Addis Ababa University College of Business and Economics School of Commerce Department of Project Management

Assessment of Factors Affecting Cost Overrun in Public Building Construction Projects: Case Study at the Ethiopian Construction Works Corporation (ECWC)

By

Yohannes Tadesse

December, 2018

Addis Ababa, Ethiopia

Addis Ababa University College of Business and Economics School of Commerce Department of Project Management

Assessment of Factors Affecting Cost Overrun in Public Building Construction Projects: Case Study at the Ethiopian Construction Works Corporation

By:

Yohannes Tadesse Bekele

Submitted in Partial Fulfillment of the Requirements for the Award of Masters of Arts Degree in Project Management.

Approved by Board of Examiners

Advisor	**Signature**	**Date**
_____	_____	_____
Internal Examiner	**Signature**	**Date**
_____	_____	_____
External Examiner	**Signature**	**Date**
_____	_____	_____

AKNOWLEDGEMENT

First of all, I would like to thank the almighty God for everything that has happed and will happen in the journey of my life. My heartfelt thank goes to my advisor, Worku Mekonen (PhD), for his unreserved assistance from the inception of the research project.

I would also like to thank the employees and the top management of Ethiopian Construction Works Corporation Building Technology and Construction Sector for their collaboration and willingness to fill out the questionnaires distributed with comprehensive and important information which made data analysis easier.

DECLARATION

I declare that this thesis entitled "**Assessment of Factors Affecting Cost Overrun in Public Building Construction Projects: Case Study at the Ethiopian Construction Works Corporation**" is my original work. This thesis has not been presented for any other university and is not concurrently submitted in candidature of any other degree. To the best of my knowledge and belief this thesis contains no materials previously published or written by another person except where due reference is made.

Candidate:

Name: Yohannes Tadesse

Signature: _____

Date: _____

Acronyms

AC-Actual Cost

CV-Cost Variance

CPI-Cost Performance Index

EEA- Ethiopian Economic Association

ECIDP- Ethiopian Construction Industry Development Policy

ECWC- Ethiopian Construction Works Corporation

EVA Earned value Analysis

EVM-Earned Value Management

EV- Earned Value

GDP- Growth Domestic Product

ISIC- Standards Industrial Classification

PMBOK- Project Management Body of Knowledge

PV-Planned Value

RII-Relative Importance Index

UN- United Nations

Abstract

The construction industry has a huge contribution to the overall economy of fast growing countries like Ethiopia, but cost overrun is causing a negative impact on it. To overcome this issue, the study aimed at identifying the causes of cost overrun in public building construction projects. A descriptive survey was conducted on 42 professional respondents who are actively involved in the construction industry. The samples were drawn using purposive sampling since the objective was to select participants who have knowledge & experience in the issues being investigated. Primary data was collected using the questionnaires and secondary data is collected through reviewing of related literatures. The study found that most important causes of cost overrun are poor preplanning process accomplished by the contractor, inaccurate cost estimation by the contractor, cash flow difficulties faced by the owner of the projects, economic instability & market inflation pressure on the price of resources, delay in decision making on critical issues by the consultant and poor financial management & control practices undertaken by the contractor are the top major factor that causes cost overrun in public building construction projects. Moreover, the study found out the most effective mitigation measures for cost overrun verified by the experts are proper project planning and scheduling by the contractor, appropriate scope definition of the project by the client &the consultant and realistic cost estimation by the contractor before contract signing. Therefore, it was concluded that even though the condition and the extent differ all key stakeholders (client, consultant, contractor, and the external factors) have a significant contribution for the construction cost overrun. Finally, the study recommended that the top management of ECWC should capacitate and provide more supervision to the teams who are responsible for the preparation of the cost estimation for the bid and proper preplanning process before kicking off the project execution.

Key words: Cost overrun, Mitigation measures, public building

Contents

List of Tables **Page**

CHAPTER ONE

This chapter deals with background of the study, statement of the problem, research questions, objectives of the study, significance of the study, scope of the study and organization of the study.

1.1. Background of the Study

According to (UN,1996) Standards Industrial Classification (ISIC), Rev. 3, construction is defined generally as an economic activity directed to the creation, renovation, repair or extension of fixed assets in the form of buildings, land improvements of an engineering nature, and other such engineering constructions as roads bridges, dams, etc.

Construction industry makes significant contributions to the socio-economic development process of a country. Globally, the construction industry hugely influences the economy, the environment &the society and the sector accounts for about six percent of the world GDP (World Economic Forum, 2016).

Unfortunately, most studies show us it is becoming common that most construction projects not to be completed on the planned scheduled, with in the allocated budget and with the desired quality. The construction project cost performance is generally expressed in terms of cost variance against its baseline and it is necessary to measure the cost variance in construction in order to check the healthiness of the project and thereby to understand financial risks involved in the project execution (Devi & Ananthanarayanan 2017).

A number of reasons may result the occurrence of significant cost overrun in a construction most frequently occurring are variation orders, change in scope of the project and cash flow and financial difficulties faced by contractors, delays in decision making, inadequate planning, frequent design changes, lack of coordination between parties, policy in accepting lowest tender, inaccurate time and cost estimates, errors and omissions in design, inaccurate quantity take-off, and contractors' project inexperience(Almaktari et al., 2017, Taye,2016, Zenabu & Getachew,2015 and Bekr,2015).

Cost overrun or poor cost performance has significant effects on all key stakeholders in the construction projects (Davi et. al, 2017). To the client, the consultant & the contractors; to the client, cost overrun incurs additional costs over the initially agreed upon at the outset, resulting in less returns on investment, to the consultant, cost overrun shows the inability to deliver value for the money and result in loss of confidence by clients, to the contractor, it shows loss of profit for non-completion, and defamation that could hinder the chances of winning further jobs, to the construction industry the cost overrun results loss of confidence to the banks or lenders to finance a construction project due to higher risk (Taye,2016).

Nowadays, the construction industry facing the challenge of managing the risk of cost overrun and delivering project within budget and difficulty of completing projects within the planned budget due to cost overrun is common for both developed and the developing nations (Saidu & Shakantu, 2017).

Ethiopia is a fast growing economy in Africa and the construction industry has important contributions to the Ethiopian economy (EEA, 2008). The construction industry in Ethiopia is a sector that opens the door for the growth of many additional industries. Building works require high input. For instance, they require different metal products, clay works, and cement and cement products, etc. As such, the growth of these industries will surely follow the growth of the construction industry. Similarly, when the construction and renovation of housing increase, the demand for household furniture increased; thereby, indirectly, opening the door for the growth of the furniture industry. The construction sector in Ethiopia, generally in the world, contributes to the realization of about fifty percent of the total capital (http://www.abyssinialaw.com accessed on October 2, 2018).

In Ethiopia, the public construction projects are the highest consumer of government annual capital budget in terms of government infrastructure development (Ministry of Construction, 2016).The construction sector's contribution is greater in the case of Ethiopia and the industry has been playing a crucial role in sustaining country's rapid and

equitable socio-economic development and changing the livelihood of millions of peoples and the sector had a 9.5 percent share from Ethiopia's total Gross Domestic Product (Ministry of Construction, 2016).Ethiopia set a vision of becoming a middle-income economy by 2025 and the realization of the vision partly depends on the existence of a reliable and competitive local construction industry (www.allafrica.com) and the construction sector is booming and the number of public building constructions projects undertaken by the Ethiopian government is increasing with time.

However, cost overrun is a common phenomenon on most public construction projects and found to be extremely significant and serious problem (ECIDP, 2014). Project cost overrun has a negative impact on the profitability and the economy (Devi &Ananthanarayanan 2017) thus; this research is intended to improve the current construction performance by determining the top construction cost overrun causes and mitigation measures as the project progresses.

1.2. Statement of the Problem

The triple constraints to be considered about a project are the cost, time and quality requirements(Lester, 2013).The major success criteria that a project is said to be successful are when it is completed by fulfilling the predefined time, cost & quality requirements with the satisfaction of the client. Project cost overrun is a common global issue in most construction projects despite much knowledge and modern technologies acquired in project management (Memon, 2013). Shah (2016) studied an exploration of causes for delay & cost overrun in construction projects in Australia, Malaysia and Ghana; the paper concluded that there are diverse groups of delay factors from one country to another country that causing project delay and cost overruns. Almaktari, Hong & Nzige (2017) studied about the Factors influencing Cost Overrun on Construction Projects in Yemen and the study contributed in addition to other factors an understanding of how the impact of political instability can cause cost overrun. KPMG International's Global Construction Survey 2015 reported that 53% of owners say they suffered one or more underperforming projects.

A survey made from 16 government financed construction projects in Ethiopia 50 % has found to be failing to meet both in time and cost, Construction Sector Transparency Initiative Ethiopia (2014). As per the survey conducted by Construction Sector Transparency Initiative Ethiopia (2014); 50% of the construction projects in Ethiopia fail to meet time and cost considerations.

Zenabu & Getachew (2015) demonstrated the cost overrun factors in Ethiopian private construction sector outlined the top five factors that causes cost overrun in construction projects are poor planning, fluctuation of price of materials, poor productivity, inflationary pressure and project financing in descending order. However, this study doesn't consider the public sector construction projects. Moreover, According to the study conducted by Nega (2008) has showed the existence of delay & cost overrun in Ethiopian public building construction sector, but the study is more than ten years old and there is a need for new assessment.

As per the preliminary discussion made with the top management of the Ethiopian Construction Works Corporation's Building Technology &Construction Sector among the current nineteen huge Public Building Construction Projects being run by the Ethiopian Construction Works Corporation seven of them are experiencing severe cost overrun but the factors are not thoroughly known. This study therefore, assessed and ranked factors that contributed to the construction cost overrun and mitigation measures in the public building construction projects.

1.3. Research Questions

- ✓ What are the causes of cost overrun in public building construction projects?
- ✓ Who are the responsible parties for the cost overrun in public building construction projects?
- ✓ What mitigation measures should be taken in public building construction projects?
- ✓ What measures should ECWC take in order to minimize or avoid cost overrun?

1.4. Objectives of the Study

Specific objectives of the study are:

- To identify the leading causes of cost overrun in the Ethiopian Construction Works Corporation (ECWC) public building construction projects and to rank them by the degree of relative importance.

- To identify the responsible parties to the causes of construction cost overrun.
- To identify the top mitigation measures of cost overrun in the Ethiopian Construction Works Corporation (ECWC) public building construction projects and to rank them by the degree of relative importance.

General objective of the study is:

- To alert the Ethiopian Construction Works Corporation (ECWC) management on the causes that will contribute to cost overrun and recommendations to minimize or to avoid cost overrun thereby make prior corrective action for the future projects.

1.5. Significance of the Study

The major success criteria that a project is said to be successful are when it is completed by fulfilling the predefined time, cost & quality requirements with the satisfaction of the client. Thus, the primary objectives of this study is to give an input for those who have a key role in the initiation, planning & implementation of public building construction projects about the factors contributing to cost overrun in order to complete a projects within the planned budget. Moreover, this study put a mitigation measures for the cost overrun factors.

1.6 Scope of the Study

The scope of the study is limited to carryout to public building construction projects conceptual and practical assessment of cost overrun and mitigation measures. Cost overrun could arise due to different factors created by various stakeholders in the construction industry such factors should be minimized or avoided in order to make the project successful. This study identify various causes of cost overrun and mitigation measures to suggest ways to improve performance public building construction projects handled by the ECWC for the case study. However, the established principle could be applied for similar building construction projects, the study might not be applied to road, water, and other unrelated projects even though it gives certain inputs.

1.7 Organization of the Study

Following the proposal this research will be logically organized into five chapters and references. Chapter one deals with the introduction, which talks about the general idea and relevance of the study. It defines the background, the problem statement, the objectives, the scope as well as the organization of the thesis. Chapter two comprises of literature review, and quotes the various related works done in this area of study. Chapter three attempts to describe in detail the methodology of the project followed in this research study. Chapter four contains data presentation, analysis of the information gathered through the data survey, summary of findings, discussion and limitation of the study. Chapter five provides conclusions and recommendations of the study.

1.8 Limitation of the Study

The following factors were the limitations of the study:

- ✓ Respondents' involuntary act to fill the questionnaires not to publicize the company's internal affair.
- ✓ The study was limited from the perspective of the contractor organization professionals (i.e. Ethiopian Construction Works Corporation). If the other key stakeholders (client, consultant and government bodies) professionals participate in the survey, their view may be different.

CHAPTER TWO: LITERATURE REVIEW

This chapter of the study identifies and discusses the findings of previous literatures conducted on the subject area of construction cost overrun and mitigation measures.

2.1 Overview

It is generally accepted that project considered as successful, if a construction project is completed within the scheduled time, allocated budget, and meeting the predefined quality standard with the satisfaction of the owner. A special feature of construction project is the huge cost incurred (EEA, 2007).Globally many construction projects frequently suffer from cost overrun even though the magnitude differ from project to project.

International studies were conducted and published in the subject area of construction projects cost overrun showed us cost overrun is a global challenge even though where developing countries are suffering more& developing countries should give more attention to the performance of the public building construction projects (Almaktari et al., 2017).

2.2 Theoretical Framework

1. **Definition of Cost and Cost Overrun**

- **Cost** is a resource sacrificed or foregone to achieve a specific objective or something given up in exchange. Costs are usually measured in monetary units like dollars.
- **Cost overrun** is unexpected costs incurred in excess of budgeted amounts due to an underestimation of the actual cost during budgeting (en.wikipedia.org). Cost overrun can simply defined as when the final cost of the project exceeds the original estimates (Bekr, 2015).Cost overrun is defined as the difference between the actual and estimated costs as a percentage of the estimated cost, with all costs calculated in constant prices. Actual costs are defined as the accounted costs actually spent, as determined at the time of project completion. Estimated costs are defined as the budgeted or forecasted costs at the time of project approval, which are typically similar to costs presented in the business case for a project

(Lee, 2008). Nega (2008) also defines cost overrun as an occurrence in which the delivery of contracted goods/services is claimed to require more financial resources than was originally agreed upon between a project sponsor and a contractor.

2. Causes of Cost Overrun

Cost overruns have a broad range across the company spectrum, and several reasons and solutions (Hinson, 2011). The common causes of cost overrun According to (kenzner, 2009) are:

- ✓ Poor estimating techniques and/or standards, resulting in unrealistic budgets
- ✓ Out-of-sequence starting and completion of activities and events
- ✓ Inadequate work breakdown structure
- ✓ No management policy on reporting and control practices
- ✓ Poor work definition at the lower levels of the organization
- ✓ Management reducing budgets or bids to be competitive or to eliminate "fat"
- ✓ Inadequate formal planning that results in unnoticed, or often uncontrolled, increases in scope of effort
- ✓ Poor comparison of actual and planned costs
- ✓ Comparison of actual and planned costs at the wrong level of management
- ✓ Unforeseen technical problems
- ✓ Schedule delays that require overtime or idle time costing
- ✓ Material escalation factors that are unrealistic

Generally, cost overrun can occur in any phase of project development life cycle (kenzner, 2009).

I. **Proposal phase:** at this phase the most common causes for cost overruns are:
   - ✓ Failure to understand customer requirements
   - ✓ Unrealistic appraisal of in-house capabilities
   - ✓ Underestimating time requirements

II. **Planning phase**: at this phase the most common causes for cost overruns are:
   - ✓ Omissions
   - ✓ Inaccuracy of the work breakdown structure
   - ✓ Misinterpretation of information

- ✓ Use of wrong estimating techniques
- ✓ Failure to identify and concentrate on major cost elements
- ✓ Failure to assess and provide for risks

III. **Negotiation phase**: at this phase the most common causes for cost overruns are:

- ✓ Forcing a speedy compromise
- ✓ Procurement ceiling costs
- ✓ Negotiation team that must "win this one"

IV. **Contractual phase:** at this phase the most common causes for cost overruns are:

- ✓ Contractual discrepancies
- ✓ Statement of work different from request for proposal requirements
- ✓ Proposal team different from project team

V. **Design phase**: at this phase the most common causes for cost overruns are:

- ✓ Accepting customer requests without management approval
- ✓ Problems in customer communications channels and data items
- ✓ Problems in design review meetings

VI. **Production phase:** at this phase the most common causes for cost overruns are:

- ✓ Excessive material costs
- ✓ Specifications that are not acceptable
- ✓ Manufacturing and engineering disagreement

3. **Project Cost Management** is the process used to minimize the cost of the project while maintaining acceptable levels of quality as well as the scope of the deliverables for the duration of the project. Project cost management includes the processes required to ensure that the project is completed within an approved budget(PMBOK Guide)and the processes include:

    - ✓ **Resource planning**: determining what resources and quantities of them should be used.
    - ✓ **Cost estimating**: developing an estimate of the costs and resources needed to complete a project.
    - ✓ **Cost budgeting**: allocating the overall cost estimate to individual work items to establish a baseline for measuring performance.

- ✓ **Cost control**: controlling changes to the project budget.

"The objectives of the cost management process are to track progress, compare actual values to planned values, analyze the impact of variances, and make adjustments in light of these variances" (Parviz, 2002).

According to (PMBOK Guide) Project Cost Management should consider the stakeholder requirements for managing costs. Different stakeholders will measure project costs in different ways and at different times. Project Cost Management is primarily concerned with the cost of the resources needed to complete project activities. Project Cost Management should also consider the effect of project decisions on the subsequent recurring cost of using, maintaining, and supporting the product, service, or result of the project.

4. Project Cost Control

Project cost control is keeping project within a budget. Project cost control is part of a larger framework in project management which is known as project evaluation and control. A project evaluation and control system measures project progress and performance against a project plan to ensure that the project is completed on time, within budget, and to the satisfaction of the customer. Cost control focuses on the ability of costs to change and on the ways of allowing or preventing cost changes from happening. Project evaluation and control has four essential components:

1. Establishing a project baseline plan: The project baseline plan provides the essential features for measuring performance.
2. Measuring and monitoring progress and performance: Accurate mechanisms for measuring and reporting the progress and performance of a project on an ongoing basis are critical for effective control systems.
3. Comparing actual performance against plan: To compare actual project performance with the original baseline plan- sometimes called "gap" analysis- essential for determining current project status.

4. Taking remedial: Significant deviations warrant some form of corrective action to bring the project back on track either by improving action or revising the original baseline.

Cost control is concerned with understanding why the cost variances, both good and bad, have occurred. The "why" behind the variances allows the project manager to make appropriate decisions on future project actions? Ignoring significant project cost variances may cause the project to suffer from budget shortages, additional risks, or scheduling problems. Therefore, when significant cost variances happen they must be recorded and investigated. Generally, cost control allows the project manager to confront the problem, find a solution, and then act accordingly.

According to (PMBOK Guide) the key to effective cost control is the management of the approved cost baseline and the changes to that baseline. Project cost control includes:

- ✓ Influencing the factors that create changes to the authorized cost baseline;
- ✓ Ensuring that all change requests are acted on in a timely manner;
- ✓ Managing the actual changes when and as they occur;
- ✓ Ensuring that cost expenditures do not exceed the authorized funding by period, by Work breakdown structure component, by activity, and in total for the project;
- ✓ Monitoring cost performance to isolate and understand variances from the approved cost baseline;
- ✓ Monitoring work performance against funds expended;
- ✓ Preventing unapproved changes from being included in the reported cost or resource usage;
- ✓ Informing appropriate stakeholders of all approved changes and associated cost; and
- ✓ Bringing expected cost overruns within acceptable limits.

Cost control is considered as one of the key success indicator of any construction project among the three iron triangle; cost, time and quality (Almaktariet al., 2017). Poor project cost controls may lead the projects to fail to meets their intended objective thus; construction companies should manage their project financial outflows and then the final construction cost will not tend to exceed its initial contract budget (Karunakaran et al., 2018).

5. Project Cost Control Techniques

According to (www.tutorialspoint.com accessed on October, 2018) the valuable and essential techniques used for efficient project cost control are:

1. Planning the Project Budget

You would need to ideally make a budget at the beginning of the planning session with regard to the project at hand. It is this budget that you would have to help you for all payments that need to be made and costs that you will incur during the project life cycle. The making of this budget therefore entails a lot of research and critical thinking.

Like any other budget, you would always have to leave room for adjustments as the costs may not remain the same right through the period of the project. Adhering to the project budget is a key to the profit from project.

2. Keeping a Track of Costs

Keeping track of all actual costs is also equally important as any other technique. Here, it is best to prepare a budget that is time-based. This will help you keep track of the budget of a project in each of its phases. The actual costs will have to be tracked against the periodic targets that have been set out in the budget. These targets could be on a monthly or weekly basis or even yearly if the project will go on for long.

This is much easier to work with rather than having one complete budget for the entire period of the project. If any new work is required to be carried out, you would need to make estimations for this and see if it can be accommodated with the final amount in the budget. If not, you may have to work on necessary arrangements for 'Change Requests', where the client will pay for the new work or the changes.

3. Effective Time Management

Another effective technique would be effective time management. Although this technique does apply to various management areas, it is very important with regard to project cost control.

The reason for this is that the cost of your project could keep rising if you are unable to meet the project deadlines; the longer the project is dragged on for, the higher the costs incurred which effectively means that the budget will be exceeded.

The project manager would need to constantly remind his/her team of the important deadlines of the project in order to ensure that work is completed on time.

4. Project Change Control

Project change control is yet another vital technique. Change control systems are essential to take into account any potential changes that could occur during the course of the project.

This is due to the fact that each change to the scope of the project will have an impact on the deadlines of the deliverables, so the changes may increase project cost by increasing the effort needed for the project.

5. Use of Earned Value Management

According to (PMBOK Guide) Earned value management (EVM) is a methodology that combines scope, schedule, and resource measurements to assess project performance and progress. It is a commonly used method of performance measurement for projects. It integrates the scope baseline with the cost baseline, along with the schedule baseline, to form the performance baseline, which helps the project management team assess and measure project performance and progress. It is a project management technique that requires the formation of an integrated baseline against which performance can be measured for the duration of the project. The principles of EVM can be applied to all projects in any industry. EVM develops and monitors three key dimensions for each work package and control account:

Planned value: Planned value (PV) is the authorized budget assigned to scheduled work. It is the authorized budget planned for the work to be accomplished for an activity or work breakdown structure component, not including management reserve. This budget is allocated by phase over the life of the project, but at a given moment, planned value

defines the physical work that should have been accomplished. The total of the PV is sometimes referred to as the performance measurement baseline.

Earned value: Earned value (EV) is a measure of work performed expressed in terms of the budget authorized for that work. It is the budget associated with the authorized work that has been completed. The EV measured cannot be greater than the authorized PV budget for a component. The EV is often used to calculate the percent complete of a project. Progress measurement criteria should be established for each work breakdown structure component to measure work in progress. Project managers monitor EV, both incrementally to determine current status and cumulatively to determine the long-term performance trends.

Actual cost: Actual cost (AC) is the realized cost incurred for the work performed on an activity during a specific time period. It is the total cost incurred in accomplishing the work that the EV measured. The AC needs to correspond in definition to what was budgeted in the PV and measured in the EV. The AC will have no upper limit; whatever is spent to achieve the EV will be measured.

Variance analysis: Variance analysis, as used in EVM, is the explanation (cause, impact, and corrective actions) Cost variance is the most frequently analyzed measurement for cost (CV = EV – AC). Cost variances from the approved baseline will also be monitored: Cost performance measurements are used to assess the magnitude of variation to the original cost baseline. An important aspect of project cost control includes determining the cause and degree of variance relative to the cost baseline and deciding whether corrective or preventive action is required.

Cost variance: Cost variance (CV) is the amount of budget deficit or surplus at a given point in time, expressed as the difference between earned value and the actual cost. It is a measure of cost performance on a project. It is equal to the earned value (EV) minus the actual cost (AC).The CV is particularly critical because it indicates the relationship of physical performance to the costs spent. Negative CV is often difficult for the project to recover. *Equation*: CV= EV − AC.

The CV values can be converted to efficiency indicators to reflect the cost performance of any project for comparison against all other projects or within a portfolio of projects. The variances are useful for determining project status.

Cost performance index: The cost performance index (CPI) is a measure of the cost efficiency of budgeted resources, expressed as a ratio of earned value to actual cost. It is considered the most critical EVM metric and measures the cost efficiency for the work completed. A CPI value of less than 1.0 indicates a cost overrun for work completed. A CPI value greater than 1.0 indicates a cost under run of performance to date. The CPI is equal to the ratio of the EV to the AC. The indices are useful for determining project status and providing a basis for estimating project cost and schedule outcome. *Equation*: CPI = EV/AC

2.3 Empirical Framework

Several studies have tried to discover the causes of cost overrun in construction sector. Olawale, Y., & Sun M. (2010) conducted survey on 250 construction project organizations in the UK, subsequently developed the top five leading cost overrun causes are design changes, risks (uncertainties), and inaccurate estimation of project time/duration, complexities and non-performance of subcontractors.

A research carried out by Doloi (2013) identified the top five significant construction cost overrun causes are accurate project planning and monitoring, effective site management, contractors' efficiency, design efficiency, and communication.

According to the study conducted by (Shah, 2016) the most influential cost overrun causes in Australia are planning and scheduling deficiencies, methods of construction, effective monitoring and feedback process, whereas in Ghana, delay in payment certificates, underestimating of project cost, complexity of projects are the most influential factors and in Malaysia Contractor's improper planning, poor site management, inadequate contractor experience are the most influential factors. Niazi & Painting (2017) studied the key critical causes that potentially result in construction cost overruns in Afghanistan are: corruption, delay in progress payment by owner, difficulties

in financing project by contractors, security, change the order by the owner during construction and market inflation.

In Ethiopia studies conducted on construction cost overrun causes; Taye (2016) has identified and ranked the top five causes of cost overrun which are less emphasis to planning, poor contract management and poor pre planning process, delayed payments to contractor and inability to deliver value for money and Nega (2008) identified delay, supplementary agreement, adversarial relations among stakeholders, and budget shortfall of project owners as a significant cost overrun causes.

After an in-depth literature review 43 potential causes for cost overrun are identified from previous studies described on the table below.

Table-1. Causes of cost overrun by previous researchers

No.	**Causes of Cost Overrun**	**Cited by**
1	Delay in approval of payments by a consultant	a ,d,f,g,h
2	Cash flow difficulties by a client	a ,d,g
3	Tax and insurance increase	a ,d
4	Contractor's financial difficulties	a ,b,c,d,e,g
5	Poor Financial management and control	a,d,g
6	Inflation pressure	a,b,c,d,e,g,h
7	Currency exchange rate fluctuation	a,b,c,d,g
8	Poor experience in contract & site management	a,b,d,e,f,g
9	Insufficient Supervision	a,d,g
10	Improper coordination & relationship between project team members	a,b,c,d,g,h
11	Lack of qualified project manager	a,d,e,g,h
12	Lack of skilled labor	a,d,e,g,h
13	Low productivity of labor	a,d,g,h
14	Policy in accepting lowest tender offer	b,d,g,h
15	Delay in tendering process	b,d,g,h
16	Delay in site possession &mobilization	b,c,d,g,h
17	Unrealistic contract duration	G

18	Client initiated additional or variation works	a,c,d,e,g,h
19	Complexity of the design	a,d,f,g
20	Poor preplanning process by the contractor	D
21	Inaccurate cost estimation by the contractor	b,c,d,e,f,h
22	Delay in decision-making by the consultant	a,d,g
23	Frequent design changes after contract award	c,d,e,g,h
24	Corruption	a,d,e,g
25	Improper allocations and control of construction resources	a,d,g
26	Shortage of materials and equipment	a,d,e,g
27	Inadequate experience of consultant and contractor	a,d,e,f,g
28	Poor methods of construction	a,d,f
29	Construction errors & defective work	d,g,h
30	Mistakes &discrepancies in contract document	d,e,g
31	Deficiencies in monitoring and feedback	a,d,f
32	No or poor risk management strategies	a,d
33	Availability of local materials	b,c,d,g
34	Project location	b,d
35	Unexpected geological condition	c,d,h
36	Adverse weather condition	b,d
37	Political condition	b,d,g
38	Social & cultural impact	b,d,g
39	Economic instability	b,d
40	Number of projects running at the same time	B
41	Change in scope of the project by the owner	H
42	Delay in disbursing interim payments by the owner	H
43	Inadequate experience of contractor	a,d,e,f,g

Source: a=(Almaktari et al., 2017); b=(Zenabu & Getachew (2015)); c=(Nega, 2008);d=(Taye ,2016); e=(Ramabhadran,2018); f= (Shah,2016); g= (Niazi& Painting(2017)); h= (Bekr,2015).

Cost overrun factors can be categorized into several groups of originating parties based on previous studies, they commonly identified four key stakeholders that contribute to construction cost overrun:

1. Clients;
2. Consultants;
3. Contractors;
4. External Factors.

Table-2. Categorization of common causes of cost overrun

No.	**Causes of Cost Overrun**	**Category**
1	Cash flow difficulties by a client	Client
2	Delay in disbursing interim payments	Client
3	Delay in tendering process	Client
4	Policy in accepting lowest tender offer	Client
5	Client initiated additional or variation works	Client
6	Unrealistic contract duration	Client
7	Change in scope of the project by the owner	Client
8	Delay in approval of payments by a consultant	Consultant
9	Frequent design changes after contract award	Consultant
10	Complexity of the design	Consultant
11	Corruption	Consultant
12	Delay in decision-making by the consultant	Consultant
13	Inadequate experience of consultants	Consultant
14	Insufficient supervision	Consultant
15	Poor experience in contract & site management	Consultant
16	Mistakes &discrepancies in contract document	Consultant
17	Deficiencies in monitoring and feedback	Consultant
18	Poor risk management strategies	Consultant
19	Improper allocations and control of construction resources	Contractor
20	Improper coordination & relationship between	Contractor

	project team members	
21	Lack of qualified project manager	Contractor
22	Lack of skilled labor	Contractor
23	Low productivity of labor	Contractor
24	Poor preplanning process by the contractor	Contractor
25	Inaccurate cost estimation	Contractor
26	Shortage of materials and equipment	Contractor
27	Inadequate experience of contractor	Contractor
28	Delay in site possession & mobilization	Contractor
29	Construction errors & defective work	Contractor
30	Poor Methods of construction	Contractor
31	Contractor's financial difficulties	Contractor
32	Poor Financial management and control	Contractor
33	Tax and Insurance increase	External Factor
34	Inflation pressure	External Factor
35	Currency exchange rate fluctuation	External Factor
36	Availability of local materials	External Factor
37	Project location	External Factor
38	Unexpected geological condition	External Factor
39	Adverse Weather condition	External Factor
40	Political condition	External Factor
41	Social & cultural impact	External Factor
42	Economic Instability	External Factor
43	Number of projects running at the same time	External Factor

Source: Almaktari et al. (2017), Niazi & Painting (2017) and Taye (2016).

2.4 Mitigation Measures for Cost Overrun

The second major research question this study addresses is that what measures should be taken in order to avoid or minimize public building construction cost overrun. However there are unavoidable causes of cost overrun, some causes can be reasonably predicted and prevented (Almaktari et al., 2017). According to Roslan et al. (2014) the top most

effective cost overrun mitigation measures are develop competent team for executing work, development of a proper system of site management & supervision, financial ability to consider as part of qualification, avoid frequent design change, adopt effective & efficient procurement system, hire competent labor, follow strictly time schedule, deliver payments to on time and hire competent labor.

Taye (2016) ranked the top resolution methods for construction cost overrun are timely progress control, schedule control, cost control, resource control by comparing with the completion date and cost, assign competent personnel and effective strategic planning.

Rehman et al.(2012) suggested fifteen mitigation measures to improve construction cost performance includes: Effective strategic planning, Proper project planning &scheduling, Effective site management and supervision, Frequent progress meeting, Proper emphasis on past experience, Use of appropriate construction methods, Use up to date technology utilization, Clear information and communication channels, Frequent coordination between the parties, Perform a preconstruction planning of project tasks and resource needs, Developing human resources in the construction industry, Comprehensive contract administration, Systematic control mechanism, Improving contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors.

A research carried out by Ramabhadran (2018) aiming at an investigation into cost overrun in construction projects in united Arab Emirates result indicated that the most effective mitigation measures for cost overrun are detailed estimation, conducting brain storming sessions for cost control, procurement planning, mobilizing resources at the right time and training of workers. In addition, the paper recommends that higher management should focus and provide more support to Human resource related issues for controlling cost overrun, as they are the predominant causes of cost overrun. Moreover, improving productivity, efficient estimation process, value management, change management and procurement management are also crucial to minimize cost overrun.

From the previous studies 27 potential cost overrun mitigation measures are identified on the table below.

Table-3.Mitigation measures of cost overrun by previous researchers

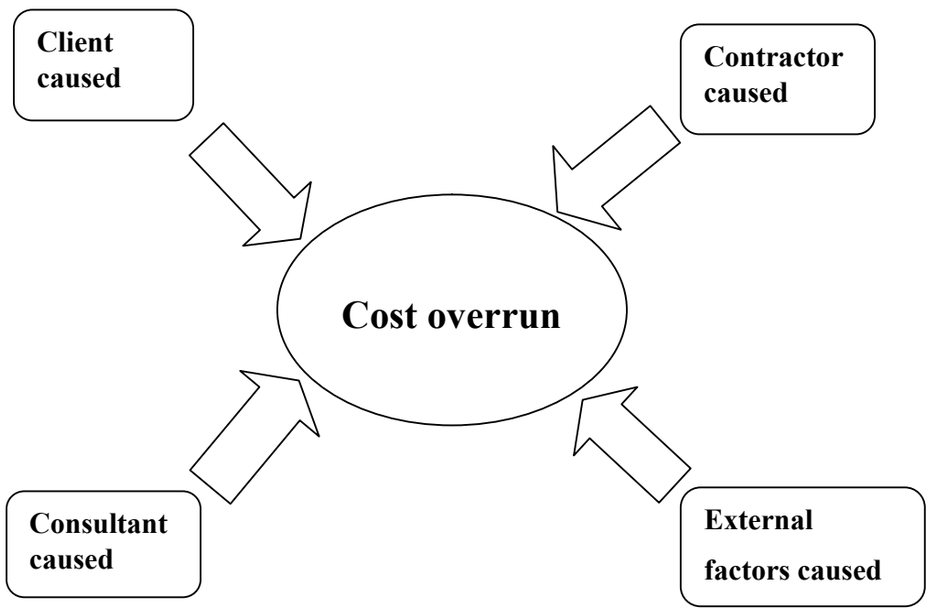
No.	Mitigation Measures of Cost Overrun	Cited by
1	Assign competent personnel	i,j,k
2	Effective strategic planning	i,k,m
3	Providing training for the project team members based on the scope of the assignment	i,k,
4	Focus on the client's interest	i,k
5	Prepare and monitor cash flow diagram during the contract period	i,k
6	Conduct site Meeting more frequently	i,j,k
7	Improving contract award procedure by giving less weight to price , more weight to technical capability & past experience	j,k
8	Use of current technology	j,k
9	Increase supply of materials	j,m
10	Use of experienced contractors	j,k
11	Progress payments should be made to the contractors on time	i,j
12	Use of appropriate construction method	j,k
13	Timely and reasonable procurement	j,m
14	Realistic cost estimation	j,m
15	Efficient management	j,k
16	Full utilization of the construction team	j,m
17	Appropriate scope definition	j,m
18	Proper project planning and scheduling	j,k
19	Committed leadership and management	j,m
20	Increase the construction productivity	j,m
21	Send clear and complete message to workers to ensure effective communication	i,j,
22	Avoid poor quality of work, more rectification and	j,

	double handling	
23	Training and development of all participant to support delivery Process	j,k
24	Hire skilled workers to achieve good progress	i,j,
25	Adoption of tools and techniques i.e. Earned Value Management Value Management, Total Quality Management and Business Process Reengineering.	j,m
26	Increase the expertise and skill of human resources	j,m
27	Application risk management during project execution	j,

Source: i=Roslan et al. (2014), j= Taye (2016), k=Rehman et al. (2012), m=Ramabhadran (2018).

2.5 Conceptual Model

Figure 1. Cost overrun conceptual frame work



Source: Own

CHAPTER THREE: RESEARCH METHODOLOGY

This chapter describes the approaches and design, sample and sampling techniques, data collection and then the research methodology to be used to conduct the overall study.

3.1 Research Approach

In this study a combination of both qualitative and quantitative approaches are used. It is qualitative because it assess causes of cost overrun and mitigation measures by critical reviewing literatures in subject area. It is also quantitative because it uses numerical data to investigating facts by taking professionals opinions and view on public building construction projects through questionnaire survey. The purpose of this research is exploration of new facts based on existing facts of cause of cost overrun and mitigation measures observed in public building construction projects.

3.2 Research Design

"Research designs are plans and the procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis" (Creswell, 2009). This research consists of five broad phases; the first one is the proposal for identifying and defining the problems and establishment of the objectives of the study and development of detailed research plan. The second phase of the research includes theoretical & empirical literature review about cost overruns and mitigation measures. The third phase of the research includes questionnaires design, distributing and conducting the survey. The fourth phase includes analysis of the data and the last phase of the research includes the conclusions and recommendations.

3.3 Population

ECWC currently constructing 19 public building construction projects and to get a more reliable assessment the questionnaires is given to all construction professionals who are directly involving in the projects. Consequently, the semi structured questionnaire survey was carried out in all projects by distributing a total of 54 questionnaire sets to 4 Top Managers, 7 Team Leaders, 11 Project Manager, 24 Site Engineers, 8 Other Construction Professionals to get their professional opinion and other relevant data.

In this study, all the respondents are civil engineering professionals who are currently working on building construction projects at different level of authority& responsibility (i.e. Top Managers, Team Leaders, Project Managers, Site Engineers and Other Construction Professionals) to get the most professional's perceptions in public building construction being handled by the ECWC that result cost overrun and mitigation measure with their rank relative importance.

3.4 Sampling

Sampling is a design to obtain sample from a given population. Mainly there are two categories of sample design methods; Probability and non -probability sampling. The sampling method used in this research is a non -probability purposive or judgmental sampling. Purposive sampling enables us to use our judgment to select cases that best to answer the research questions to meet its objectives (Mark et. al, 2009). Moreover, Purposive sampling is particularly useful for this situation as it helps to reach a targeted sample quickly and sampling for proportionality is not the primary a concern (Ramabhadran, 2018).The selected samples are all construction professional who have expertise in the sector.

3.5 Data Collection and Instrument

For this study Both quantitative and qualitative methods were used, in the first step qualitative analysis were done for identifying causes of construction cost overrun & mitigation measures from several literature; in the second step quantitative analysis were done by collected using questionnaires survey. The primary data were obtained with the use of semi-structured questionnaires to capture the current construction industry experiences from professionals view point. Secondary data is used for preparation of the questionnaire and to discuss the findings of the research.

The request in the questionnaire for cost overrun causes identified by conducting in-depth literature review of (Almaktari et al., 2017; Zenabu &Getachew, 2015; Nega, 2008; Taye, 2016; Ramabhadran, 2018; Shah, 2016; Niazi and Painting, 2017; Bekr, 2015. And the request in the questionnaire for the mitigation measures identified by conducting detailed literature review of (Roslan et al., 2014; Taye, 2016; Rehman et al., 2012; Ramabhadran (2018)).

To measure the data from questionnaire survey the ordinal scale is used and these factors were measured by using a series of Likert's items to measure responses on a scale from 1 to 5 according to the level of contributing used where;

1 = not significant,
2 = slightly significant,
3 =moderately significant,
4 =very significant, and
5 = extremely significant.

The questions are organized to get appropriate information and it has four sections:

- ✓ Section I- request for the background information of the respondents.
- ✓ Section II- consists of 43causes of cost overrun that respondents is expected to rate them with Likert's scale.
- ✓ Section III- Consists of 27 mitigation measure that respondents is expected to rate them with Likert's scale.
- ✓ Section IV-Consists of subjective questions.

The questionnaires distributed to the selected employees of ECWC in hard in person. Telephone call and personal discussion is made to all the respondents to clarify the questions on the questionnaires to alert them to finalize the response on time. In addition respondents were told that primary purpose of the survey is purely academic and that their responses will be kept confidential.

3.6 Data Analysis

Following a critical review of the literature in relation to cost overrun provide a basis to develop the questionnaire which is distributed to professionals involved in the construction sector. This research developed a list of 43 major causes of cost overruns and 27 mitigation measures in public building construction projects which forms the focal point of the research. In this study, mainly a survey will be conducted by designing a questionnaire to respondents to assess factors that they supposed to be major causes of

cost overrun & mitigation measures in public building construction projects from their professional perspective to analyze and to draw the findings from the survey.

According to (Almaktari et al., 2017) different methods can be used to rank and subsequently identify the relative critical attributes out of a raw data analysis and a number of researchers and the mean and standard deviations are not reliable statistics for assessing overall ranking of the attributes. Thus, the relative importance index method is adopted in this study to determine the relative importance of the various causes of cost overrun and mitigation measures. The data were tabulated and analyzed using Excel spread sheet.

In this study the five scale rang from (1 = not significant),(2 = slightly significant), (3 = moderately significant), (4 =very significant), (5 = extremely significant) will be used to calculate the Relative Importance Index (RII) to rank the causes of construction cost overrun and their mitigation measures in projects.
The RII value was calculated with the following equation:

$$RII = \frac{\sum_{i=1}^{5} W_i \cdot X_i}{A \times N}$$

Source: Niazi & Painting (2017)
Where:
RII – Relative Importance Index
W –Weighting given to each factor by the respondents and ranges from 1 to 5
X – Frequency of i-th response given for each cause
A – Highest weight (i.e. 5 in this case)
N – Total number of respondents.

3.6 Validity and Reliability

Indicators must meet two fundamental criteria both valid and reliable. Nahid (2003) defined reliability and validity test in the qualitative research as follows, with respect to reliability, whether the result is the extent to which results are consistent over time or repeatable and with respect to validity which implies the extent to which the research instrument measures what it is intended to measure.

According to Kirk and Miller (1986) as cited by (Nahid, 2003) reliability referred in a qualitative research relate to the similarity of measurements within a given time. Thus, on the questionnaire survey the same questions was used to all respondents and answered in a similar fashion and the questions were adopted from previously studied researches which were subject to critics by different scholars and practitioners. With regard to validity all questions on the questionnaires clearly represented the factors that are intended to address the desired goal.

3.7 Ethical Consideration

In this research, issues related to ethics were given more weight; mainly the two ethical considerations were consent and confidentiality. Firstly, every respondent participated in the survey were asked for their consent and all respondents were ensured that data obtained for the purpose of this study solely used for academic purpose & were kept confidential.

CHAPTER FOUR: RESULT AND DISCUSSION

This chapter describes the result and discussion of the questionnaire survey concerning cost overruns and mitigation measures from the professionals' view points. This chapter also focuses on describing the respondent's characteristics and summary of the survey.

4.1 Respondents demographic

The respondents that participated in this survey had significant working experience in public building construction projects in different parts of Ethiopia. The respondents are categorized into five groups, Top Managers, Team Leaders, Project Managers, Site Engineers and Other Construction Professionals. The response rate for the questionnaire survey for the above mentioned Top Managers, Team Leaders, Project Managers, Site Engineers and Other Construction Professionals are 9.5%, 16.7%, 23.8%, 42.9%, 7.1% respectively. According to Sekaran (2001) as quoted by Zenabu&Getachew (2015), a response rate of 30% is acceptable for most studies; therefore, as the response rate of this study is 77.8 % and it is considered as adequate for the research.

All the respondents were involved in implementing public building construction projects.16% of respondents have been engaged for 5 years in the construction industry, 50% have experience 5 -10 years, 21% have experience of 10 -15 years and 13% have more than 15 years of working experience.

The academic qualifications of the respondents were assessed. Accordingly, out of 42 participants 3, 35 and 4 of the respondents have diploma, bachelor and masters degree in engineering, respectively. The education qualifications of the respondents show sufficient educational qualification to make the information acquired more reliable.

4.2 Questionnaires Collection Summary

The semi structured questionnaire survey was carried out by distributing a total of 54 questionnaire sets. 47 out of the 54 questionnaires distributed were returned. Distributed was to 4 Top Managers, 7 Team Leaders, 11 Project Manager, 24 Site Engineers, and 8 Other Construction Professionals.

Table.4 Summary of survey carried out

Group	Number of questionnaire Distributed	Number of questionnaire Returned	Number of valid questionnaire received	Percentage of valid responses received (%)
Top Managers	4	4	4	9.5
Team Leaders	7	7	7	16.7
Project Manager	11	10	10	23.8
Site Engineers	24	20	18	42.9
Other Construction Professionals	8	6	3	7.1
Total	**54**	**47**	**42**	**77.8**

4.3 Discussion of the result

The main objective of this study was, therefore, to identify the major causes of cost overrun and mitigation measures on public building construction projects at ECWC from professionals view point. Desk study was used to understand the existence and the severity of the cost overrun plus the questionnaire survey was also used to identify the causes and mitigation measures of cost overrun. A total of 42 samples were analyzed statistically with Importance Index (RII) on 43 causative factors of cost overrun and 27 mitigation measures. The responses of the respondents which were collected through questionnaires survey discussed by using tables and percentages extracted from the analysis as follows.

4.3.1 Ranking of causes of cost overrun by a client

Table 5. The leading causes of cost overrun related to the client

Factors of cost overrun	Client caused	
	RII	**Rank**
Cash flow difficulties faced by the owner of the project	0.91	1
Delay in disbursing interim payments to the	0.85	2

contractor by the client		
Changing the scope of the work by the client after the contract awarded to the contractor	0.84	3
Unrealistic contract duration or completion period set by the client	0.83	4
Client initiated Additional or Variation works on the original contract.	0.78	5
Delay in tendering process to select a contractor	0.60	6
Policy in accepting a contractor with a lowest financial tender offer	0.55	7

Source: Own Survey, 2018

The respondents ranked the causes of construction cost overrun factors caused by the client listed in Table 5 above. Top three ranked causes of cost overrun are: cash flow difficulties faced by the client of the project was ranked as the first factor leads to cost overrun in a client related financial group with relative important index [RII=0.91],delay in disbursing interim payments to the contractor by the client ranked second with relative important index[RII=0.91]. As stated in the contract agreement the client should pay an interim payment to the contractor accordingly and the interim payments should be done on monthly basis based on the work executed and changing the scope of the work by the client after the contract awarded to the contractor ranked third [RII=0.84].

4.3.2 Ranking of causes of cost overrun by a consultant

Table 6. The leading causes of cost overrun related to the consultant

Factors of cost overrun	**Consultant caused**	
	RII	**Rank**
Delay in decision-making on critical issues	0.89	1
Frequent design changes on the project after	0.86	2

the contract awarded to the contractor		
Insufficient supervision of the consultant during construction on progress	0.74	3
Corruption practice of the consultant's employees	0.73	4
Deficiencies in monitoring and feedback to problems observed onsite to the contractor	0.71	5
Poor experience in contract & site management of the consultant's employees	0.69	6
Poor risk management strategies to tackle problems happened onsite	0.67	7
Delay in certifying of an interim payment certificate to the contractor	0.63	8
Inadequate experience of consultant organization	0.61	9
Mistakes & discrepancies in a contract document and on design documents prepared by the consultant	0.59	10
Complexity of the design to be constructed	0.56	11

Source: Own Survey, 2018

The respondents ranked the causes of construction cost overrun factors caused by the consultant responsibility listed in Table 6 above. Top three ranked causes of cost overrun are: delay in decision-making on critical issues ranked first causes of cost overrun created by the consultant with the relative importance index [RII=0.89], frequent design changes on the project after the contract awarded to the contractor ranked second with the relative importance index [RII=0.86]. As much as possible the consultant expected to complete the design diligently before the contract is awarded to the contractor and insufficient supervision of the consultant during construction on progress ranked third with relative importance index [RII=0.74].

4.3.3 Ranking of causes of cost overrun by a contractor

Table 7. The leading causes of cost overrun related to the contractor

Factors of cost overrun	Contractor caused	
	RII	**Rank**
Poor preplanning process accomplished by the contractor	0.94	1
Inaccurate cost estimation by the contractor	0.92	2
Poor financial management and control practices undertaken by the contractor	0.89	3
Poor understanding of the scope of the work & methods of construction	0.88	4
Inadequate experience of the contractor organization	0.87	5
Low productivity of labor force assented on the construction project	0.81	6
Improper coordination & relationship between project team members	0.77	7
Delay in site possession & mobilization of resources to the construction site	0.72	8
Lack of skilled labor force to assign on the construction project	0.70	9
Lack of qualified project manager	0.70	9
Construction errors & defective work performed on the construction project	0.69	11
Contractor's financial difficulties	0.69	11
Shortage of construction materials and equipment mandatory for the project	0.68	13
Improper allocations and control of construction resources	0.65	14

Source: Own Survey, 2018

The respondents ranked the causes of construction cost overrun factors caused by the contractor listed in Table 7 above. Top three ranked causes of cost overrun are: poor preplanning process accomplished by the contractor ranked first with the relative importance index [RII=0.94].Inaccurate cost planning estimation ranked second with the relative importance index [RII=0.92]and poor financial management and control practices undertaken by the contractor ranked third with the relative importance index [RII=0.89].

4.3.4 Ranking of causes of cost overrun by an External factors

Table 8. The leading causes of cost overrun related to the external factors

Factors of cost overrun	**External factors**	
	RII	**Rank**
Economic instability and market inflation pressure on the price of resources required for the construction	0.90	1
Availability of local construction materials and labor nearby the project location	0.88	2
Currency exchange rate fluctuation	0.85	3
Number of construction projects running at the same time in the same area.	0.78	4
Political Condition (i.e. uprising, riot, war)	0.75	5
Unexpected geological condition or sub-surface difficulties faced during execution.	0.71	6
Adverse weather condition or unsuitable weather condition to undertake construction activities	0.70	7
Project location (the availability of resources, utilities & infrastructure)	0.63	8
Tax and Insurance premium increase by the government	0.55	9
Social & cultural impact of the society around the construction project location.	0.53	10

Source: Own Survey, 2018

The respondents ranked the causes of construction cost overrun factors caused by the External listed in Table above. Top three ranked causes of cost overrun are: economic instability and market inflation pressure on the price of resources required for the construction ranked first with the relative importance index [RII=0.90], availability of local construction materials and labor nearby the project location ranked second with the

relative importance index [RII=0.88] and currency exchange rate fluctuation ranked third with the relative importance index [RII=0.85].

4.3.5 Overall ranking of causes of cost overrun

Table 9. The Top ten overall causes of cost overrun

Factors of cost overrun	**Overall**		**Category**
	RII	**Rank**	
Poor preplanning process accomplished by the contractor	0.94	1	Contractor
Inaccurate cost estimation by the contractor	0.92	2	Contractor
Cash flow difficulties faced by the owner of the project	0.91	3	Client
Economic instability and market inflation pressure on the price of resources required for the construction	0.90	4	External Factor
Delay in decision-making on critical issues by the consultant	0.89	5	Consultant
Poor financial management and control practices undertaken by the contractor	0.89	5	Contractor
Poor understanding of the scope of the work & methods of construction	0.88	7	Contractor
Availability of local construction materials and labor nearby the project location	0.88	7	External Factor
Inadequate experience of the contractor organization	0.87	9	Contractor
Frequent design changes on the project after the contract awarded to the contractor	0.86	10	Consultant

Source: Own Survey, 2018

Table 9 above shows, according to the survey analysis result the top ten causes of cost overrun in public building construction projects with respect to the client, consultant, contractor and external factors: poor preplanning process accomplished by the contractor ranked first contributor of cost overrun with [RII=0.94]. Shah (2016) identified contractor's improper planning as a leading cost overrun factor in Malaysia and Zenabu & Getachew (2015)also showed the cost overrun in public construction projects in Ethiopia as mainly due to poor planning, inaccurate cost planning & scheduling of activities by the contractor ranked second with [RII=0.92], cash flow difficulties faced by the owner of the project contractor ranked third with [RII=0.91],economic instability and market inflation pressure on the price of resources required for the construction ranked fourth with [RII=0.90]. Bekr(2015) identified inflation pressure (price fluctuation) as a major cause of cost overrun in Jordan, Nega (2008) and Zenabu & Getachew (2015)also identified inflationary pressure as causes of cost overrun in Ethiopia. Delay in decision-making on critical issues by the consultant ranked fifth with [RII=0.89].

4.3.6 Ranking the mitigation measures

Table 10. The rank of mitigation measures

Mitigation measures	**Overall**	
	RII	**Rank**
Proper project planning and scheduling by the contractor	0.92	1
Appropriate scope definition of the project at start of the project by the client & consultant	0.91	2
Realistic cost estimation by the contractor before contract signing	0.89	3
Giving prompt decisions and clarifications to critical issues by the consultant	0.87	4
Increase supply of construction materials to the project site by the contractor	0.87	4
Assign competent personnel to the project by the consultant & contractor	0.83	6
Timely and reasonable procurement of construction materials by the contractor	0.81	7
Use of appropriate construction methods by the contractor	0.80	8
Increasing the frequency of supervision to the project site by the consultant	0.80	8

Implementing efficient construction management practice by the contractor	0.77	10

Source: Own Survey, 2018

Table 10 above shows, the relative importance index (RII) of the mitigation measures for the cost overrun in public building projects. Proper project planning and scheduling by the contractor ranked first with [RII=0.92] followed by appropriate scope definition of the project at start of the project by the client & consultant with [RII=0.91] and realistic cost estimation by the contractor before contract signing with [RII=0.89].The top ten mitigating measures RII result showed that all of them are above average 0.50 this implies that, RII results are on the higher level the mitigation measures able to curb the cost overrun (Jacob et al, 2015).

CHAPTER FIVE: FINDING, CONCLUSION AND RECOMMENDATION

5.1 Summary of major findings and conclusion

The findings of the study summarized as follows:

i. 7 out of 19 (36.84%) projects investigated in the desk review suffered with cost overruns in their execution. For these construction projects, the actual cost overrun ranges from 10 % to 50% of the contract completion cost.

ii. There are 14 contractor- related cost overrun factors considered in this study. Five of them are among the top 10. These are Poor preplanning process accomplished by the contractor ranked 1st, Inaccurate cost estimation by the contractor ranked 2nd, Poor financial management and control practices undertaken by the contractor ranked 5th. Poor understanding of the scope of the work & methods of construction ranked 7thand Inadequate experience of the contractor organization ranked 9th.

iii. In this study, there are 11 consultants-related cost overrun factors considered in this study. Delay in decision-making on critical issues by the consultant ranked 5th and Frequent design changes on the project after the contract awarded to the contractor ranked 10th .

iv. This study 7 client-related cause of cost overrun considered but, only one factor is found among the top 10 factors shown in (Table 9). Cash flow difficulties faced by the owner of the project ranked 3rd.

v. The study considered 10 cost overrun factors related to External factors. There are 2 External-related factors among the top 10 factors. Economic instability and market inflation pressure on the price of resources required for the construction ranked 4th and Availability of local construction materials and labor nearby the project location ranked 7th.

vi. Out of 10 top mitigation measures 7 of them are contractor-related issues. Proper project planning and scheduling by the contractor ranked 1st, realistic cost estimation by the contractor before contract signing ranked 3rd,increase supply of construction materials to the project site by the contractor ranked 4th,assign competent personnel to the project ranked 6th, timely and reasonable procurement of construction materials by the contractor 7th, use of appropriate construction methods by the contractor and increasing the frequency of supervision to the project site by the consultant 8th and implementing efficient construction management practice by the contractor ranked 10th .

vii. Out of 10 top mitigation measures 3 of them are consultant-related issues and out of the 3, one of them was a joint responsibility of the client and the consultant.

viii. The findings shown as even though the condition and the extent differs all stakeholders (the client, consultant, contractors and the external) were contribute for the cost overrun and mitigation measures in construction projects.

It is known that financial resources are so scarce in a country like Ethiopia. Assessment of causes of construction cost overrun and mitigation measure are mandatory to minimize or avoid the unnecessary additional cost incurred on the construction industry.

The main conclusions revealed by this study are:

- ✓ An assessment of factors affecting cost overrun in public building construction projects in ECWC from the professional perspective has found that, poor preplanning process accomplished by the contractor[RII=0.94],inaccurate cost estimation by the contractor[RII=0.92], cash flow difficulties faced by the owner of the project [RII=0.91], economic instability and market inflation pressure on the price of resources required for the construction[RII=0.90], delay in decision-making on critical issues by the consultant and poor financial management and control practices undertaken by the contractor[RII=0.89]are the top major factors that causes cost overrun in public building construction projects.
- ✓ Secondly, the study has identified the mitigation measures that should be taken to avoid or minimize cost overrun. As a result of this, Clients are required to focus on appropriate scope definition of the project at start of the project together with

the consultant. Contractors are required to be sure on proper project planning and scheduling, realistic cost estimation, increase supply of construction materials to the project site, assign competent personnel to the project, timely and reasonable procurement of construction materials, use of appropriate construction methods and implementing efficient construction management practice. Consultants should focus on giving prompt decisions and clarifications to critical issues, assigning competent personnel to the project and increasing the frequency of supervision to the project site.

The study concluded that all in all cost overruns as well as mitigation measures weren't a one party responsibility or accountability thus, all stakeholders (i.e. the client, the consultant, the contractor and the External bodies) should fulfill their obligation in order to tackle cost overrun in general.

5.2 Recommendation

Considering the outcomes from the literature review and based on the findings of the survey, the following recommendations are suggested to manage the cost overrun risks associated with ECWC building construction projects in order to control, minimize and avoid cost overrun.

- ✓ ECWC better to realistically estimate the cost of the project in a scrutinized manner during the preparation of financial proposal for bidding.
- ✓ ECWC should properly preplan the projects in detail before commencement of execution.
- ✓ ECWC properly plan and manage the project cash flow to avoid the financial problems created by own financial inefficiency.
- ✓ ECWC had better to use advance and interim payments properly to avoid the financial problems created by client due to cash shortage.
- ✓ ECWC better to check and present in advance critical issues which require the consultants prompt decision.
- ✓ ECWC should develop well defined, efficient and effective organizational structures to manage the project.

- ✓ The government should regulate the market inflation pressure on the price of resources required for the construction.
- ✓ All stakeholders involving in the construction industry should work hand in hand and fulfill their obligations for the success of the industry.

REFERENCES

1. Almaktari,M.A., Hong,R. & Nzige, J. (2017). The Factors influencing Cost Overrun on Construction Projects in Yemen, International Journal of Scientific & Engineering Research Volume 8, Issue 11, November-2017, pp.582-589.
2. Construction Sector Transparency Initiative Ethiopia Report (2014).
3. Devi, C.A. & Ananthanarayanan,K. (2017). Factors influencing cost overrun in Indian construction projects.
4. Doloi, H. (2013). Cost Overruns and Failure in Project Management: Understanding the Roles of Key Stakeholders in Construction Projects, Journal of Construction Engineering and Management.
5. Ethiopian Construction Industry Development Policy (ECIDP), (2014).
6. Ethiopian Economic Association (EEA),(2008). Report on the Ethiopian Economy, Volume VI, 2006/07, Addis Ababa.
7. Ghanim, A.B. (2015). Identifying Factors Leading to Cost Overrun in Construction Projects in Jordan, Journal of Construction Engineering, Technology and Management, Volume 5.
8. Hinson, G. (2011) Cost Overruns in Construction.
9. Jacob A. B., Jonathan K. F. & Olubola A. A. (2015). Assessment of Contractors' Mitigating Measures for Cost Overrun of Building Projects in South-Western Nigeria.
10. Karunakaran,P.,Abdullah,A.H.,Nagapan,S.,Sohu,S. & Kasvar,S. (2018). Categorization of potential project cost overrun factors in construction industry, IOP Conference Series: Earth and Environmental Science.
11. Kerzner, H. (2009). Project Management, a Systems Approach to Planning, Scheduling and Controlling, 8 th Edition, PP. 685-686.
12. KPMG International's Global Construction Survey Report (2015).
13. Lee, Jin-Kyung (2008). Cost Overrun and Cause in Korean Social Overhead Capital Projects: Roads, Rails, Airports, and Ports, Journal of Urban Planning and Development, Vol. 134, No.2, 59-62.

14. Lester, A. (2013). Project Management, Planning and Control: Managing Engineering, Construction and Manufacturing Projects to PMI, APM and BSI Standards, 6th Edition, Butterworth-Heinemann Imprint, pp.592.
15. Mark, S., Philip, L., and Andrian, T. (2009). Research Methods for Business Students, 5thEdition, pp 233-237.
16. Ministry of Works and Urban Development Report (2012).
17. Ministry of Construction Report (2016).
18. Memon, A., Rehman, I., & Azis, A. (2012). Time & Cost performance in Construction Projects in Southern and Central Region of Peninsular Malaysia International Journal of advances in applied sciences, Vol. I, pp. 45-52.
19. Memon, A.H. (2013). The way forward in sustainable construction: Issues and challenges. International Journal of Advances in Applied Sciences, 2(1), pp.1-8.
20. Nahid, G. (2003). Understanding Reliability and Validity in Qualitative Research, pp.598.
21. Nega, F. (2008). Causes and effects of cost overrun on public building construction projects in Ethiopia. Master thesis, Addis Ababa University.
22. Niazi,G.A. & Painting, N. (2017). Significant Factors Causing Cost Overruns in the Construction Industry in Afghanistan, 7th International Conference on Engineering, Project, and Production Management, Available online at www.sciencedirect.com.
23. Olawale, Y.A. & Sun, M. (2010). Cost and time control of construction projects: Inhibiting factors and mitigating measures in practice, Construction Management and Economics, pp. 509 – 526.
24. Parviz F. R. (2002). Project Estimating and Cost Management, Management Concepts, 1st Edition pp. 81.
25. PMBOK® Guide (5thed.). Newtown Square, PA, USA: Project Management Institute (PMI).
26. Ramabhadran, M. (2018). An Investigation into Cost Overrun in Construction Projects in United Arab Emirates, International Journal of Construction Engineering and Management, pp. 1-21.
27. Retrieved from https://allafrica.com /stories/ 201803280594.html.
28. Retrieved from http://www.abyssinialaw.com /study-on-line/item/413-historical-background-of-the-construction-industry.

29. Retrieved from http://www.tutorialspoint.com.
30. Roslan,N., Zainun,N.Y. & Memon,A.H. (2014). Measures for Controlling Time and Cost Overrun Factors during Execution Stage, International Journal of Construction Technology and Management, Vol.1, No.1, 2014.
31. Saidu, I. & Shakantu, W. (2017). An investigation into cost overruns for ongoing building projects in Abuja, Nigeria.
32. Sekaran, U. (2001). Research methods for business: A skills building approach (2nd Ed.). New York: John Wiley & Sons, Inc.
33. Shah,R.(2016). An Exploration of Causes for Delay and Cost Overruns in construction Projects; Case Study Australia, Malaysia and Ghana, Journal of Advanced College of Engineering and Management, Vol. 2.
34. Subramani, T., Sruthi, P.S., & Kavitha, M. (2014). Causes of Cost Overrun in Construction, IOSR Journal of Engineering, Vol. 04, PP 01-07.
35. Taye, M. (2016). Assessment of Time and Cost Overrun in Construction Projects; Case study at Defense Construction Enterprise.
36. UN (1996). International Standards Industrial Classification (ISIC), Rev. 3, United Nations Statistical Division.
37. World Economic Forum Report (2016).
38. Zewdu, Z. T. & Teka, G. (2015). Causes of Contractor Cost Overrun in Construction Projects: The Case of Ethiopian Construction Sector. International Journal of Business and Economics Research. Vol. 4, No. 4, 2015, pp. 180-191.

Questionnaire for data collection

Dear respondents,

I am studying Master's degree program of Project Management which is conducted by Addis Ababa University School of Commerce.

The main purpose of this questionnaire survey is to collect information on "Assessment of Factors Affecting Cost Overrun in Public Building Construction Projects" (case study at Ethiopian Construction Works Corporation). You are requested to answer the questions in the questionnaire based on your personal knowledge and experience. The questionnaire has four sections. The first section (Section I) consists of questions aimed at collecting General information about the respondent. The second section (Section II) is aimed at finding out the causes of cost overruns. The third section (Section III is focused on how to mitigate cost overruns. The fourth section (Section IV) focused on subjective questions.

Hence, I kindly request you to fill up the questionnaire which will have an immense help for my study. I assure you that, this study is solely intended for academic purposes and confidentiality of your response is guaranteed. Please provide the information as soon as you can.

Finally, I would like say thank you in advance for your kind cooperation.

SECTION – I (General Information)

Instruction: Please indicate the significance rate of each factor by ticking the appropriate box.

Q.1 Respondent Name (Optional)

_____,

Q.2 Job status

Top Manager ☐ Team Leader ☐ Project Manager ☐
Site Engineer ☐ Other construction Professional ☐

Q.3 Relevant work experience (Years)

Up to 5 ☐ 5 – 10 ☐ 10 – 15 ☐ Above 15 ☐

Q.4 Educational qualification

Diploma ☐ 1st Degree ☐ 2nd Degree ☐

SECTION – II (Causes of Cost overrun)

Instruction: Please indicate the significance rate of each factor by ticking the appropriate box. Add any remark relating to each factor on the last column.
1 = not significant, 2 = slightly significant, 3 =moderately significant, 4 = very significant, and 5 = extremely significant

No.	**Causes of Cost overrun**	**1**	**2**	**3**	**4**	**5**	Remark
I	**Client Caused**						
1	Cash flow difficulties faced by the owner of the project						
2	Delay in disbursing interim payments to the contractor by the client						
3	Delay in tendering process to select a contractor						
4	Policy in accepting a contractor with a lowest financial tender offer						
5	Client initiated additional or variation works on the original contract.						
6	Unrealistic contract duration or completion period set by the client						
7	Changing the scope of the work by the client after the contract awarded to the contractor						
II	**Consultant Caused**						
8	Delay in certifying of an interim payment certificate to the contractor						
9	Frequent design changes on the project after the contract awarded to the contractor						
10	Complexity of the design to be constructed						
11	Corruption practice of the consultant's employees						
12	Delay in decision-making on critical issues						

13	Inadequate experience of consultant organization						
14	Insufficient supervision of the consultant during construction on progress						
15	Poor experience in contract & site management of the consultant‘s employees						
16	Mistakes &discrepancies in a contract document and on design documents prepared by the consultant						
17	Deficiencies in monitoring and feedback to problems observed onsite to the contractor						
18	Poor risk management strategies to tackle problems happened onsite						
III	**Contractor Caused**						
19	Improper allocations and control of construction resources						
20	Improper coordination & relationship between project team members						
21	Lack of qualified project manager						
22	Lack of skilled labor force to assign on the construction project						
23	Low productivity of labor force assented on the construction project						
24	Poor preplanning process accomplished by the contractor.						
25	Inaccurate cost estimation						
26	Shortage of construction materials and equipment mandatory for the project						
27	Inadequate experience of the contractor organization						
28	Delay in site possession & mobilization of resources to the construction site						

29	Construction errors & defective work performed on the construction project						
30	Poor understanding of the scope of the work & methods of construction						
31	Contractor's financial difficulties						
32	Poor financial management and control practices undertaken by the contractor						
IV	**External Factors**						
33	Tax and Insurance premium increase by the government						
35	Currency exchange rate fluctuation by the government						
36	Availability of local construction materials and labor nearby the project location						
37	Project location(the availability of resources, utilities & infrastructure)						
38	Unexpected geological condition or sub-surface difficulties faced during execution.						
39	Adverse weather condition or unsuitable weather condition to undertake construction activities						
40	Political Condition (i.e. uprising, riot, war)						
41	Social & cultural impact of the society around the construction project location.						
42	Economic instability and market inflation pressure on the price of resources required for the construction						
43	Number of construction projects running at the same time in the same area.						

SECTION – III (Mitigation Measures)

Instruction: Please indicate the significance rate of each factor by ticking the appropriate box. Add any remark relating to each factor on the last column.

1 = not significant, 2 = slightly significant, 3 =moderately significant, 4 =very significant, and 5 = extremely significant

No.	Mitigation Measure	1	2	3	4	5	Remark
1	Assign competent personnel to the project by the consultant & contractor.						
2	Effective strategic planning (by the client, consultant &contractor)						
3	Providing training for the project team members based on the scope of the assignment (by the consultant & contractor).						
4	The consultant & contractor focus on the client's interest.						
5	Consultant & contractor prepare and monitor cash flow during the implementation period.						
6	Conducting regular project site meeting (the client, consultant &contractor).						
7	Improving contract award procedure of the client. (By giving less weight to price & more weight to technical capability and past experience of the contractor).						
8	Use of current technology or use of up-to-date technology utilization by the contractor.						

9	Increase supply of construction materials to the project site by the contractor.						
10	Use of experienced subcontractors and suppliers by the contractor						
11	Timely changing or cancellation of purchase orders by the contractor.						
12	Use of appropriate construction methods by the contractor						
13	Timely and reasonable procurement of construction materials by the contractor						
14	Realistic cost estimation by the contractor before contract signing.						
15	Implementing efficient construction management practice by the contractor.						
16	Efficient utilization of the project teams by the contractor.						
17	Appropriate scope definition of the project at start of the project by the client& consultant.						
18	Proper project planning and scheduling by the contractor.						
19	Giving prompt decisions and clarifications to critical issues by the consultant.						
20	Increasing the labor productivity by the contractor.						
21	Sending clear and complete message to workers to ensure effective communication by the contractor.						

22	Avoid poor quality of work, more rectification and double handling by hiring skilled workers by the contractor.						
23	Creating awareness to the participants to support delivery process by the client.						
24	Increasing the frequency of supervision to the project site by the consultant.						
25	Adoption of tools and techniques (i.e. Earned Value Management, Value Management, Total Quality Management and Business Process Reengineering).						
26	Increasing the expertise and skill of human resources of the contractor and consultant employees.						
27	Application of risk management strategy by the consultant.						

SECTION- IV (Subjective Questions)

1. Prioritize and justify any other factor contributed to causes of construction cost overrun?

_____
_____
_____
_____
_____
_____

2. Prioritize and justify any other mitigation measures?

_____
_____
_____
_____
_____

3. Please give your suggestion and recommendation on cost overruns and the mitigation measures?

_____
_____
_____
_____
_____

Thank You!