work carried out from June, 2023 to June, 2024 under the supervision of Dagnachew Adugna (PhD), Department of **Construction Technology and Management**, Addis College, and that all source of materials used for this thesis have been duly acknowledged.

To the best of my knowledge and belief, the thesis contains no material previously published or written by author person except where due reference is made.

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List of Abbreviations and Acronyms

AA	Addis Ababa
AAGR	Annual Average Growth Rate
BOQ	Bill of Quantities
C1	Grade One Contractor
C2	Grade Two Contractor
C3	Grade Three Contractor
CC	Cost Control
COVID	Corona Virus Disease
CPI	Consumer Price Indices
ECCA	Ethiopian Construction Contractor Association
ECIDP	Ethiopian Construction Industry Development Policy
EEA	Ethiopian Economic Association
ERA	Ethiopia Road Authority
ETB	Ethiopian Birr
FDRE	Federal Democratic Republic of Ethiopia
FIDIC	Federation International des Ingenious-Conseils
GCC	General Condition of Contract
GDP	Gross National Product
GVA	Gross Value Addition
ICTAD	Institute of Construction Training and Development
MoCUD	Ministry of Construction and Urban Development
MoF	Ministry of Finance
MoFED	Ministry of Finance and Economic Development
MoWUD	Ministry of Works and Urban Development
NGCF	National Gross Capital Formation
PMBOK	Project Management Body of Knowledge
PPA	Public Procurement Agency
PPI	Producer Price Indices
PPPAA	Public Property Procurement and Administration Agency
RI	Relative Index
RII	Relative Importance Index
SCC	Special Condition of Contracts

Abstract

Construction projects, especially public building projects, are vital contributors to the economic development of Addis Ababa, Ethiopia. However, these projects frequently experience cost overruns and delays, affecting the efficiency and success of construction outcomes. This research focuses on assessing the project cost management methods used in public building construction within Addis Ababa. The study identifies the key factors influencing cost control, investigates the cost minimization strategies employed by contractors, and evaluates the relationship between cost control methods and effective project delivery. The research employs both quantitative and qualitative approaches, involving data collection through surveys, interviews, and desk studies from various stakeholders, including contractors, clients, and consultants.

Findings reveal that inadequate cost control techniques, limited use of technology, inefficient cost monitoring, and poor communication between stakeholders are major contributors to cost overruns. Additionally, external factors such as fluctuating material costs, inflation, and unforeseen conditions also significantly impact project costs. The study concludes that effective cost control, supported by appropriate cost monitoring systems, technology adoption, and collaboration among stakeholders, is critical for delivering construction projects within budget and on time. Recommendations are made to improve cost control practices, enhance the skills of construction professionals, and encourage the use of advanced project management techniques to minimize cost overruns and improve overall project performance.

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

The construction industry plays a vital role in economic development, particularly in developing nations like Ethiopia, where it is a significant contributor to Gross Domestic Product (GDP). In Ethiopia, public construction projects, specifically those in Addis Ababa, have been critical for national economic growth. Between 1997 and 2002, these projects constituted about 58.2% of the capital budget, with the construction industry accounting for up to 7.6% of the GDP between 2010 and 2014. The sector is responsible for creating infrastructure necessary for socio-economic development, generating employment, and contributing to major national goals.

The construction process typically includes three major phases: conception/design, construction, and operation/use. Each phase is crucial, with decisions made during the conception and design phases significantly impacting a project's success. Despite the construction industry's contributions, many projects in Addis Ababa face challenges such as cost overruns and time delays, often due to poor project management and external factors. These delays and budget overruns negatively affect both the project owner and the contractor, leading to financial losses and reduced economic impact.

In the context of Addis Ababa's public building projects, cost overruns have become a recurring problem. Various factors contribute to these cost control issues, including inflation, unexpected conditions during the construction phase, and changes in material specifications or labor costs. Furthermore, contractors often fail to implement adequate cost control measures, exacerbating the issue. The construction industry also struggles with issues like ambiguous contract terms, inadequate technical specifications, and fluctuating market conditions, all of which undermine cost control efforts.

The need for effective cost control mechanisms has become increasingly urgent to ensure that public building projects in Addis Ababa are completed on time and within budget. This study aims to assess the current cost management methods used in these projects, identify the key factors

influencing cost overruns, and propose strategies to mitigate these issues. By doing so, the research seeks to improve project delivery and overall performance in the construction sector.

1.2 Statements of the problem

Public construction projects in Addis Ababa, including road, building, and infrastructure developments, have consistently faced significant challenges related to cost control and project management. More than 82.3% of road and building construction projects in the city suffer from severe time delays, with road projects delayed by an average of 175% and building projects by 110%. These delays have led to substantial cost overruns, often exceeding the initial budget estimates and placing a heavy financial burden on project stakeholders.

In the case of public infrastructure and condominium projects, despite the government's efforts to support contractors through training and provision of resources, cost overruns continue to hinder timely project completion. Factors such as poor estimation, lack of effective cost monitoring systems, and reliance on traditional cost control methods exacerbate these issues. Additionally, external influences like inflation, fluctuating material prices, and changes in project scope further contribute to budgetary challenges.

These problems reflect a deeper inefficiency in the current cost management practices within Addis Ababa's construction industry. The frequent cost escalations not only delay project timelines but also reduce the quality of outputs and undermine stakeholder confidence. As a result, the need for improved cost control methods, better communication among stakeholders, and the adoption of advanced project management tools has become crucial to addressing these persistent issues and ensuring the success of future construction projects.

1.3 Objective of the study

1.3.1 General objective

The general objective of this study is to Assess Project Cost Control Methods in the Case of Construction Industry in Addis Ababa.

1.3.2 Specific Objectives

In order to address the general objective the following specific objectives are formulated:

1. To investigate the cost controlling practice in construction projects.
2. To find out the factors that influencing cost control in construction projects.

3. To investigate intervention methods.

1.4 Research Questions

The following questions will be raised and has been responded through a detailed analysis that will be conducted in research process.

1. What are the cost control practice on public building construction projects in Addis Ababa?
2. What are the factors that influencing cost control methods on public building construction projects in Addis Ababa?
3. What are intervention methods?

1.5 Scope of the study

1.5.1 **Spatial scope**:

The research focuses on the assessment of project cost management methods in the specific geographical context of six public health center building projects in six different sub cities, Addis Ababa, Ethiopia.

1.5.2 **Thematic scope**:

The study entirely focused on construction cost management methods, examining how these methods are applied in public building construction projects in Addis Ababa.

1.5.3 **Temporal scope**:

The research gathered data and analyzed cost management methods within a specific time frame from December 2023 to February 2024, reflecting the current practices and challenges in public building construction projects in Addis Ababa.

1.6 Significance of the Study

This study will be of importance to construction professionals, practitioners, and the general public because it would not only clarify but also create awareness of the extent to which inadequacies can adversely affect project performance. The study will also help contractors, clients, consultants and all parties involved in construction industry about ways of improving their current method of cost management and control. The study will also be of great importance for other researchers who may want to venture in to the same subject matter. Having gotten results both empirically and theoretically, the study will serve as a foundation for future research studies. Finally, the research is expected to deliver the following contributions to construction industry of Ethiopia.

- The study might help policy makers and regulatory bodies to make good decisions and be aware of the challenges that hamper the construction industry from continuous growth.

- The study would provide formulated information for stakeholders in construction industry about key challenges that exist in construction environment.
- The study may help some researchers as resource for whom are interested to make further research on similar subject matter.
- The study would provide formulated information and data useful to build the capacity of building construction contractors, clients, consultants, and stakeholders affected by cost management problems.
- The study might help contractors, clients, consultants, and stakeholders seeking to find possible means to mitigate the effects of cost control problems.

Generally, the study serves as a litmus for dealing on construction project cost controlling challenges that are the main drivers of cost overruns and schedule delays in construction industry and considered as a basis for further studies that follow similar or related development challenges.

1.7 Limitations of the study

Time constraint: The researcher was simultaneously engaged in this study with other responsibilities and personal works, the short time given to do this study. This consequently will cut down on the time devoted for the research work.

Financial constraint**:** Insufficient fund tends to impede the efficiency of researcher in sourcing for the relevant materials, literature or information and in the process of data collections.

Lack of the cooperation of some respondents: Some respondents fail to complete the questionnaire survey to the required level.

Absence of relevant and historical database on the national basis with regard to price escalation.

Hence due to these limitations and other bottlenecks such as problems in terms of acquiring relevant data due to the unavailability and unwillingness of the relevant people, business of respondents and lack comprehensive data narrows the study to focus on some selected projects and stakeholders of the construction sector at Addis Ababa city level only.

1.9 Organization of the paper

This research is organized into five chapters, excluding the references and appendices sections. Chapter one deals with the background and organization of the study, which discusses about the general idea and relevance of the study. It also defines the background, the problem statement, the objectives, the scope as well as the organization of the thesis. Chapter two comprises of both

theoretical & empirical review of related literature, and quotes the various related works done in this area of study. Chapter three Consists of the research design, research approach, target population of the study, sampling techniques & sample size determination, &data analysis tools in this research study. Chapter four contains the results and sicussion chapter .The last chapter comprises of conclusion & recommendation.

CHAPTER TWO: REVIEW OF LITERATURE

2.1 Introduction

This chapter mainly focuses ont challenges encountered on construction project that have direct relationship with construction cost management trends in various construction companies. Generally the comprehensive literature review is conducted with aim to address the objectives of the research through a brief discussion on past findings related to challenges and best practices of construction cost management on building construction projects undertaken in Ethiopia, particularly at Addis Ababa, with the objectives to assess the current cost controlling practices and techniques; determine best practices and benchmarking tools and techniques; identify factors influencing cost control; identify methods of construction cost minimization and develop cost controlling tool which can be applied in the construction industry.

2.2 Theoretical Literature Review

The term "cost" is ambiguous since it has several different meanings to different persons. To a financial or cost accountant, it means the main elements which go to make a product, hence basically classifying cost into material, labor and equipment cost. Anyanwu (2013) defined cost as "the cost of producing a certain output of a commodity. It is the sum of all the payments to the factors of production engaged on the production of that commodity".

Enyi (2007) refers to cost as "the expenses incurred on the course of realizing a revenue or implementing a project, this cost are fixed, variable and semi - variable in nature" To the "Pure" economist, cost must be viewed in realistic terms, in which case the real cost of any product or services is the cost of the alternative that was foregone. On the other hand, management as defined by Stoner and Wankel is "the process of planning, organizing, leading and controlling the efforts of organizational members and of using all other organizational resources to achieve stated organization goals.

However, it is the project manager's responsibility to adopt or formulate a performance standard to track cost performance (Larry, 2002). Several factors that cause cost overruns in construction

projects have been identified in various places and time. The basic reason for cost overrun is that most contractors quote price based on their projected estimates. Unfortunately, the price change so quickly that the initial budget become completely unrealistic (Azhar et al, 2008). According to Larry, (2002) project cost is influenced by the following factors: specifications of the end products (such as levels of performance, quality, and reliability); compliance with governmental, institutional, or internal standards; and technical requirements (such as a need to upgrade computer hardware) and administrative needs (such as a company's financial policies).

In public construction projects, evaluating performance of each activity throughout the project life cycle is vital for the successful delivery of infrastructures (Rahman et al. 2013). An infrastructure project is considered successful when it is completed in the allotted time, with agreed contract budget, and within the depicted specifications (Belay et al. 2021). It is also important to denote that successful delivery of construction projects requires the utmost cooperation and coordination of project team across the project life cycle (Alias et al. 2014 and Mukhtar et al. 2017).In contrast, many construction projects in different regions of Ethiopia fail to meet the success criteria due to various challenges, including low level of cost and time performances (Sinesilassie et al. 2018). Previous studies highlighted a number of causes and risk factors leading to poor cost and time performances, including different aspects of cost overrun and schedule delays in both developing and developed nations.

Currently one of the most challenging and critical problems facing the construction industry is the overrun of costs and schedules in construction projects of various types. (Andrew N. Blair, 1992) suggests the necessity to forecast the amount in monetary terms of escalation costs that will be incurred during the execution of a construction for budgetary and bidding purpose.(Tamhankar et al. 2018),further insists that over the time span between project initiation, concept development, design, and the completion of construction, project cost increase usually occurs as a result of market forces and reflect increase in the cost of material, labor, and higher levels of construction activity.

Most recent studies that have sought to provide insight in to actions to improve the outcomes and results of projects have been devoted to professing practices for general project success. But it is clear that there are multiple factors with considerable impact on project success. Also most studies in the area of project cost control have focused on issues to do with critical success factors of

projects, many have also been dedicated to looking at the factors causing cost overruns, not the factors that makes it difficult to control these factors in practice. There seems to be an implicit assumptions that the most important factors causing cost and time overruns are also those most difficult to control, and needs to be explicitly validate. Some studies have also not engaged with construction practitioners in practice to understand the challenges they face in the quest to control their projects, therefore project control techniques are often recommended without additional suggestions in relation to the enabling environment required for their success. There seems to be a premise that project control operates in a vacuum devolved of the project environment. Therefore there is a gap in knowledge and integrated project management processes in relation to the identification of the challenges of effective control of construction projects in practice and the provision of deeper insights in to the day to day practical issues that make effective project cost and time control challenging from practitioner's perspective. This study seeks to add to knowledge in this area by unearthing the challenges to avoid in practice for effective cost control in practice. Despite the availability of many project control techniques, many projects still strive to achieve their objectives. The main objective in construction projects is to accomplish the projects on time, within budget, and quality according to terms and conditions of the contractual agreement. Among these objectives, completion within budget is of priority concerned among clients. Therefore, knowledge of cost control in construction projects is crucial. However, though the various researches and studies on the area reviewed have a great importance on the area of construction project cost control management process, they focus on general terms and principles to introduce the cause and their recommendation to avoid effects of construction cost escalations. Most of the researches and studies agree the construction cost overruns are a global phenomenon and tends to continue mentioning more general variables for its occurrence, and solutions are proposed also in general terms. For example many studies lack, overwhelming empirical evidence shows that many psychological, political, ethical conduct, project environment conditions, and economic reasons are not fully reflected as risk factors in the project budget.

Project cost control is concerned with ensuring that projects stay within their budgets, while getting the work done on time and at the correct quality. One system for doing this, called earned value analysis, was developed in the 1960s to allow the government to decide whether a contractor should receive a progress payment for work done. The method is finally coming into

its own outside government projects, and it is considered the correct way to monitor and control almost any project. The method is also called simply variance analysis (Lewis 2007).

Philips (2004) suggested that a successful project manager must be able to plan, predict, budget, and control the costs of a project. Lewis (2007) tells that variance analysis is the way that allows the project manager to determine trouble spots in the project and to take corrective action. He advised that the following definitions are useful in understanding the analysis:

Cost variance: Compares deviations and performed work.

Schedule variance: Compares planned and actual work completed.

BCWS: (Budgeted cost of work scheduled): The budgeted cost of work scheduled to be done in a given time period, or the level of effort that is supposed to be performed in that period.

BCWP: (Budgeted cost of work performed): The budgeted cost of work actually performed in a given period, or the budgeted level of effort actually expended. BCWP is also called earned value and is a measure of the dollar value of the work actually accomplished in the period being monitored.

ACWP: (Actual cost of work performed): The amount of money (or effort) actually spent in completing work in a given period. Variance thresholds can be established that define the level at which reports must be sent to various levels of management within an organization.

Therefore, using the above information one can analyze the variation on cost estimation and help to decide whether the costs were actually estimated, overestimated or underestimated. In the process of implementing such analysis, Richman (2002) suggested the theory of percent complete that provides a more accurate way of planning and reporting on an activity where one part of the activity is more difficult than another. This method measures and reports the percent complete.

In relation to cost control Heerkens (2002), emphasize that cost management system is not to control the cost rather it is to manage the inevitable changes. In supporting this concept Richman (2002) pointed out a good understanding of where costs can get out of control and consider the following list of common causes:

Poor budgeting practices, such as

1. basing the estimates on vague information from similar projects rather than the detailed specifications of the project at hand,
2. Failure to plan sufficient contingency budget,
3. Failure to correctly estimate research and development activities, or
4. Failure to consider the effects of inflation on the cost of materials or labor.

Receiving or analyzing status information too late to take corrective action.

A climate that does not support open and honest disclosure of information.

Indiscriminate use of the contingency budget by activities that overrun their budgeted cost.

Failure to re budget when

1. Flaws are discovered,
2. Technical performance falls below performance standards, or
3. Changes in project scope are approved.

2.2.1 Cost Estimation Models

Accurate cost estimation is dependent on the reliable elements of the work breakdown structure (WBS). Since the estimation is driven out from the information contained in the WBS refers to as the bottom up estimate, Heerkens (2002). According to Heerkens the in accuracy of early estimates could be emerged from their nature which bases sketchy data so that detailed and accurate estimate requires explicit information.

Therefore, in the absence of detailed project information, Heerkens (2002) described project managers may use the following estimating techniques for making preliminary project cost estimate.

Analogous estimating is the simplest forms of estimating which refers to the estimating process where, in the project manager' s opinion, there is significant similarity between the proposed project and those projects contained in the historical database.

Modular Estimating it is a model uses historical data and predictive formulas developed for the modules' characteristics to estimate the project' s cost, duration, and the amount of necessary resources. It is characterized by indices describing the quantity and size of several key components.

Parametric Model is Similar to the modular model; the parametric model uses historical data as the basis of the model' s predictive features. However, the characteristics that are

input into the process are primarily based on performance indicators such as speed, accuracy, tolerance, reliability, friendliness, error rate, and complexity of the environment of the deliverables.

Ratio Estimating is one of the more basic forms of estimating in construction, industrial, and process projects. The basis of this technique is that there is a linear relationship between the cost and duration of the project and one or more of the basic features of the proposed project. The so-called ratios or factors are refined from personal experience, company files, or published industry-specific data.

Range Estimating It refers to an estimate, to provide not just one estimate for the cost of an element but rather define the range of possible values for the cost of a specific element. This concept was the foundation of the PERT technique by which probabilistic project duration is obtained through the use of multiple durations defined for individual activity durations. Here a range of probable and likely duration values is computed.

2.2.2 Traditional cost control approach

In traditional cost control approach the most important measurements are today's date and the actual amount of money spent on the project. The amount of money spent is compared to the budgeted cost for the reached date to measure the performance of the project (commonly called S Curve). S-curves are used in project management worldwide and for nearly one hundred years where records of their practical application can be traced back to 1928 (Vanhoucke et al. 2008). they are representation of 'cumulative effort' related with the project plotted against time. This effort is expressed in the same units for all tasks the project comprises, usually man-hours (labor consumption) or monetary units (cost or payments). Comparing the 'as planned' S-curve with records of actual effort, if done on regular basis, enables the manager to follow the development of the project. S-curves are used both in the form of charts (to provide a one-glance insight into project performance) or tables (for easy data manipulation).

2.2.3 EVM Cost Control Approach

Earned value management is a mechanism that can determine how much work was accomplished for the money spent. The earned value system uses the data from the work breakdown structure, the project network, and the schedule to compare time-phased budget with scheduled activities. In

the process, it enables meaningful comparisons to be made between actual and planned schedules and costs.

The use of EVM as a project monitoring and control mechanism began in the 1960s, when it was championed by the U.S. Government as a viable system for its agencies and contractors to track project performance. The focus was to track the "value'' performance of projects, in addition to cost and other traditional measures. In the 40 years since its origin, EVM has been used worldwide in a wide variety of settings, ranging from governmental agencies to a host of project based organizations in numerous industries.

Unlike S-curves, EVM evaluates a project by integrating the criteria of time, cost, and value. In other words, in addition to comparing actual and budgeted costs, EVM integrates the important element of time in determining what was accomplished (value realized) to draw conclusions about current project status. In essence, the earned value method measures the value of the work actually accomplished at the cost rates set out in the original budget. This quantity is known as earned value (EV). Furthermore, as EVM provides information about the efficiency with which budgeted money is used relative to the value realized, forecasts about the estimated cost and schedule to project completion can be made.

2.2.4 Relationship between cost control and effective project delivery

Cost control is a critical aspect of effective project delivery. By effectively managing and controlling costs throughout a construction project, contractors can ensure that the project is completed within budget and on schedule. Here are some key points highlighting the relationship between cost control and effective project delivery:

1. Budget adherence: Cost control helps ensure that the project stays within the allocated budget. By monitoring expenses, identifying cost variances, and implementing corrective actions, contractors can prevent budget overruns and financial losses.

2. Resource optimization: Effective cost control allows contractors to optimize the use of resources, such as labor, materials, and equipment. By minimizing waste and inefficiencies, project costs can be reduced, and productivity can be maximized.

3. Timely decision-making: Cost control provides real-time visibility into project costs, allowing project managers to make informed decisions promptly. This enables proactive management of

potential cost overruns and ensures that corrective actions can be taken promptly to keep the project on track.

4. Risk management: Cost control is closely linked to risk management in construction projects. By identifying potential cost risks early on, contractors can develop mitigation strategies to minimize their impact on project costs. Effective risk management helps prevent unexpected expenses and delays that can hinder project delivery.

5. Stakeholder satisfaction: Effective cost control contributes to stakeholder satisfaction by delivering projects within budget and on time. Meeting cost targets demonstrates professionalism and reliability, enhancing the contractor's reputation and fostering positive relationships with clients, investors, and other project stakeholders.

6. Quality assurance: Cost control is not just about minimizing expenses; it also involves ensuring that quality standards are met. By monitoring costs related to materials, workmanship, and quality control measures, contractors can uphold quality standards while staying within budget constraints.

7. Continuous improvement: Cost control practices promote a culture of continuous improvement within construction projects. By analyzing cost data, identifying areas for optimization, and implementing lessons learned from previous projects, contractors can enhance efficiency, reduce costs, and improve project delivery outcomes over time.

2.2.5 Problems encountered by contractors in control construction project costs

There are several common problems that contractors encounter when managing construction project costs. Some of these include:

1. Inaccurate cost estimates: Contractors may underestimate the costs involved in a project, leading to budget overruns and financial strain.

2. Change orders: Changes in project scope, materials, or design can result in additional costs that were not originally accounted for in the budget.

3. Poor communication: Lack of communication between project stakeholders can lead to misunderstandings, delays, and cost overruns.

4. Inefficient project management: Inadequate planning, scheduling, and coordination can result in wasted time and resources, increasing project costs.

5. Fluctuating material prices: Price fluctuations in construction materials can impact project costs, especially if prices increase unexpectedly.

6. Delays in obtaining permits or approvals: Delays in obtaining necessary permits or approvals can result in project delays and increased costs.
7. Unforeseen site conditions: Unexpected site conditions, such as poor soil quality or hidden underground utilities, can lead to additional costs and delays.
8. Labor shortages: Shortages of skilled labor can result in increased labor costs and project delays.
9. Inaccurate tracking of costs: Failure to accurately track and monitor project costs can lead to budget overruns and financial losses.
10. Inadequate risk management: Failure to identify and mitigate potential risks can result in unexpected costs and project delays.

2.3 Empirical Literature Review

Currently, most building construction projects in Addis Ababa suffer delay behind schedules, underperformance, and cost overruns due to a number of reasons. One of the reasons is the poor practice of cost controlling of projects that is leading to dispute and termination of contracts among stakeholders. Numerous methods of managing cost on projects throughout the project life cycle exist, yet construction projects globally are marred with cost overruns, an indicator of poor cost management. A project is a temporary endeavor undertaken to produce a unique product, service, or result. This means that a project is done only one time (PMBOK, 2008). A project should have definite starting and ending time frames, estimated budget (cost), a clearly defined scope or magnitude of work to be done, and specific performance requirements that must be met (PMBOK, 2008). construction project management needs planning, scheduling, evaluation, and controlling of construction tasks or activities to accomplish specific objectives by effectively allocating and utilizing appropriate labor, material, and time resources in a manner that minimizes costs and maximizes customer/owner satisfaction (Lester, 2006). Project control is the last element in the functional chain of management after work has planned and organized. It completes a closed circuit or loop that will enable the project manager to detect deviations from the plan that could be related to organizational or production problems, inefficient use of resources, or the uncertain nature of the work in question. The project manager will be able to take corrective action by adjusting the production process and/or improving the use of resources. The main function of project control is to ensure successful attainment of the objectives that have formulated in plans (Uher, 2003).Project cost management includes the processes involved in estimating, budgeting,

and controlling costs so that the project can be completed within the approved budget. According to (PMBOK, 2008), project cost management processes includes:

- Estimate Costs-The process of developing an approximation of the monetary resources needed to complete project activities.
- Determine Budget-The process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline.
- Control Costs-The process of monitoring the status of the project to update the project budget and managing changes to the cost baseline.

(Humphreys, 2005), has explained a project cost control system has four objectives:

- To focus management attention on potential cost trouble spots in time for corrective or cost-minimizing action (i.e., detect potential budget overruns before, rather than after, they occur).
- To keep each project team informed of the budget for each specific area of responsibility and how expenditure performance compares to budget.
- To create a cost-conscious atmosphere so that all persons working on a project will be cost-conscious and aware of how their activities impact on the project cost.
- To minimize project costs by looking at all activities from the viewpoint of cost reduction

There are three elements or processes of Cost Management; cost estimating, cost budgeting and cost controlling (Owens et al, 2007).

Proper cost control is an essential element for a successful project performance. The first step of cost control is to identify the factors that affect project costs. Due to a various number of factors that hamper the course of construction projects need to be considered, it is difficult to predict the exact cost to complete construction projects. It is common to see that the final project cost is higher than the budgeted cost. Cost overrun is one of the main problems in the construction industry (Zhang, 2012).

Accordingly, the literature review includes concepts of cost control such as: the definition of cost control, classification of cost control, and elements of cost control system, factor influencing construction project cost controlling, tools and techniques applied to control construction project cost control, and methods in reduction of project cost.

According to (Humphreys, 2005), cost control is the application of procedures to monitor expenditures and performance against progress of projects or manufacturing operations; to measure variance from authorized budgets and allow effective action to be taken to achieve minimum costs. According to (Jackson, 2004), cost control is a continuous monitoring process used to track the variances between actual performance and planned performance on a project, specifically concerning cost and time. It used to track all items of work contributing to the overall project costs. That includes material, labor, equipment, subcontracts, and overhead. According to (Ritz, 1994), the term cost control is simple, and however different people give different meaning. Some people synonyms cost control with cost engineering cost reporting, value engineering, and cost reduction. Cost control is the purposeful control of all project costs in every way possible. That means that every member of the project team has a great role in reducing and controlling costs. The project and construction managers are the leaders of the cost control program, and they must constantly reinforce the project team throughout the life of the construction. (Nunnally, 2007) stated project cost control involves the measurement and recording of project costs and progress. It is a comparison between actual and planned performance. The primary objective of project cost control is to maximize profit, completing on time with the specified quality. Proper cost control processes is collection of cost data, which are valuable in estimating and controlling future project costs. (Abobakr, 2017) defined that cost control is the practice of identifying and reducing business expenses to increase profits, and the work starts with the budgeting process. A business owner compares actual results to the budget expectations, and if actual costs are higher than planned, management takes action. The main objective of cost control is to optimize the use of resources in the entire project life cycle and to provide maximum advantages to all the involved stakeholders. (Mohammed and Mukhtar, 2014) described cost control one element of the overall process of management of investment in the project or contract. It realizes in a careful planning of the allocation and commitment of resources linked to an appropriate policy for the procurement of materials. The overall management process must take into account the agreed objective and the commercial. There are three elements or processes of Cost Management; cost estimating, cost budgeting and cost controlling (Owens et al, 2007).

(Nega, 2008) concluded that the common cause of cost overrun are inflation or increasing in the cost construction material, change in foreign exchange rate, change order and lack of control on excessive change orders, failure to identify problems, and institute the necessary and timely

actions. The effects are delay, supplementary agreement, budget shortfall of the project owners, adversarial relationship among stakeholders, and loss of reputation for professionals.

(Mulugeta, 2017) has made evaluation of project cost control system (a case of on a selected construction PLC). It stated that the cost control method used by the company was the traditional cost monitoring and control approach, EVM approach has proven to be more effective and reliable project cost monitoring and control system compared to the traditional approach. Finally, the researcher recommended further investigations to be carryout on more companies, in different projects on cost controlling system.

(Wakjira, 2011) also investigated that unexpected inflation/ material price escalation, delays on completion time, scope changes, unstable cost of manufactured materials, inadequate site investigation and right of way problems (access to site and quarry) are major factors leading problems to cost overrun in Ethiopian. In addition, the study has indicated further investigations on the mechanisms to reduce cost and control budget is required.

(Assefa, 2008) a thesis called "Time – Cost Relationships for Public Road Construction Projects in Ethiopia." has reviewed project cost control includes influencing the factors that create changes to the cost baseline; managing the actual changes when and as they occur; monitoring cost performance to detect and understand variances from the cost baseline; recording all appropriate changes accurately against the cost baseline; preventing incorrect, inappropriate, or unapproved changes from being included in the reported cost or resource usage and acting to bring expected cost overruns within acceptable limits. The study also reviewed earned value analysis method is probably the most commonly practice tool which uses the cost baseline contained in the project management plan to assess project progress and the magnitude of any variations that occur.

2.3.1. Factors Influencing Project Cost Control

Different studies were conducted on factors that influenced the cost of the construction project. Some of the factors were beyond control (unforeseen), and some were a result of poor management or lack of foresight (Jackson, 2004).

According to Jackson (2004), the factors that contributed to the cost of the project were project size, the complexity of the project, site location, time of construction, quality of the work, market conditions, and management factors.

Different studies were conducted on factors that influenced the cost of the construction project. Some of the factors were beyond control (unforeseen), and some were a result of poor management or lack of foresight (Jackson, 2004).

(Mahadik, 2015) investigated the major factors which affected the construction cost of a project were similarity of construction project, construction material cost, labor wage rate, construction site condition, inflation factor, project schedule, quality of plans and specifications, the reputation of an engineer, regulatory requirements, size and types of a construction project, location of construction were the major factors which affected the construction cost of a project.

(Olawale and Sun, 2014) rankly indicated that design changes, risk and uncertainty associated with projects, inaccurate evaluation of projects, non-performance sub-contractor and nominated suppliers, complexity of works, conflict between project parties, discrepancies in contract document, contract and specification interpretation disagreement, inflation of prices, financing and payment for completed works, lack of proper training and experience of project manager, low skilled manpower, unpredictable weather conditions, dependency on imported materials, lack of appropriate software, unstable interest rate , fluctuation of currency/ exchange rate, weak regulation and control, project fraud and corruption, unstable government policies as major project cost control inhibiting factors.

Orczyk (2018) stated the factors for the differences between project actual costs and the project being estimated were; location, size of the project, workspace per worker (density), cost escalation due to time, site conditions, complexity of the design, specific requirements of the owner.

Mohan et al., (2017) indicated that unexpected ground condition, design change, poor project management, land acquisitions cost, inflation/relative price change, shortages of material and

plant, shortages of labor and equipment, exchange rate, inappropriate contractors, lack of qualified expertise, funding procedures were the cost changing factors in construction projects.

Sanni and Hashim (2013) concluded that the five critical barriers that affected construction cost control in Nigeria's construction industry were improper contract document, engagement of inexperienced staff, unstable market condition, complexity of the project, unstable government regulations, choice of procurement method and lack of research and innovation were the leading challenges affecting cost control practices.

After thorough comprehensive literature review the following 29 factors were identified as the main factors that affected cost controls of a construction project: (Jackson, 2004), (Mahadik, 2015), (Orczyk, 2018), (Olawale and Sun, 2014), (Sanni and Hashim, 2013).

2.3.2 FACTORS INFLUENCING CONSTRUCTION PROJECT COST

1. Planning & Designing

- Design change
- Time of construction
- Discrepancies in contract document
- Contract and specification interpretation disagreement
- Dependency on imported materials
- Lack of appropriate software

2. Cost Related

- 2.1. Market conditions /inflation factor
- 2.2. Construction material cost
- 2.3 .Labor wage rate
- 2.4 Construction equipment cost

3 External Factors

- 3.1 Fluctuation of currency/ exchange rate
- 3.2 Unstable interest rate
- 3.3 Unpredictable weather conditions
- 3.4 Risk and uncertainty associated with projects

- 3.5 Fraud and corruption, unstable government policies
- 3.6 Regulatory requirements

4 Project Characteristics

- 4.1 Size and types of a construction project
- 4.2 Site location
- 4.3 The complexity of the project
- 4.4 The similarity of construction project
- 4.5 Construction site condition

5 Personnel Related Factors

- 5.1 The reputation of an engineer
- 5.2 Labor productivity
- 5.3 The conflict between project parties
- 5.5 Lack of proper training and experience of project manager
- 5.6 Inaccurate evaluation of projects
- 5.7 Quality of the work
- 5.8 Management factors

However, the mentioned and other relative literatures all agree on the problems of cost management in construction industry, and its adverse effect on current state and future. Furthermore though these researches tries to describe the matter and its impacts on general and theoretical terms while the more affecting results and its driving factors are not well addressed specifically in Ethiopia concept. Related sources on the area, such as scholarly publications news, magazines, books and chapters, government documents and reports, and thesis have been reviewed. The review results indicates that the construction sector is the substantial contributor to the economic growth that helps to create a large portion of the resource needed to fund social development programs in the country. In addition, creation of employment and hence generation of income take place in the sector directly and are indirectly fostered in other sectors like manufacturing, service, retail, etc…through their linkage to industry. Hence methods and strategies should be made and strictly followed to measure and manage costs of construction projects. To do so it is first to understand the driving forces behind it. This is especially critical in the current situation, where cost control becomes the challenge nationally and internationally, that

it has been difficult to predict or estimate what the today's bid amounts might actually be tomorrow.

Controlling costs in construction projects to ensure the cost objectives are met has always been essential to any project's success. According to Ashworth and Perera (2015), in recent years there has been a need for a better understanding of cost control from both the client and contractor's perspectives. Cost overrun problem is affected by many factors which may include; psychological biases in estimating and monitoring costs, political intervention in decision-making, geological and weather conditions, contractor's profit margins being reduced, environmental aspects such as greater elimination of waste and more consideration on the environment, economic recession producing a shortage of funds available, high inflation and higher interest rates leading to construction prices soaring, etc. (Jergeas, 2008; Cantarelli *et al.*, 2010; Ahiaga-Dagbui and Smith, 2014). These factors, together with a greater trend towards producing cost efficiency and the availability of better tools and techniques, have led to greater importance being placed upon controlling costs as well as expecting more accurate results (Olawale and Sun, 2010)., emphasizes the importance of cost control, labelling cost management as the single most important role undertaken by a Quantity Surveyor (QS).

2.4 Conceptual frame work

When we summarize the literature review it revealed that cost control techniques are one and common uncertainties of construction projects. More over the reasons/causes of cost control problems vary from project to project and they are numerous in number. But after reading the details of these different factors and their relationship with cost control, the factors are crudely classified into five categories and depict their association with cost control using the conceptual framework in the following page.

The conceptual framework is presented by grouping factors sharing similar patterns of how they impact on project cost control. This conceptual frame work illustrates the factors that contribute to cost control problems and represents the literature review.

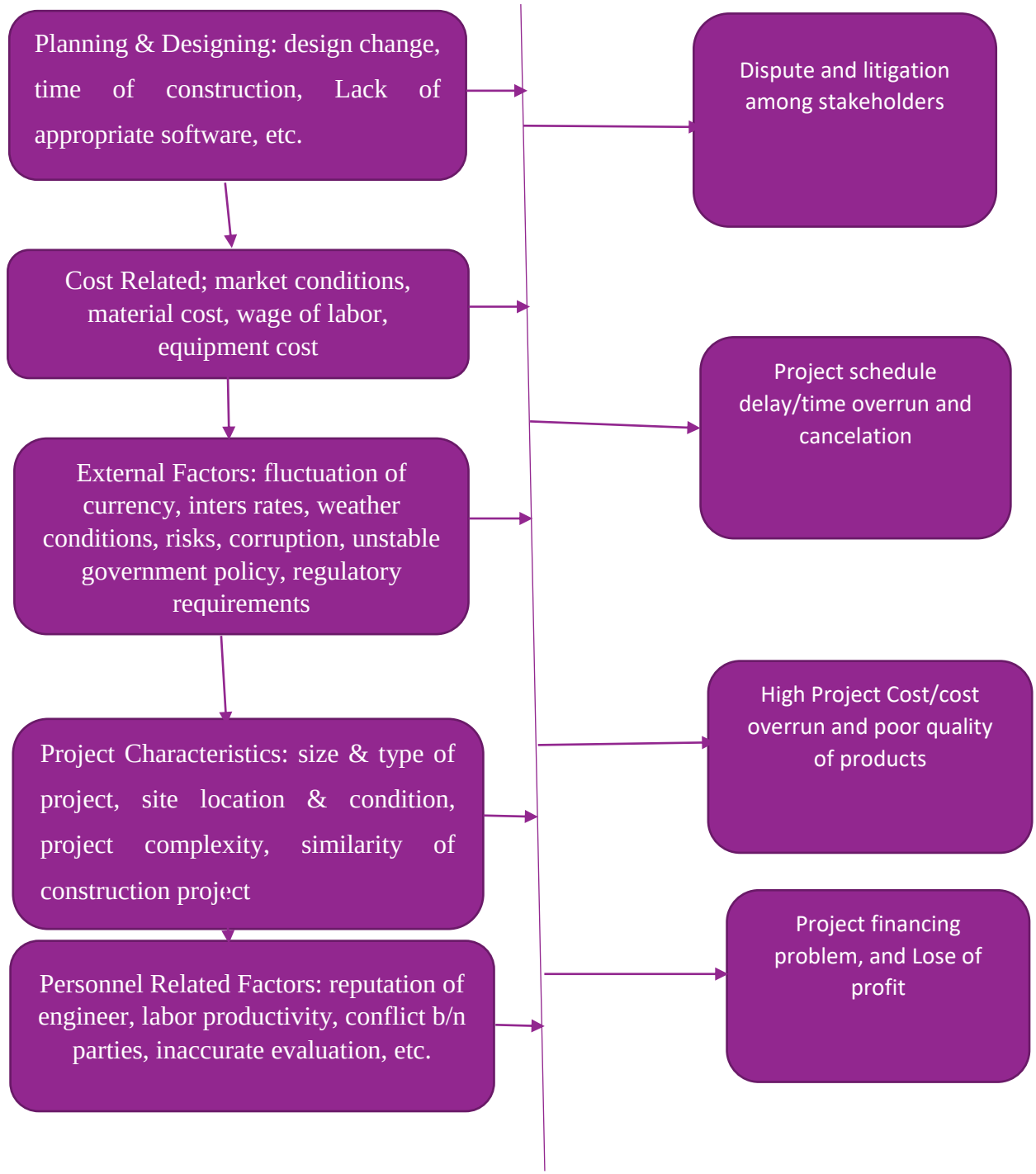

Figure 2.1 Conceptual Framework

2.5 International Practice

Here are examples of international construction projects known for implementing best cost control practices. These projects illustrate how effective cost management, technology, and collaboration between stakeholders can lead to successful project delivery within budget:

1. The Channel Tunnel (UK & France)

Project Overview: The Channel Tunnel, connecting the UK and France, is one of the largest infrastructure projects in Europe, completed in 1994.

Best Practices in Cost Control:

Earned Value Management (EVM) was employed to monitor the project's performance against its budget and schedule.

Regular Cost Audits: Both governments performed regular audits and reviews of the project's financial status, ensuring early identification of cost variances.

Risk Management Frameworks: Due to the complexity of tunneling under the sea, comprehensive risk assessments were conducted to mitigate unforeseen cost escalations.

Outcome: Though the project faced initial budget issues, these best practices ensured that the project met its revised cost targets during construction and operation phases.

2. Crossrail (UK)

Project Overview: Crossrail is one of the largest railway construction projects in Europe, connecting different parts of London. It was initiated in 2009 and is nearing completion.

Best Practices in Cost Control:

Building Information Modeling (BIM): Crossrail used BIM extensively to visualize the project before construction, which helped in reducing design errors and improving cost forecasting.

Integrated Project Delivery (IPD): Crossrail implemented collaborative approaches between stakeholders to ensure better communication and avoid costly delays.

Real-Time Monitoring: Cost management tools such as Oracle's Primavera were used to track expenses and manage changes dynamically.

Outcome: Despite some delays in the final stages, the cost control practices helped keep the project closer to its revised budget and minimized overruns.

3. Marina Bay Sands (Singapore)

Project Overview: The Marina Bay Sands is a large-scale commercial and leisure project in Singapore, completed in 2010.

Best Practices in Cost Control:

Lean Construction Principles: The project applied lean principles to streamline the construction process and reduce waste, particularly during the complex structural and design phases.

Parametric Estimating: This method was used early in the project to create accurate cost models based on the size and scope of the construction.

Comprehensive Risk Management: The project had extensive contingency plans in place to address potential cost risks associated with the complex design of the structure.

Outcome: Despite its large scale and complexity, the project was completed within a reasonable budget, attributed to robust cost control measures and lean management strategies.

4. Burj Khalifa (Dubai, UAE)

Project Overview: The Burj Khalifa, completed in 2010, is the tallest building in the world and a symbol of modern engineering and construction.

Best Practices in Cost Control:

Value Engineering (VE): During the construction of the Burj Khalifa, value engineering was applied to ensure that cost-saving measures were considered without compromising on quality or design.

Advanced Construction Technologies: Construction management software was used for real-time cost tracking and managing supply chains for materials, which contributed to better cost management.

Project Collaboration: The project's use of integrated delivery systems ensured better communication and reduced inefficiencies between contractors, suppliers, and consultants.

Outcome: The project was completed successfully, with a focus on controlling costs while achieving the ambitious design goals.

5. Hong Kong-Zhuhai-Macau Bridge (China)

Project Overview: The Hong Kong-Zhuhai-Macau Bridge is one of the longest sea-crossing bridges in the world, completed in 2018.

Best Practices in Cost Control:

Earned Value Management (EVM): EVM was used extensively to monitor project performance against the budget, and the project management team regularly reviewed variances to correct any deviations.

BIM Implementation: BIM technology was used for the project design and execution, significantly reducing rework and ensuring more accurate cost predictions during construction.

Cross-Border Collaboration: Given the involvement of multiple regions (Hong Kong, Macau, and Zhuhai), strong collaboration between governments and contractors was essential to keeping the project on budget.

Outcome: Despite the project's complexity, the effective use of cost control techniques allowed the project to manage its expenses efficiently, delivering a landmark infrastructure.

6. Gotthard Base Tunnel (Switzerland)

Project Overview: The Gotthard Base Tunnel, completed in 2016, is the world's longest and deepest traffic tunnel, located under the Swiss Alps.

Best Practices in Cost Control:

Advanced Risk Management: Given the geological challenges of tunneling under the Alps, a robust risk management framework was applied to manage unexpected costs related to delays or material shortages.

Life Cycle Costing (LCC): The project also incorporated life cycle costing to ensure long-term financial sustainability, focusing not just on construction costs but also on future operational and maintenance costs.

Benchmarking Against Similar Projects: The project team compared its cost management strategies against similar large-scale tunnel projects across Europe, allowing them to implement best practices.
Outcome: The Gotthard Base Tunnel was completed within its budget due to strong cost control measures and has been celebrated as an engineering marvel that minimized cost overruns.

7. Sydney Metro (Australia)
Project Overview: Sydney Metro is Australia's biggest public transport project and the largest urban rail infrastructure project in the country, expected to be fully completed by 2024.

Best Practices in Cost Control:
Integrated Project Delivery (IPD): This project has implemented IPD to ensure that all stakeholders are aligned in their goals, with shared accountability for the project budget and timelines.
Lean Construction and Continuous Improvement: Lean construction techniques are used to reduce delays and minimize material waste, which helps in keeping the project within budget.
Real-Time Data Analytics: Sydney Metro makes use of data analytics and predictive models to monitor project costs in real-time and adjust forecasts accordingly.
Outcome: Sydney Metro is on track to meet its cost goals, with significant cost savings attributed to lean construction methods and real-time data monitoring.

These international projects demonstrate how a combination of modern technologies, project management tools, and collaborative frameworks can help maintain strict cost control even in the most complex construction projects. Adopting similar practices in other regions, including Addis Ababa, could greatly enhance cost management and project success.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Research design

With reference to the research objectives and questions of the study, the research design adapted for this research was both quantitative and qualitative, of an exploratory type. The research was initiated from practical problems and aimed to find out whether practical cost control techniques existed in construction projects. It involved a questionnaire survey, interviews, and a literature review to gain a deep understanding, diagnose the current situation, assess alternative systems, and discover new findings on present cost control improvement practices in construction projects in Addis Ababa.

Once the research area was identified, a conceptual and contextual literature review was conducted to gain an in-depth understanding of the research topic. The review included books, engineering journals and articles, previous research on similar topics, internet sources, and archival document searches such as progress reports, completion reports, and contract documents of construction projects undertaken in Addis Ababa.

The literature search facilitates identification of major concepts, their correlation and it helps the researcher to fill the knowledge gaps related to the field of interest and organize ideas related to study on Assessment of cost control methods and its improvement mechanisms in construction Projects undertaken in Addis Ababa.

After literature review, the data collection process has been preceded by organizing questionnaires and documents which are helpful to gather the required information in order to achieve the stated objectives of the study.

3.2 Sources of data

The data for the research were obtained from both primary and secondary sources. Primary data were collected from respondents (project manager, project consultant, site engineer, site foreman

and laborers) through close ended questionnaire, interview and secondary data was obtained from literature review.

3.3 Sampling Design

3.3.1. Sample Population:

The study focused on evaluating the project cost monitoring and control system in public building construction projects in Addis Ababa. The sample population consists of six public buildings constructed under Addis Ababa health bureau and Addis Ababa construction bureau in Addis Ababa, with the sample population include all four Health centers and two Hospitals projects within six sub-city.

3.3.2. Sample Size:

To determine an appropriate sample size, factors such as available time, study funds, minimum acceptable precision level, confidence level, and sample statistics were considered. The sample size was calculated using the formula provided by Moore et al. (2003), resulting in a minimum required sample size of 65 respondents. To account for potential non-response rates, 10% was added to the sample size, leading to a total of 72 questionnaires distributed to clients, contractors, and consultants.

To select appropriate sample size the following statistical equations were used, Moore et al, (2003) showed that the sample size can be calculated using the following equation:

$$n = \frac{n^1}{1 + \frac{n^1}{N}} \qquad \text{equation 3.1}$$

$$n^1 = \frac{S^2}{E^2} \ , S^2 = P(1-p) \qquad \text{equation 3.2}$$

Where;

E= Standard error of the sampling distribution

N- Total population

P - Percentage picking a choice, expressed as a decimal (0.50 used for sample size needed). Z – Z value (e.g., 1.96 for 95% confidence level)

E - Margin of error (+5%)

$$S^2 = P(1-P) = 0.5(0.5) = 0.25$$

$$E^2 = 0.05^2 = 0.0025$$

$$n^1 = \frac{0.25^2}{0.0025^2} = 100$$

$$n = (100/(1+100/180)) = 64.28 = 65.$$

The sample size formula used above provides the minimum number of responses to be obtained should be 65, but 10% of the sample size was added to compensate for non-response rate and a total number of questionnaires distributed to client, contractors and consultants were 72.

3.3.3. Sampling Technique:

The research used non-probability sampling, specifically purposive sampling, to collect data from professionals such as project managers, project consultants, site engineers, site foremen, and laborers to identify key factors affecting project cost estimations. The targeted population comprises construction professionals and practitioners involved in construction projects where construction progress exceeds 50%. Six projects were identified for participation within the construction network in Addis Ababa based on information availability and the critical nature of cost control in those areas. Participants include the Addis Ababa Construction Bureau (planners, designers, supervisors, contract administrators), consultants (general managers, project coordinators, resident engineers, project supervisors), and contractors (project managers, project management teams, general managers).

3.4 Methods of Data Collection

Among different available data collection tools, self-administered close-ended questionnaire survey, semi structured interviews and case study was used to collect all the relevant data.

In order to achieve the objectives of the study, the data sources used for conducting this research are both primary and secondary sources. Primary sources are self-generated and consists of survey data, participant observation data, and so on; whereas Secondary data occur as raw data or processed.

In this research primary data was collected through questionnaire survey, interview and case Study on six selected construction projects. Secondary data also collected through review of civil engineering journals, related researches, internet sources, archival documents, correspondences and other related documents focused on Assessment of Cost Control Methods and its improvement mechanisms on building Construction Projects undertaken in Addis Ababa.

These secondary sources provide a general understanding of the subject area by presenting a wide range of ideas in the field which help to supplement other specific information obtained from the primary data sources.

3.4.1. Questionnaire

Questionnaire provides firsthand information for the subject matter of a research as it focused on issues which further serves as a survey to understand the main concerns and attitudes of respondents towards the problems (Kasiem, 2008).

In this research, close-ended questionnaire was developed and distributed to selected sample representativesfrom construction project owners representatives, Consultants, and Contractors who have been engaged and have exposure to involve in the construction projects at AA. The detail of Questionnaires design is shown in Appendix A.

3.4.2. Interview

Interview is one of the primary data collection methods, which is flexible and adaptive way of investigating underlying motives of a subject in a way that self-administered questionnaires cannot (Kasiem, 2008).

In this research semi-structured interview was conducted, which have a predetermined set of questions (generalized form of questionnaire) with a flexible order depending on what the interviewer perceives the subject matter by looking at the respondent capability and exposure or experience. For this thesis, the interview was made with seven Engineers from the three major stakeholders of construction projects. Three Engineers were selected from each of contractors, consultants and client's side.

3.4.3. Desk Study

Desk studies were used in this research to support or supplement responses and arguments found by questionnaire and interview through in-depth analysis of cases. The researcher selected five

projects as a desk study from construction projectsat Addis Ababa. The purpose of the desk study is to supplement the gap not covered by the survey. Archival documents like completion report, progress report, payment certificates and contract documents are used as data source for each case.

3.5 Methods of Data Analysis

In this research a descriptive statistical method was used to analyze the data collected from various sources. For summarizing the collected data and to determine the number of responses belonging to each category, frequency tables and charts were used.

The procedure used in analyzing of data was aimed at establishing the relative importance of the various factors that causing cost control problems, its effect, improvement mechanisms and current cost control method practices of construction projects in Addis Ababa.

The data collected through questionnaire survey have been summarized by using Microsoft Excel software. Then there were deep analysis, interpretation and comparison on results secured using various research instruments. Since the semi structured interview is designed to have predetermined set of questions to fulfill the missing data, additional data secured through an interview is used to support the result secured through questionnaire survey and desk study.

There are three steps in analyzing the data:

- Calculating RII
- Ranking of each factor based on RII
- Determining degree of correlations in ranking the variables among Clients, Consultants and Contractors.

In the analysis, the “Relative Importance Index” methods were adopted to determine the ranking relative importance of variables for construction projects undertaken at Addis Ababa. The method adopted in this study within various groups of respondents (Clients, Consultants and Contractors). The five-point scale (0, 1, 2, 3, and 4) was used to calculate the relative importance index for each variable which was then used to determine the relative ranking.

3.5.1 Relative Important Index

The five-ordinal measure of agreement of Likert scale represents the following rating:

Ordinal scale used for the measurement of rate of occurrence for factors causing price escalation:

Never (0) Seldom (1) Sometimes (2) Often (3) Always (4).

Ordinal scale used for the measurement of the degree of significances for effects of cost control on construction projects: No significance (0) Minor significance (1) Average significance (2) High significance (3) Extreme significance (4).

Ordinal scale used for the measurement of the degree of importance of methods to manage/administer cost controls on construction projects:

Unimportant (0) less important (1) Important (2) Very important (3) Extremely important (4).

The relative importance index is computed as (Cheung et al, 2004; Iyer and Jha, 2005; Ugwu and Haupt, 2007):

$$\mathrm{RII} = \frac{\sum \mathrm{W}}{\mathrm{A} \times \mathrm{N}} \ldots\ldots\ldots Eq.\ 3.3$$

Where:

W- Is the weight assigned to each factor by the respondents (ranging from 0 to 4)

A- Is the highest weight (i.e. 4 in this case)

N- Is the total number of respondents (61 in this case)

RII-Relative Importance Index

The value of relative importance index had range from 0 to 1, where 1 is extremely important and 0 is unimportant.

3.5.2. Correlation Analysis

Spearman's Rank Correlation Coefficient method, which number varies between -1 and +1, was used to know owners, consultants and contractors' perceptions of factors causing cost overruns, its effect, and Current methods to manage/administer cost control problems on construction projects.

$$rs = \frac{1 - 6\sum d^2}{n(n^2 - 1)} \ldots\ldots\ldots Eq\ 3.4$$

Where:

rs is Spearman's Rank Correlation Coefficient,

d is the difference in the factors ranks given by the respondents and

n" is the number of data pairs.

• A correlation coefficient of +1 means perfect positive correlation (agreement).

• A correlation coefficient close to 0 means no correlation.

• A correlation coefficient of -1 means perfect negative correlation (disagreement

3.5.3 Desk Studies Analysis

To analyze the data of archival records the researcher used the following procedure:

• Read their Completion Reports, Progress Reports, contract documents and payment certificates thoroughly.

• Identify the causes, effects and the methods to manage/administer cost control methods.

3.6. Model specification

In this research a descriptive statistical method is used to analyze the data collected from various sources. For summarizing the collected data and to determine the number of responses belonging to each category, frequency tables and charts were used.

The procedure used in analyzing of data was aimed at establishing the relative importance of the various factors that causing cost control problems, its effect, improvement mechanisms and current cost control management practices of construction projects in Addis Ababa.

In the analysis, the "Relative Importance Index" methods were adopted to determine the ranking relative importance of variables for construction projects undertaken at Addis Ababa. The method adopted in this study within various groups of respondents (Clients, Consultants and Contractors). The five-point scale (0, 1, 2, 3, and 4) was used to calculate the relative importance index for each variable which was then used to determine the relative ranking. Spearman's Rank Correlation Coefficient method, which number varies between -1 and +1, was used to know owners, consultants and contractors' perceptions of factors causing cost overruns, its effect, and Current methods to manage/administer cost control problems on construction projects.

The five-ordinal measure of agreement of Likert scale represents the following rating:

Ordinal scale used for the measurement of rate of occurrence for factors causing price escalation: Never (0) Seldom (1) Sometimes (2) Often (3) Always (4).

Ordinal scale used for the measurement of the degree of significances for effects of price escalation on public building construction projects: No significance (0) Minor significance (1) Average significance (2) High significance (3) Extreme significance (4).

Ordinal scale used for the measurement of the degree of importance of methods to manage/administer price escalation on AA city public building construction projects:
Unimportant (0) less important (1) Important (2) Very important (3) Extremely important (4).

Regression analysis- is a set of statistical methods used for the estimation of relationships between a dependent variable and one or more independent variables.
Correlation analysis- used to study the strength of a relationship between two, numerically measured, continuous variables (e.g. height and weight)
Ordinal Scale – Values are rank ordered. e.g. good, better, worse; cold, colder, coldest.

3.7 Method Data presentation

This chapter presents the analysis, discussions, and findings on causes of cost overrun in a construction project. This was guided by the objectives to present empirical evidence to agree or controvert. The researcher administered questionnaires to collect the data that was analyzed using SPSS to be able to come up with the results presents here. Descriptive statistics have been used to describe respondents' characteristics. The further regression analysis has been used to determine the impact the independent variables have on the dependent variable.

3.8. Research ethics

The researcher is going to approach with respondents in order to creating awareness about the objectives of the study and provided enough orientation how to react to the questions by contacting each respondent. The questionnaire was distributed with enough time for returning back so that it was possible to get qualified data and the interview were made at due time and place on the interests of the respondents. The ethical issues are at each stage of a research process and the researcher gave due attention because of the nature of the study area. To undertake the research, necessary approval and permit obtained from the respondents and a covering letter attached to the questionnaire ensuring participant's secrecy or confidentiality that information is obtained from them cannot be disclose to the third party. Hence, the respondent's rights to privacy, to be fully

informed consent or permission and confidentiality or silence was addressed individually. In addition the data collected from secondary sources were fully cited to avoid plagiarism and to respect the intellectual property of each author. This research was made on such basis by taking due attention to guidelines for the responsible conduct of research; among others honesty, objectivity, integrity, carefulness, openness, respect for Intellectual Property, confidentiality, responsible publication, legality, and subjects protection.

3.9. Validation

For measuring what actually is proposed to be measured with accurate and precise measurement procedure; the study used reliable and mostly recent sources of information. Questionnaire that is with close ended questions and a desk study were developed so that the results of the data can be easily comparable. Generally, to ensure the quality of research and make it credible for the scientific community; the researcher will give due care to both validity and reliability issues of the data, the research process in general as well as the research output. The questionnaires reliability was checked by the Cornbrash's alpha test coefficient using SPSS software and the gained result will be compared with the recommended cut-off value 0.7.

Therefore, based on the test, the results for the items reliability and validity will be tested and compared to recommended and acceptable limits.

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CHAPTER FOUR: RESULTS AND DISCUSSION

4.1. Socioeconomic description and Response rate of respondents

4.1.1 Socioeconomic description

Sample description deals with several important issues closely connected with the purpose of current research. It helps to forecast general validity and reliability of data collected from the respondents. The data contains responses of highly experienced participants which works in companies of different size and operated in different parts of the country and moreover all the respondents deal with construction projects might be able to provide relevant data in order to answer research questions, The respondents profile includes respondent's type or origin in the organization, Experience on construction projects and number of construction projects executed. Large numbers of questionnaires were distributed for Clients (27 questionnaires), and therefore, the researcher concludes that the 27 questionnaires may represent the client's perception towards this research questions. While Contractors and Consultants takes nearly equal numbers of questionnaires 23 and 22 questionnaires respectively. Therefore these distribution of the questionnaire makes the sample unbiased.

Table 4. 1 Questionnaire distribution

Respondent category	**Distribution**	**Frequency (No of response)**	**Percentage**	**Cumulative**	**Response rate, %**
Client	27	22	30.56	30.56	81.48
Contractor	23	20	27.78	58.34	86.96
Consultant	22	19	26.39	84.72	86.36

The overall response rate for the survey was 61 (84.72%). The response rate in the survey was 19 (86.36%) for consultants, 20 (86.96%) for Contractors, 22 (81.48%).Table 4.1, Shows that among 72 questionnaire respondent's 19 (26.39%) were Consultants, 20 (27.78%) were Contractors, 22(30.56%) were Clients, therefore most of the respondents were clients, contractors and consultants have nearly equal respondents.

4.1.2.2. Experience of Respondents

Table 4.2 shows that 32.79% (20) of the respondent's firm have experience less than 5 years at public building construction works, 54.1% (33) of respondents have experience between 6 to 10 years, 13.11% (8) of respondents have experience from 10 to 15 years and there is no respondent participated with experience more than fifteen years in the questionnaire survey.

Table 4. 2. Experience of respondents (years)

Experience in years	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Less than 5 years	20	32.79	32.79	32.79
From 6 to 10 years	33	54.1	54.1	86.89
From 10 to 15 years	8	13.11	13.11	100
More than 15 years	0	0	0	
Total	61	100	100	

Table 4.3 shows that for this study 32.79% (20) of the respondents execute in less than 5 construction projects, 42.62% (26) of the respondents had executed in between 6-10 projects, and 24.59% (15) of the respondents execute more than 10 projects in their past and current experience.

Table 4. 3 Experience of respondents on number of projects executed

Frequency (projects)	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
< 5 years	20	32.79	32.79	32.79
6-10 years	26	42.62	42.62	75.41
> 10 years	15	24.59	24.59	100
Total	61	100	100	100

4.1.2 Response rate of respondents

Detailed self-administered questionnaires were designed and distributed for the assessment of the influencing factors of cost control practices and the current cost controlling methods in construction projects, for this purpose the questionnaires were distributed to major stakeholders in the construction industry; these are contractors, consultants, and clients. To make the analysis more

comprehensive a total of 72 questionnaires were distributed to consultants, contractors, and clients (project owners), and 61 questionnaires (84.72%) were filled and returned. Table 4.1 below shows the number of questionnaires distributed to clients, consultants, and contractors, and the number of questionnaires returned from these stakeholders including their percentage response rate. Although the results mentioned below may not represent the whole projects under Addis Ababa construction network, respondents were presented with a range of questions designed to identify factors influencing cost control practices, and the methods used to minimize/mitigate construction project costs.

4.2 Cost Control Practice in Construction Projects in Addis Ababa

The current cost control practices in construction project in Addis Ababa were investigated based on the responses received from the client, contractors and consultants.

A. Responses from the Client

Table 4-4. Respondents Level of Understanding (client)

No	Respondents	Expert level understanding	Well understanding	Average understanding	Don't understand	Total
1	Client	2	12	8		22

Table 4-5. Respondents Frequency of Cost Control Practice (client)

FREQUENCY OF COST CONTROL PRACTICE							
No	Respondents	Daily	Weekly	Monthly	Quarterly	Other	Total
1	Client		2	7	11	2	22

Table 4-6 Respondents Techniques Used in Cost Control Practice (client)

TECHNIQUES USED IN COST CONTROL PRACTICE						
No	Respondents	Overall profit and loss	EVM	EAC & BAC	Other	Total
1	Client		5	17		22

The questionnaire result obtained from the client indicated that 2 (9%) of the respondents have an expert level of understanding about cost controls 12 (54.55%) of the respondents have a well understanding about cost control, 8 (36.45%) have an average understanding about cost control in the construction process. Also the entire respondent carries out cost control during the construction process. The result shows that 5 (23%) of the respondents practice cost control all the time, 6 (27%) responded most of the time, and also 7 (32%) of the respondents practice cost control sometimes in their respective projects. It is also investigated that 2 (9%) of the respondents practice to measure the project cost on a daily basis, 7 (32%) of the respondents measure their construction project cost monthly, 11 (50%) of the respondents measure cost quarterly and 2 (9%) have no fixed time for construction projects cost measurement and control. According to the respondent data, 17 (77%) of the respondent apply estimate at completion and budget at completion technique to control the construction project cost, while 5 (23%) of the respondents uses earned value analysis management technique. Moreover, all the respondents responded that they use20 (91%) of the respondents use MS-excel software package to control the Project costs, while 2 (9%) use MS-project. At the end, about 15 (68%) of the respondents reacted that their cost control practice was not so effective whereas 7 (32%) responded somewhat effective.

Responses from the Contractors

Table 4-4. Respondents Level of Understanding (contracto)

No	Respondents	Expert level understanding	Well understanding	Average understanding	Don't understand	Total
1	Contractor	3	11	6		20

Table 4-5. Respondents Frequency of Cost Control Practice (contracto)

FREQUENCY OF COST CONTROL PRACTICE							
No	Respondents	Daily	Weekly	Monthly	Quarterly	Other	Total
1	Contractor	2	3	10	4	1	20

Table 4-6 Respondents Techniques Used in Cost Control Practice (contracto)

TECHNIQUES USED IN COST CONTROL PRACTICE						
No	Respondents	Overall profit and loss	EVM	EAC & BAC	Other	Total
2	Contractor	12	3	5		20

The questionnaire results obtained from the Contractor indicated that 11 (55%) have a well understanding of construction project cost control, 6 (30%) of the respondents have an average understanding about their construction project cost control and 3 (15%) of the respondents have an expert understanding about cost control in the construction process. Results also indicated that 13 (65%) of the respondents carry out cot control most of the time, 4 (20%) of the respondents practice cost control all the time while 3 (15%) responded sometimes due to reluctance to the work and difficulty to collect and obtain reliable cost data.

The frequency of cost control measurement result indicated 10 (50%) of the respondents measure the project cost in a monthly basis, 4 (25%) of the respondents measure quarterly, 3 (15%) of the respondents also measure the project cost weekly, 2 (10%) of the respondent measure daily, 1 (5%) measure any time. According to the respondent data, 12 (60%) of the respondent apply overall profit and loss of the contract, 5 (25%) practice forecast/estimate at completion and budget at completion technique, while 3 (15%) of the respondents uses earned value analysis management technique, and therefore this indicates that most contractors practice cost control process without detailed analysis and documentations of cost control. It was also found that 4(20%) of the respondents use the MS-excel software package for cost control, while 15 (75%) of the respondents use MS-project, and 1 (5%) use primavera. However, the application of the MS-project and primavera was used as a time control software, they described it as controlling the time is controlling the cost.

Additionally, the effectiveness of cost control was investigated, and the results indicated that 5 (25%) of the respondents were very effective, 8 (40%) were somewhat effective, 7 (35%) responded not so effective.

Therefore, the results indicated that more than half of the respondents of the contractors have confirmed the presence of cost control practice gaps and effectiveness with respect to the results of cost control practices they are employing due to factors beyond their control.

Responses from the Consultant

Table 4-4. Respondents Level of Understanding (consultant)

No	Respondents	Expert level understanding	Well understanding	Average understanding	Don't understand	Total
1	Consultant	2	8	7	2	19

Table 4-5. Respondents Frequency of Cost Control Practice (consultant)

FREQUENCY OF COST CONTROL PRACTICE							
No	Respondents	Daily	Weekly	Monthly	Quarterly	Other	Total
1	Consultant			15	2	2	19

Table 4-6 Respondents Techniques Used in Cost Control Practice (consultant)

TECHNIQUES USED IN COST CONTROL PRACTICE						
No	Respondents	Overall profit and loss	EVM	EAC & BAC	Other	Total
1	Consultant			14	3	19

The questionnaire result obtained from the consultant indicated that 3 (15.78%) of the respondents have expert understanding of cost control, 7 (38%) of the respondents have an average understanding of cost control, 8 (42%) have a well understanding of cost control, 2and 1 (5.26%) have no understanding about cost control in the construction process. Results also indicated that 17 (89%) of the respondents carry out cost control throughout the project while 2 (11%) have not practice cost control. Results also indicated 9 (47%) of the respondents practice cost control most of the time, 5 (26%) of the respondents practice cost control all the time, 2 (11%) responded sometime and 1 (5%) responded rarely and 2 (11%) of the respondent never control project cost. The respondents' indicated that they believe controlling the cost of the project is the contractors' duty, while the consultant is expected to control the variation amounts from the contract also in some consultant firms skilled experts are not assigned on positions to execute cost controls. They also indicated that the contractor has to control in detail and manage the expenses and profit of the project. The respondents' result also indicated 15 (79%) of the respondents measure the project

cost on a monthly basis, 4 (21%) of the respondents check and measure on quarterly basis or at any time when measurement is required, and no fixed time for cost control, also most consultants believe that the control of cost is only contractors duty and the main benefited party from this task is contractor contrary to the reality.

According to the respondent data, 14 (74%) of the respondents practice forecast/estimate at completion and budget at completion technique, while 3 (16%), of the respondent check variation amount of the specific item of work with the contract, while 2 (10%) of the respondents do nothing. It was also found that 12 (63%) of the respondents use the MS-excel software package for cost control and 5 (26%) of the respondents use MS-project to compare the project variation amount and planned amount.

Accordingly, the effectiveness of the project cost control practice was investigated, 6 (32%) of the respondents were somewhat effective, and 9 (47%) were not so effective, whereas 2 (10%) were very effective.

The overall response rate of the parties under survey

In table 4.4 below, the overall parties' response outcome on cost control practice indicated that 31 (51%) of the respondents have a well understanding about cost control practices, 21 (35%) of the respondent have an average understanding about cost control, 7 (11%) of the respondents have expert understanding and 2 (3%) have not totally understood cost control in the construction process.

About 55 (90%) of the respondents carry out cost control throughout the project while 6 (10%) have not practice cost control and they believe that cost control requires additional cost and time, difficult to collect the cost data, and requires expertise. In addition, reluctance and negligence to the work was also the problem in cost control. The overall parties result indicated that majorities of the respondents have well understanding about cost control irrespective of the output of their cost control practices.

Table 4-4. Respondents Level of Understanding

No	Respondents	Expert level understanding	Well understanding	Average understanding	Don't understand	Total
1	Client	2	12	8		22
2	Contractor	3	11	6		20
3	Consultant	2	8	7	2	19
	Overall respondent	7	31	21	2	61

Table 4-5. Respondents Frequency of Cost Control Practice

FREQUENCY OF COST CONTROL PRACTICE							
No	Respondents	Daily	Weekly	Monthly	Quarterly	Other	Total
1	Client		2	7	11	2	22
2	Contractor	2	3	10	4	1	20
3	Consultant			15	2	2	19
	Overall respondent	2	5	32	17	5	61

In table 4.5 above, the result indicated 32 (52%) of the respondents measure the project cost on a monthly basis, 5 (8%) measure any time measurement is required, 17 (28%) of the respondents measure quarterly, 5 (8%) of the respondents measure by weekly, 2 (3%) of the respondents measure daily. The result indicted the majorities of the respondent from contractor and client carryout cost control in a monthly basis and from client on quarterly basis, this shows more focus on cost control practices were made by contractors and consultants respectively and the concern of clients on the matter is less compared to contractors.

The techniques observed and applied in the investigated/surveyed construction projects for cost control practice are:

- Overall profit and loss: the comparisons between the total expenses invest for the project and the profit obtained at the end of execution.
- EVM: it compares the baseline plan to actual schedule and cost performance.
- EAC & BAC: actual cost incurred for work completed plus an estimate complete the remaining work.

Table 4-6 Respondents Techniques Used In Cost Control Practice

TECHNIQUES USED IN COST CONTROL PRACTICE						
No	Respondents	Overall profit and loss	EVM	EAC & BAC	Other	Total
1	Client		5	17		22
2	Contractor	12	3	5		20
3	Consultant			14	3	19
	Overall respondent	12	8	36	5	61

In addition, table 4-6 above reveals the respondents survey that 36 (59%) of the respondent practice forecast/estimate at completion and budget at completion technique, 12 (20%) of the respondent apply overall profit and loss of the contract, 8 (13%) of the respondents uses earned value analysis management technique, and 3 (5%) of the respondent check variation amount of the specific item of work with the contract. The result indicated the total overall profit and loss of the work done method of measurements were mostly applied technique by contractor, and the majorities of clients and consultants practices EAC & BAC technique to control project cost. The overall respondent result indicated EAC & BAC were the most applied technique by the respondents. EVM is the least used techniques that the respondents state that most of the time the monitoring, evaluation and controlling methods and the data collected from the site were not reliable.

From the table 4-7 below it was also investigated that 36 (59%) of the respondents use MS-excel software package for cost control and 22 (36%) of the respondents use MS-project and 1 (2%) use primavera, while 2 (3%) of respondents do not use any software. However, the application of the MS-project and primavera was used as planned and executed amount controlling software mostly in contractors.

Table 4-7 Respondents Software Application for Cost Control Practice

SOFTWARES APPLIED IN COST CONTROL PRACTICE						
No	Respondents	MS-Excel	MS-project	Primavera	Other	Total
1	Client	20	2			22
2	Contractor	4	15	1		20
3	Consultant	12	5		2	19
	Overall respondent	36	22	1	2	61

In the table 4.8 below, the finding from the respondents identified that 21 (34%) of the respondents were somewhat effective, 31 (51%) were not so effective, 7 (12%) were very effective and 2 (3%) were not at all effective.

The overall result of the respondents from the questionnaire and analysis of the results indicated that cost control practices in construction projects in Addis Ababa has many gaps to be filled by knowledge and project management processes. Therefore, each party has to train the personals and hire cost control personnel to improve the cost control practices must use practical and modern software to practice cost controls and budget management in construction projects.

Table 4-8 Effectiveness on Cost Control Practice

EFFECTIVENESS ON COST CONTROL PRACTICE						
Respondents	Extremely effective	Very effective	Somewhat effective	Not so effective	Not at all effective	Total
Client			7	15		22
Contractor		5	8	7		20
Consultant		2	6	9	2	19
Overall respondent		7	21	31		61

4.3 Factors Influencing Cost Control in Construction Projects

The major factors influencing cost control in construction projects in Addis Ababa were determined using a five point Likert scale, namely not a factor=1, insignificant factor=2, somewhat a factor=3, significant factor=4, and major factor=5. The cost minimization methods were ranked by comparing their relative index.

This section deals with the analysis of the information gathered from the questionnaire survey including identification of rate of occurrences of factors influencing cost controls of construction projects. The factors were grouped into five groups; these groups are planning and designing related factors, cost related factors, external factors, project characteristics, and personal related factors. Lists of factors influencing construction cost control practices were presented to the respondents to score them according to the rate of occurrence on the scale of 1 to 5. Here under each individual factors influencing construction cost control practices, Relative Importance Index (RII) perceived by all respondents was computed for overall analysis.

Clients Perspective

From the ranking assigned to each factors influencing construction cost control practices, 8 the most important ones contributing major problem on the process of cost control practices on construction projects were identified below with RII value (0.93-0.79, and ranking 1-8), and tabulated on table 4-9 below.

Table 4-9 Frequency of Factors Influencing Cost Control Practice from the Clients Group

No.	Factors Influencing cost control practice	RII	Rank
1	Change of currency/exchange rate fluctuation	0.93	1
2	Construction material cost fluctuation	0.91	2
3	Market conditions /inflation factor	0.90	3
4	Dependency on imported materials	0.887	4
5	Design change	0.86	5
6	Inaccurate evaluation of projects	0.84	6
7	Size and types of a construction project	0.80	7
8	Construction site ground condition	0.79	8

From Table 4.9 above, we can see that the respondent's response to factors influencing cost control in construction projects with respect to each questionnaire survey factor were analyzed and ranked by computing and comparing their respective RII. Accordingly the respondents of clients ranked the construction project cost control influencing factors as: Change of currency/exchange rate fluctuation with RII value 0.93 as the most influencing factor to, Construction material cost

fluctuation with RII value 0.91, Market conditions/inflation factor with RII value 0.90,Dependency on imported materials with RII value 0.89, Design changes with RII value 0.86,Inaccurate evaluation of projects with RII value 0.84,Size and types of a construction project with RII value 0.80, and Construction site ground condition with RII value 0.79 as the 8th construction cost control influencing factors.

Generally, the result indicated cost related factors with (RII=0.86) were the major factors influencing cost control practices and followed by planning and designing factors with (RII=0.80), personal related factors (RII=0.73), project characteristics (RII=0.72), and external factors (RII=0.82).

Contractor Perspective

From the ranking assigned to each factors influencing construction cost control practices, 8 the most important ones contributing major problem on the process of cost control practices on construction projects were identified below with RII value (0.97-0.84, and ranking 1-8), and tabulated on table 4-10 below.

Table 4-10 Frequency of Factors Influencing Cost Control Practice from the Contractor Group

No.	Factors Influencing cost control practice	RII	Rank
1	Market conditions /inflation factor	0.97	1
2	Construction material cost fluctuation	0.95	2
3	Scope changes	0.92	3
4	Construction site ground condition	0.91	4
5	Change of currency/exchange rate fluctuation	0.90	5
6	Unpredictable weather conditions	0.88	6
7	Dependency on imported materials	0.87	7
8	Inaccurate evaluation of projects	0.84	8

From Table 4.10 above, we can see that the respondent's response frequency to factors influencing cost control in construction projects with respect to each questionnaire survey factor were analyzed and ranked by computing and comparing their respective RII. Accordingly the respondents of contractor group ranked the construction project cost control influencing factors as: Market

conditions /inflation factor with RII value 0.97 as the most influencing factor to, Construction material cost fluctuation with RII value 0.95, Scope changes with RII value 0.92,Construction site ground condition with RII value 0.91, Change of currency/exchange rate fluctuation with RII value 0.90,Unpredictable weather conditions with RII value 0.88,Dependency on imported materials with RII value 0.87, and Inaccurate evaluation of projects with RII value 0.84 as the 8th construction cost control influencing factors.

Generally, the result indicated cost related factors with (RII=0.89) were the major factors influencing cost control practices and followed by planning and designing factors with (RII=0.87), personal related factors (RII=0.78), project characteristics (RII=0.70), and external factors (RII=0.83).

Consultant Perspective

From the ranking assigned to each factors influencing construction cost control practices, 8 the most important ones contributing major problem on the process of cost control practices on construction projects were identified below with RII value (0.94-0.80, and ranking 1-8), and tabulated on table 4-11 below.

Table 4-11 Frequency of Factors Influencing Cost Control Practice from the Consultant Group

No.	Factors Influencing cost control practice	RII	Rank
1	Market conditions /inflation factor	0.94	1
2	Construction material cost fluctuation	0.92	2
3	Discrepancies in contract document	0.91	3
4	Scope changes	0.90	4
5	Change of currency/exchange rate fluctuation	0.89	5
6	Management factors	0.85	6
7	Dependency on imported materials	0.83	7
8	Size and types of a construction project	0.80	8

From Table 4.11 above, we can see that the respondent's response frequency to factors influencing cost control in construction projects with respect to each questionnaire survey factor were analyzed and ranked by computing and comparing their respective RII. Accordingly the respondents of

consultant group ranked the construction project cost control influencing factors as: Market conditions /inflation factor with RII value 0.95 as the most influencing factor to, Construction material cost fluctuation with RII value 0.92, Discrepancies in contract document with RII value 0.91,Scope changes with RII value 0.90, Change of currency/exchange rate fluctuation with RII value 0.89,Management factors with RII value 0.85,Dependency on imported materials with RII value 0.83, and Size and types of a construction project with RII value 0.80 as the 8th construction cost control influencing factors.

Generally, the result indicated cost related factors with (RII=0.90) were the major factors influencing cost control practices and followed by planning and designing factors with (RII=0.89), personal related factors (RII=0.73), project characteristics (RII=0.71), and external factors (RII=0.85).

Overall Perspective

From the ranking assigned to each factors influencing construction cost control practices, by all respondents client, contractor and consultant the 8 the most important ones contributing major problem on the process of cost control practices on construction projects were identified below with RII value (0.94-0.817, and ranking 1-8), and tabulated on table 4-12 below.

Table 4-12 Frequency of Factors Influencing Cost Control Practice from the Overall Group

No.	Factors Influencing cost control practice	RII	Rank
1	Market conditions /inflation factor	0.94	1
2	Construction material cost fluctuation	0.93	2
3	Change of currency/exchange rate fluctuation	0.91	3
4	Scope changes	0.87	4
5	Dependency on imported materials	0.86	5
6	Discrepancies in contract document	0.83	6
7	Size and types of a construction project	0.82	7
8	Inaccurate evaluation of projects	0.817	8

From Table 4.12 above, we can see that the respondent's response frequency to factors influencing cost control in construction projects with respect to each questionnaire survey factor were analyzed

and ranked by computing and comparing their respective RII. Accordingly the respondents of all (client, contractor, consultant) group ranked the construction project cost control influencing factors as: Market conditions /inflation factor with RII value 0.94 as the most influencing factor, Construction material cost fluctuation with RII value 0.93, Change of currency/exchange rate fluctuation with RII value 0.91,Scope changes with RII value 0.87, Dependency on imported materials with RII value 0.86,Discrepancies in contract document with RII value 0.83,Size and types of a construction project with RII value 0.82, and Inaccurate evaluation of projects with RII value 0.817 as the 8th construction cost control influencing factors.

Generally, the result indicated cost related factors with (RII=0.87) were the major factors influencing cost control practices and followed by planning and designing factors with (RII=0.79), personal related factors (RII=0.74), project characteristics (RII=0.71), and external factors (RII=0.77).

Finally, the spearman correlation coefficient is calculated to test the correlation between consultant-contractor, consultant-client, client-contractor using Equation 3.2 and the results of calculation results with Summary of correlation test on the ranking on factor Influencing cost control practices as:

Consultant VS Contractor…….0.9785…….very strong relation of respondents

Consultant VS Client……0.9776…….very strong relation of respondents

Contractor VS Client……0.9589…….very strong relation of respondents

This correlation results above indicated a strong correlation between the attitudes of the respondents' parties in all the three groups with respect factors influencing construction project costs.

4.4 Methods of Construction Cost Minimization in Construction Projects

The major methods employed to minimize/mitigate construction costs in construction projects in Addis Ababa were determined using a five point Likert scale, namely not a factor=1, insignificant factor=2, somewhat a factor=3, significant factor=4, and major factor=5. The cost minimization methods were ranked by comparing their relative index.

This section deals with the analysis of the information gathered from the questionnaire survey including identification of rate of occurrences of factors for best minimization of construction projects costs. The factors were grouped into three groups; these groups are planning related factors, organizational related factors, and controlling and monitoring related factors. Lists of

factors that best favors construction project cost minimization practices were presented to the respondents to score them according to the rate of occurrence on the scale of 1 to 5. Here under each individual factors/practices that best favors the methods of minimizing construction project costs, Relative Importance Index (RII) perceived by all respondents were computed for overall analysis.

Clients Perspective

From the ranking assigned to each factors influencing construction cost control practices, 8 the most important methods contributing to minimization of construction project costs were identified below with RII value (0.92-0.72, and ranking 1-8), and tabulated on table 4-9 below.

Table 4-13 Frequency of Methods of Construction Cost Minimization from the Clients perspective

No.	Methods of Construction Cost Minimization	RII	Rank
1	Inspecting and evaluating the actual and budgeted cost of work	0.92	1
2	Periodical monitoring of the project costs performance	0.90	2
3	Good work planning	0.89	3
4	Controlling procurement	0.86	4
5	Efficiently scheduling labor, materials, and equipment, etc.	0.81	5
6	Take corrective action to minimize cost overruns	0.78	6
7	Properly organizing, productivity improving techniques	0.76	7
8	Minimizing rework through timely quality control	0.72	8

From Table 4.13 above, we can see that the respondent's response to factors that best favor construction project cost minimization in construction projects with respect to each questionnaire survey were analyzed and ranked by computing and comparing their respective RII, and 8 the most important one's are selected. Accordingly the respondents of clients ranked the construction project cost minimization methods as: Inspecting and evaluating the actual and budgeted cost of work with RII value 0.92 as the most and best method ,Periodical monitoring of the project costs performance with RII value 0.90, Good work planning with RII value 0.89,Controlling procurement with RII value 0.86, Efficiently scheduling labor, materials, and equipment, etcwith

RII value 0.81,Take corrective action to minimize cost overruns with RII value 0.78,Establishing baselines (mission, or goal) with RII value 0.76, and Minimizing rework through timely quality control with RII value 0.72 as the 8th construction cost minimizing methods

Generally, the analysis of the client respondents perspectives on cost minimization methods used in construction projects ranked as: planning related with (RII=0.85) was the leading best method to control/minimize cost and followed by controlling and monitoring related methods with (RII=0.84) and organizing with (RII=0.71).

Contractor Perspective

From the ranking assigned to each factors best contributing to project cost control/minimization practices, the most important 8 contributing factors of cost control practices on construction projects were identified below with RII value ranging (0.98-0.86, and ranking 1-8), and tabulated on table 4-14 below from the contractors respondent perspectives.

Table 4-14 Frequency of Methods of Construction Cost Minimization from the Contractor perspective

No.	Methods of Construction Cost Minimization	RII	Rank
1	Efficiently scheduling labor, materials, and equipment, etc.	0.98	1
2	Periodical monitoring of the project costs performance	0.96	2
3	Properly organizing, productivity improving techniques	0.93	3
4	Inspecting and evaluating the actual and budgeted cost of work	0.92	4
5	Value engineering	0.90	5
6	Take corrective action to minimize cost overruns	0.88	6
7	Monitoring and improving field labor productivity using advanced Techniques	0.87	7
8	Minimizing rework through timely quality control	0.86	8

From Table 4.14 above, we can see that the contractor respondent's response ranking frequency to factors most important to cost control/minimize in construction projects with respect to each

questionnaire survey factor were analyzed and ranked by computing and comparing their respective RII and the 8 most contributing factors are identified. Accordingly the respondents of contractor group ranked the construction project cost control/minimization methods as: Efficiently scheduling labor, materials, and equipment, etc. factor/method with RII value 0.98 as the most important factor/method, Periodical monitoring of the project costs performance with RII value 0.96, Properly organizing, productivity improving techniques with RII value 0.93, Inspecting and evaluating the actual and budgeted cost of work with RII value 0.92, Value engineering with RII value 0.90, Take corrective action to minimize cost overruns with RII value 0.88, Monitoring and improving field labor productivity using advanced techniques with RII value 0.87, and Minimizing rework through timely quality control with RII value 0.86 as the 8^{th} construction cost control/minimization method/factors.

Generally, the analysis of the contractor respondents perspectives on cost minimization methods used in construction projects ranked as: controlling and monitoring related with (RII=0.898) was the leading best method to control/minimize cost and followed by planning related methods with (RII=0.86) and organizing with (RII=0.77).

Consultant Perspective

From the ranking assigned to each factors best contributing to project cost control/minimization practices, the most important 8 contributing factors of cost control practices on construction projects were identified below with RII value ranging (0.98-0.86, and ranking 1-8), and tabulated on table 4-15 below from the contractors respondent perspectives.

Table 4-15 Frequency of Methods of Construction Cost Minimization from the Consultants perspective

No.	Methods of Construction Cost Minimization	RII	Rank
1	Efficiently scheduling labor, materials, and equipment, etc.	0.97	1
2	Inspecting and evaluating the actual and budgeted cost of work	0.96	2
3	Properly organizing, productivity improving techniques	0.94	3
4	Take corrective action to minimize cost overruns	0.92	4
5	Careful selection & training of workers and managers	0.91	5
6	Periodical monitoring of the project costs performance	0.90	6
7	Monitoring and improving field labor productivity using advanced Techniques	0.89	7
8	Minimizing rework through timely quality control	0.87	8

From Table 4.15 above, we can see that the consultant group respondent's response ranking frequency to factors most important to cost control/minimize in construction projects with respect to each questionnaire survey factor were analyzed and ranked by computing and comparing their respective RII value and 8 most contributing factors were identified. Accordingly the respondents of consultant group ranked the construction project cost control/minimization methods as: Efficiently scheduling labor, materials, and equipment, etc. factor/method with RII value 0.97 as the most important factor/method, Inspecting and evaluating the actual and budgeted cost of work with RII value 0.96, Properly organizing, productivity improving techniques with RII value 0.94, Take corrective action to minimize cost overruns with RII value 0.92, Careful selection & training of workers and managers with RII value 0.91, Periodical monitoring of the project costs performance with RII value 0.90, Monitoring and improving field labor productivity using advanced techniques with RII value 0.89, and Minimizing rework through timely quality control with RII value 0.87 as the 8^{th} construction cost control/minimization method/factors.

Generally, the analysis of the contractor respondents perspectives on cost minimization methods used in construction projects ranked as: controlling and monitoring related with (RII=0.88) was the leading best method to control/minimize cost and followed by planning related methods with (RII=0.86) and organizing with (RII=0.82).

Overall Perspective

From the ranking assigned to each factors that best suits for construction project cost control/method practices, by all respondents client, contractor and consultant 8 most important ones contributing the most on construction project cost control process were identified based on the respondents perspectives on construction projects with RII value ranging from (0.9333-0.82, and ranking 1-8), and tabulated on table 4-16 below.

Table 4-16 Frequency of Methods of Construction Cost Minimization from the overall perspective

No.	Methods of Construction Cost Minimization	RII	Rank
1	Inspecting and evaluating the actual and budgeted cost of work	0.93333	1
2	Efficiently scheduling labor, materials, and equipment, etc.	0.92	2
3	Periodical monitoring of the project costs performance	0.92	3
4	Properly organizing, productivity improving techniques	0.88	4
5	Take corrective action to minimize cost overruns	0.86	5
6	Good work planning	0.8533	6
7	Monitoring and improving field labor productivity using advanced Techniques	0.8233	7
8	Minimizing rework through timely quality control	0.82	8

From Table 4.16 above, we can see that the respondent's response frequency to factors that best suit to cost control/method in construction projects with respect to the responses of contractors, client and consultant group to each questionnaire survey factor were analyzed and ranked by computing and comparing their respective RII. Accordingly the respondents of all (client, contractor, consultant) group ranked the construction project cost control/minimization methods as: Inspecting and evaluating the actual and budgeted cost of work factor with RII value 0.9333 as the most influencing factor, Efficiently scheduling labor, materials, and equipment, etc. with RII value 0.92, Periodical monitoring of the project costs performance with RII value 0.92, Properly organizing, productivity improving techniques with RII value 0.88, Take corrective action to minimize cost overruns with RII value 0.86, Good work planning with RII value 0.8533, Monitoring and improving field labor productivity using advanced techniques with RII value

0.8233, and Minimizing rework through timely quality control with RII value 0.82 as the 8th construction cost control influencing factors.

Generally, the analysis of the contractor, consultant, and client group overall respondents perspectives on cost minimization methods used in construction projects ranked as: controlling and monitoring related with (RII=0.86) was the leading best method to control/minimize cost and followed by planning related methods with (RII=0.81) and organizing with (RII=0.879).

Finally, the spearman correlation coefficient is calculated to test the correlation between consultant-contractor, consultant-client, client-contractor using Equation 3.2 and the results of calculation and iteration results with Summary of correlation test on the ranking on factor Influencing cost control practices as:

Consultant VS Contractor…….0.91585…….very strong relation of respondents

Consultant VS Client……0.92376…….very strong relation of respondents

Contractor VS Client……0.87389…….very strong relation of respondents

This correlation results above indicated a strong correlation between the attitudes of the respondents' parties in all the three groups with respect factors used to mitigate construction project costs control/minimizations.

For measuring what actually is proposed to be measured with accurate and precise measurement procedure; the study used reliable and mostly recent sources of information. Questionnaire that is with close ended questions and a desk study were developed so that the results of the data can be easily comparable. Generally, to ensure the quality of research and make it credible for the scientific community; the researcher will give due care to both validity and reliability issues of the data, the research process in general as well as the research output. The questionnaires reliability was checked by the Cronbach's alpha test coefficient using SPSS software and the gained result will be compared with the recommended cut-off value 0.7.

Therefore, based on the test, the results for the items reliability and validity will be tested and compared to recommended and acceptable limits.

4.5 Tests for Reliability of the Responses

Cronbach's alpha (Cα) test was used to check the reliability of the factors influencing cost control and methods of minimization for controlling project cost.

4.5.1. Test for Reliability on the Responses for Factors Influencing Cost Control in Construction Projects

Test for reliability on the client, contractor and consultant questionnaire responses Cronbach's alpha (Cα) test has been carried out for the factors influencing cost control in construction projects for all questionnaires and the results were compared with the recommended cut-off value 0.7.

The Reliability Result of the Client Respondents

The summary of the Cronbach's alpha (Cα) test for reliability tests performed(table 4-17) below shows that all of the responses of client groups on factors influencing cost Control in construction Projects were good with respect to the recommended cut-off value 0.7. This indicates that the client's response for all questionnaires (34) as a factors influencing cost control in construction projects are consistent and stable throughout a series of measurements.

Table 4-17 Summary of Cronbach Alpha Reliability Test Result for Client's Response on Factors Influencing Cost Control in Construction Projects

Reliability Statistics for Clients			
Cronbach's Alpha	**Cronbach's Alpha Based on Standardized Items**	**N of Items**	**Remark**
0.789	0.798	34	Good

The Reliability Result of the Contractor Respondents

The summary of the Cronbach's alpha (Cα) test for reliability tests performed (table 4-18) below shows that all of the responses of contractor groups on factors influencing cost Control in construction Projects were excellent with respect to the recommended cut-off value 0.7. This indicates that the contractor's group response for all questionnaires (34) as afactors influencing cost control in construction projects are consistent and stable throughout a series of measurements.

Table 4-18 Summary of Cronbach Alpha Reliability Test Result for Contractors' Response on Factors Influencing Cost Control in Construction Projects

Reliability Statistics for Contractors			
Cronbach's Alpha	**Cronbach's Alpha Based on Standardized Items**	**N of Items**	**Remark**
0.972	0.987	34	Exellent

The Reliability Result of the Consultant Respondents

Table 4-19 Summary of Cronbach Alpha Reliability Test Result for Consultants' Response on Factors Influencing Cost Control in Construction Projects

Reliability Statistics for Consultants			
Cronbach's Alpha	**Cronbach's Alpha Based on Standardized Items**	**N of Items**	**Remark**
0.972	0.987	34	Exellent

The summary of the Cronbach's alpha (Cα) test for reliability tests performed (table 4-19) above shows that all of the responses of consultant groups on factors influencing cost Control in construction Projects were very good with respect to the recommended cut-off value 0.7. This indicates that the consultant's group response for all questionnaires (34) as a factors influencing cost control in construction projects are consistent and stable throughout a series of measurements.

4.5.2. Test for Reliability on the Responses for Methods of Construction Cost Minimization

Test for the reliability on the client, contractor and consultant questionnaire responses, Cronbach's alpha (Cα) test has been carried out for Methods of Construction Cost Minimization in construction projects for all questionnaires and the results were compared with the recommended cut-off value 0.7.

The Reliability Result of the Client Respondents

The summary of the Cronbach's alpha (Cα) test for reliability performed (table 4-20) below shows that all of the responses of client groups on factors on methods of construction project cost minimization in construction Projects were very good with respect to the recommended cut-off value 0.7. This indicates that the client's response for all questionnaires (19) as a methods of

construction project cost minimization/cost control in construction projects are consistent and stable throughout a series of measurements.

Table 4-20Summary of Cronbach alpha reliability test result for Client's response on Methods of Construction Cost Minimization

Reliability Statistics for Clients			
Cronbach's Alpha	**Cronbach's Alpha Based on Standardized Items**	**N of Items**	**Remark**
0.889	0.896	19	Very good

The Reliability Result of the Contractors Respondents

Table 4-21Summary of Cronbach alpha reliability test result for Contractor's response on Methods of Construction Cost Minimization

Reliability Statistics for Contractors			
Cronbach's Alpha	**Cronbach's Alpha Based on Standardized Items**	**N of Items**	**Remark**
0.889	0.896	19	Very good

The summary of the Cronbach's alpha (Cα) test for reliability performed (table 4-21) above shows that all of the responses of contractor groups on factors on methods of construction project cost minimization in construction Projects were very good with respect to the recommended cut-off value 0.7. This indicates that the contractor's response for all questionnaires (19) as a methods of construction project cost minimization/cost control in construction projects are consistent and stable throughout a series of measurements.

The Reliability Result of the Consultants Respondents

The summary of the Cronbach's alpha (Cα) test for reliability performed (table 4-22) below shows that all of the responses of consultant groups on factors on methods of construction project cost minimization in construction Projects were very good with respect to the recommended cut-off

value 0.7. This indicates that the consultant's response for all questionnaires (19) as amethods of construction project cost minimization/cost control in construction projects are consistent and stable throughout a series of measurements.

Table 4-22Summary of Cronbach alpha reliability test result for Consultant's response on Methods of Construction Cost Minimization

Reliability Statistics for Consultants			
Cronbach's Alpha	**Cronbach's Alpha Based on Standardized Items**	**N of Items**	**Remark**
0.873	0.896	19	Very good

4.6. Analysis of Data from the Interview and Desk Study

The interviews were made between selected and well experienced professional engineers participating in the public building and private construction projects. The interview results indicated that currently the contractors, consultant and client have well understanding and awareness about the cost control in construction industry though they have different attitudes towards the issue.

However, the practice is not as effective as per their level of understanding in their respective construction projects. Most of the interviewed contractor's professionals reported that the total expenditure with value or overall profit and loss of the work done method of measurements were applied, and sometimes earned value methods of analysis were used to control the project cost on the monthly and quarterly basis. Some of the respondents practice cost control in a weekly basis though their efforts are not effective. Whereas, the client and consultant responded comparing the project budget based of bill of quantity and executed work is the common and traditional cost control practice which performs every time they like. They indicated this system helps to control the cost/ budget of the project with the recommended amount of the variation.

The interviewed respondents suggested that the major factors to influence control project cost were summarized as follows:

- Inflation makes difficult to determine/forecast construction resource budgets.
- The increase of price of the construction material and high escalations is at an alarming rate which is too high to be foreseen and estimated by any experienced contractor. This

incurs additional cost and thus contractors suffer financial losses, project delays, and conflict between the stakeholders.

- The exchange rate has increasing at a high rate from time to time and is not available on the market, thus most materials imported from abroad become greater challenge.
- Currently construction projects suffer from poor project management process and control system that leads to extended completion of projects beyond the planned completion time, cost and poor quality.
- Cost control requires proper data collection and data analysis, like the material, labor, and equipment utilized and the executed work properly. Then, it requires detailed analysisand evaluation between the income and expenses or profit and loss. This requires additional working times and personnel, which incur additional costs.
- Clients changing the scope of work more than acceptable limits varying the volume and quality of works without proper consultation with contractors that leads to cost and time overruns
- Additional works due to design change due to not incorporating in pre-tendering process and missing the items in the bill of quantity
- Lack of knowledge, motivation, and initiation from the staff to collect all the relevant information for monitoring and evaluation and data helps to measure the cost.

Moreover, the respondents have forwarded the following opinion for the success of project cost control:

- Proper planning and Prepare detail design with the locally available material as much as possible before tendering.
- The government has to control and supply the required hard currency and exchange rate.
- The contractors should fix their unit rates by forecasting the cost increment trend in the country and economic conditions conceiving the phenomenon to happen during contract period before signing the contractual agreements.
- Bulk purchase and mobilize the adequate material, during the commencement of the project considering the risk of thefts on project sites.
- Prepare complete design and drawing as per the client scope of the project work.
- Monitoring, evaluating and controlling the productivity of the labor and equipment and taking the necessary timely actions are the critical methods of cost control.

CHAPTER FIVE- CONCLUSIONS AND RECOMMENDATIONS

5. 1 CONCLUSIONS

The cost control practice methods in construction projects showed that the majority of the respondents have a well understanding of cost control and carry out cost control at different time using different methods and they witness that their cost controlling practices are not so effective. As contractors' responded more than half of respondents have a well understanding of cost control. The finding indicated all the respondents carry out cost control through the construction process. The majority carry out cost control most of the time on a monthly and quarterly basis, but some of the respondents carry out sometimes due to reluctance of the work and difficulty to collect the data.

According to the result of the consultants' majority of the respondents have an average understanding of cost control and a few of them have not totally understood cost control also some consultant group believe that cost controlling is only contractor's duty.

The majority carry out cost control throughout the project process on a quarterly basis.

Therefore, the result of the overall parties indicated that majorities of the respondents have an understanding of cost control and carry out cost control most of the time on a monthly basis.

The research response analysis also determines the tools and techniques practiced in the construction projects cost control.

The majority of the clients apply forecast/estimate at completion and budget at completion techniques to control the project cost by using the MS-excel software package. However, the result indicated that the cost control practice was not effective. The reasons for this was lack awareness, commitment, motivation, absence of accurate data and methods they apply.

The majority of the contractor respondents apply overall profit and loss of the contract by using the MS-excel software package. However, some use MS-project other minimum respondents who practice earned value analysis management technique, and some of them are extremely effective in cost control.

The consultants' response also indicated majorities apply forecast/estimate at completion and budget at completion technique of cost control by using MS-excel software package. However, they are not very effective in cost control practice.

The overall result indicated that applying earned value management technique can make the practice more effective than applying overall profit and loss of the contract, forecast/estimate at completion and budget at completion cost controlling technique, checking and comparing the variation amount.

Thus, cost controlling techniques has to apply all the time in a detail monitoring and evaluation system to minimize project cost and maximize profit.

The major findings related to factors influencing cost control of public building construction projects pointed out that the three parties, the overall response indicated market conditions /inflation factor, construction material cost, change of currency/ exchange rate, design change, and dependency on imported materials were the top five ranked factors affecting cost control in construction projects.

Therefore, it is concluded that cost-related factors were the major factors to control cost, followed by planning and designing, personal related, external factors, and project characteristics.

The findings related to factors influencing cost control of construction projects indicated that efficiently scheduling labor, materials, and equipment, good work planning, taking corrective action to minimize cost overruns, inspecting and evaluating the actual and budgeted cost of work, and minimizing rework through timely quality control were the major top-five ranked methods of construction cost control/minimization methods in construction projects. Additionally, the response from interviews and desk studies reveals that proper planning and scheduling, monitoring, evaluating, and controlling, and taking timely corrective action, giving training, and hiring competent project managers and teams were the major possible way-out to minimize construction project costs and avoid the related side effects.

5.2. Recommendations

Based on the findings of the study, the following recommendations have been forwarded:

- ✓ To minimize expense and maximize profit all the parties has to practice cost control in the projects by assigning professional's personnel who can monitor and evaluate the project cost, using suitable techniques/methods otherwise arrange training for all stakeholders.
- ✓ It is identified from the research analysis results that earned value management is a very effective technique in construction project cost control. Therefore, it recommended applying this technique by all stakeholders to be more effective in their cost controlling practices.
- ✓ The research analysis result indicated that cost-related factors are the most problems to control construction project costs, hence it is advisable to purchase construction material in bulk during the commencement of the work and protect it from theft in site.
- ✓ Apply effective and good work planning and measure the performance of the project at least monthly, and taking corrective actions to minimize construction costs.
- ✓ Further research to be carried out on cost control practice in all types of construction projects to minimize delay and cost overrun on the projects

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ADDIS COLLEGE

DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

M.SC IN CONSTRUCTION TECHNOLOGY MANAGEMENT

Assessment of project cost management methods: The case of public building construction in Addis Ababa

Dear Sir/Madam,

The purpose of this questionnaire is to obtain Current and Relevant professional Perceptions/Opinions/information from construction industry key actorson the current practice of project management control systems(cost control methods) inEthiopia construction industry context. The information provided will be kept confidential and used to research on the existing construction project management challenges encountered during project execution, and identify their consequential impacts to recommend the appropriate scientific solutions for the accelerated development of the sector in technological and implementation capacity and mitigate the associated problems such as cost overruns that affect most construction projects. Therefore this questionnaire is required to be filled with exact and relevant facts as much as possible. The study is undertaken by SurafelAlene as partial fulfilment of MSc in Construction Technology and management at **Addis College**. All data included in this questionnaire will be used only for academic research purpose and will be strictly confidential. For unclear questions (if there is) or any questions related to the questionnaire use my addresses below. Your inputs are critical for the success of this study and I thank you in advance for your cooperation and help!

Student name: SurafelAlene sincerly

Advisor: Dagnachew (Dr)

Address: Mob. No. +251 911267750:E-mail: surara11@gmail.com.

Section one: A. General / Organization Information

1.1. Company Name (optional):_____

1.2. Educational Background Qualifications (General)

☐BelowMatriculation ☐Matriculation and above but below Graduate ☐Graduate and above

1.3. Type or origin of your organization (Please indicate with "√" when appropriate)

☐Project Owner/Client ☐Consultant ☐ Contractor

☐MoCUD (Federal Construction Admn.)☐Ethiopian Construction Contractor Association

If others (please specify) _____

1.4. Please specify class/grade, if a consultant or contractor_____

1.5. Please specify your job title/position_____

1.6. Relevant Years of Experience in Building Construction Projects:

☐Less than 5 Years ☐ from 6 to 10 Years

☐From 10 to 15 Years ☐ More than 15 Years

1.7. If foreign consultant/contractor, how long have your organization have been involved in Ethiopian public building construction project particularly in A.A.?

☐Less than 5years ☐6-10 years☐more than 10 years

1.8. In how many public building construction projects you have been involved in Ethiopia?

☐Less than 5 projects ☐6-10 projects☐more than 10 projects

B. Project Information

If you work on more than one project, please select one of the projects you prefer and answer the following questions.

1. How much is the total project contract amount? _____
2. How much is the project total contract period? _____
3. How much is the project's to-date planned amount? _____
4. How much is the project's to-date executed amount? _____
5. How much is the project's to-date time elapsed? _____

6. If available, please list the amount of total cost incurred to execute the project's to-date progress status _____

Section Two: Cost Controlling Practice Investigation

Below are lists of questions to study the cost control practice of the public building construction projects in Addis Ababa. Please put tick (√) sign in the box representing your selection under each preference.

1. What is your understanding on cost control practice in construction project?

☐ Expert understanding ☐ Well understand ☐ Average ☐ don't

2. Does your company/organization carry out cost control during the construction works?

☐ Yes ☐ No

3. If your response to question no. 2 is YES, How often does your company carry out cost control?

☐ All the time ☐ Most of the time ☐ Sometimes ☐ Rarely ☐ Never

4. If your response to question no 2 is NO, what are the problems to conduct cost control?

☐ Lack of expertise ☐ Reluctance to the work ☐ Difficulty in collection of cost data

☐ Not important to control the cost, it incurs additional cost and time.

If any specify, _____

5. At what frequency does your company measure the cost performance?

☐ Daily ☐ Weekly ☐ Monthly ☐ Quarterly ☐ Other

6. What processes does your company follow to control the project construction cost? _____

_____

7. Which type of technique or method do you use for cost control?

☐ Overall profit or loss of contract

☐ Earned value management

☐ Forecasting/estimate at completion and budget at completion

☐ If other, specify_____

8. What type of software do you use for project cost control?

☐ Microsoft project

☐ Primavera

☐ MS-Excel

☐ If other, specify_____

9. How much effective is your cost control technique/method?

☐ Extremely effective ☐ Very effective

☐ Somewhat effective ☐ Not so effective ☐ Not at all effective

Section Three: Factors Influencing Cost Control in Construction Projects

The following are list of factors influencing cost controls in public building construction projects in Addis Ababa as identified from literature review and experience. Based on your experience, please tick (√) sign on the table below. Please indicate your level of agreement with the following questions on a scale of 1 to 5 to indicate the extent of factor influencing cost control practice.1= Not a factor, 2= Insignificant factor, 3=Somewhat a factor, 4=Significant factor, 5=Major factor, NA= Not applicable or do not know

S. No	Factorsaffecting cost control practice	Not a factor	Insignificant factor	Somewhat a factor	Significant factor	Major factor	Not applicable
		1	2	3	4	5	NA
1.0	Planning & designing						
1.1	Design change						
1.2	Discrepancies in contract document						
1.3	Contract and specification interpretation disagreement						
1.4	Time of construction						
1.5	Dependency on imported materials						
1.6	Lack of appropriate software						
1.7	Project scope change						
1.8	Change orders						
1.9	Variations						
2.0	Cost Related						
2.1	Market conditions /inflation factor						
2.2	Construction material cost						
2.3	Labor wage rate						
2.4	Construction equipment						
3.0	External Factors						
3.1	Fluctuation of currency/ exchange rate						

3.2	Unstable interest rate						
3.3	Unpredictable weather conditions						
3.4	Risk and uncertainty associated with projects						
3.5	Regulatory requirements						
3.6	Fraud and corruption, unstable government policies						
3.7	Scarcity of resources/mat'l						
4.0	Project Characteristics						
4.1	Size and types of a construction project						
4.2	The complexity of the project						
4.3	Site location						
4.4	The similarity of construction project						
4.5	Construction site condition						
5.0	Personnel Related Factors						
5.1	Labor productivity						
5.2	The conflict between project parties						
5.3	The reputation of an engineer						
5.4	Non-performance of sub-contractor and nominated suppliers						
5.5	Lack of proper training and experience of project manager						
5.6	Quality of the work						
5.7	Management factors						
5.8	Inaccurate evaluation of projects						
5.9	Inaccurate reporting of projects						
	If any other Factors affecting cost control, please specify						

Section Four: Methods of Construction Cost Minimization

Please tick (√) sign on the table below about the type of measures that should be used to minimize the costcontrolling problem in public construction during the construction stage? Please indicate your level of agreement with the following questions on a scale 1 to 5.1=Un-important, 2=Less Important, 3= Moderately Important4= Important, 5= Very Important, NA=Not Applicable or Do Not Know.

S.No	**Methods of Construction Cost Minimization**	**Unimportant**	**Less Important**	**Moderately Important**	**Important**	**Very Important**	**Not Applicable**
		1	2	3	4	5	NA
1.0	**Planning related**						
1.1	Value engineering						
1.2	Good work planning						
1.3	Efficiently scheduling labor, materials, and equipment, etc.						
1.4	Selecting effective contracting plan direct-hire with subcontractors						
1.5	Establishing baselines (mission, or goal)						
1.6	Periodical re-forecasting						
2.0	**Organizational related**						
2.1	Careful selection & training of workers and managers						
2.2	Properly organizing, productivity improving techniques						
2.3	Hiring a highly qualified construction specialist						
2.4	Providing adequate and suitable facilities for the job						
3.0	**Controlling and Monitoring Related**						
3.1	Monitoring and improving field labor productivity using advanced tech						
3.2	Minimizing rework through timely quality control						
3.3	Preventing accidents						
3.4	Controlling procurement						
3.5	Inspecting and evaluating the actual and budgeted cost of work						
3.6	Periodical monitoring of the project						

	costs performance						
3.7	Take corrective action to minimize cost overruns						
3.8	Take corrective action to minimize material wastage						
3.9	Proper and effective logistics and warehousing						
4.0	If any other methods minimizing cost control, please specify						