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Assessment of Factors Affecting Cost Overrun of Road Construction Projects, The case of Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector

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DECLARATION

This research thesis is my original work and has not been presented for any academic purpose in this or any other university. All sources of material used for the thesis have beenduly acknowledged.

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Dedication

My dear wife, Mrs.Mekdes Awoke, and my little baby boy, you deserve greater praise for your support and understanding and bearing with my absence during my entire MBA study and class attendance. This thesis would not have been fruitful without your love and remarkable support.

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Abstract

In Ethiopian, under a government regulatory body, i.e. Ethiopian Roads Authority, number of road construction projects is increasing from time to time. However, it becomes difficult to complete projects in the allocated budget. Cost overrun is one of the major problems of road construction projects undertook by Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector. This research was carried out to assess and rank the severity of major factors that cause cost overrun during construction projects in the Corporation. Questionnaire surveys together with desk study were used to collect data on time and cost overrun. A total of 82 responsescomprising 32 clients, 38 contractors and 12 consultants were collected and a desk study of 7 completed road construction projects in Ethiopia were investigated. The data was subjected to descriptive statistical analysis and subsequently mean scores were determined to rank factors level of severity. From the study it was found that except one which was completed under estimated budget, the majority of road construction projects finished with severe cost overrun. The rate of cost overrun ranges from a minimum of 14.85 % to the maximum of 37.32% of the work executed and certified amount. The study identified 31 causes of cost overrun for the case of Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector. The most important causes of cost overrun were found to be ineffective way of management of Material and Machinery resources at project (3.56), Skill of Site Management Crew (3.53), wrong method of System/Approach employed to manage site activities (3.44), contract management (Inadequate knowledge and skills of Project Management and Contract Administration teams) (3.43) and Design errors (3.4) are the five most important factors affecting cost of construction projects. It is likely that these findings will help focus on very significant factors to improve the construction performance of the Corporation in the future.

Key Words: Cost Overrun, Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector

CHAPTER I

1.1 Introduction - Background of the Study

An overview of construction industry development in Ethiopia in which ERA, mainly, and the ECWC, which have been the dominant actors, is presented in this chapter; while it may have been appropriated to discuss the topic in the frame of reference, it is discussed here to give the reader a better understanding of the research problem.

The construction industry is multipart in nature because it involves different technology, equitable size of the projects; a high level of organizational complexity and different parties; client, contractor, consultant, Supplier, Bank, Insurance, permitting agency and public). (Venkataramanand & Pinto,2008). Since it opens an opportunity for the large employments; create a market for construction inputs providers and its services and the services delivered are an input for other sectors. Due to its enormous investment, it's considered as an economic uplifting of a country (Chantal & Cantarelli, 2010). That is why developing countries also invest in infrastructure development to increase their infrastructure status that is used to compete in the globalized world (J.-K. Lee, 2008). The development of infrastructure has positive significant effect for developed and developing society, predominantly road projects in the aspects of creating the direct and indirect career opportunity, improve the standards of the country internationally as well as locally (Garry, Creedy, Skitmore, 2010). This positive significance depends on the achievements of the goal of the project, which is accomplishing the project within the available environment by putting together all the resources inbounded time, estimated project cost and specified quality.

Road sector construction projects in Ethiopia are way through which development strategies are achieved. Development strategies which are fulfilled through successful road projects to import accessibility of rural areas, lower costs associated with transport maintenance and open more areas for development activities. Road projects, involving large amount of capital, also contribute to the total economy through job creation and in a ripple effect to other business activities.

In Ethiopia the result of midterm and final reviews of the RSDP (Road sector development program) shows, despite the improvement seen in performance and productivity within the sector, there are problems of delay and cost overrun in almost all road construction projects. It is

also identified that there is a need for further strengthening of institutional capacity, adoption of new construction technologies and modern project management principles, and additional regulatory reforms in order to maximize the efficiency of the Ethiopian road construction industry. (Midterm review, RSDP II, 2005)

Mostly, Ethiopian road projects are financed by the government and it is sensitive to the unpredictable costs. Whereas significant amount of capital is being invested in to infrastructure development, the infrastructure of the country is still considered to be very poor, when it compared with the standards of the Sub-Saharan countries (Lhee, 2012)

1.2 Features of Construction Projects

It is obvious that the construction industry has special features that are not usually encountered in other industries. Usually in construction, when conditions in the field turn out to be more complex than what was anticipated in the planning and design phase, additional costs and time are needed. Any extremes can affect productivity level, damage materials and work in place. Moreover the industry, most of the time, is routine oriented, meaning that it is difficult to use mass production techniques due to the variability of the construction site. One of the variability of the construction is, bearing capacity of the soil. Because of all these factors and others, it is difficult to predict accurately how much money will be necessary to complete construction projects. Creating a large facility takes a longtime and usually involves a large capital investment. Cost overruns, delays and other problems tend to be proportionally huge [Gould, et al, 2002].

Although there is ample literature on project cost overruns within the construction industry, the review of the literature revealed that very few studies have been conducted within the Ethiopian road construction sector. Though some example could be mentioned that have examined road construction project overruns, it has been agreed that the issue has not gained as much attention as it needs when compared to the critical role it holds to the country.

1.3 Road Construction Development in Ethiopia

The construction sector is one of the most important contributors for the political, economic, social and technological development of one country (T. Wakjira, 2012). Existing facts show that about 50% of the Federal capital budget of Ethiopia is routed to the development of physical

infrastructure, from this nearly 33% were for the road projects (Sae-Hyun J, 2011). Besides, the involvement of the private sector as the partners in the capital investment, increased capital investment in the field, as well as, promote more advanced technologies and materials.

This sector is significantly increased both in volume and density of work seen in construction of Ethiopia. A number of studies in the public sector show that more than 80% of the construction projects are delayed run over budget and/or lack the management (Ashebir,Wubishet, Murad, 2017).

Since its commencement the Ethiopian Roads Authority (ERA) has administered the road sector. ERA was established in 1967 by proclamation No 256/67 to provide for the control and regulation of travel and transport on the road. The ERA is responsible for the use of all roads within Ethiopia, vehicles using these roads, and to all matters relating to road transport activities of the country. After the downfall of the military government, ERA restructured its obligations with a vision to ensure the provision of a modern, integrated, and safe road transport service to meet the needs of all the communities of a strong and unitary economic and political system in Ethiopia. When we look at the road network of the country over the past five decades, compared to the year 1951 the total road network has increased with factor seven to reach the level in 2009. In 1951 the total stock of road network was only 6400 km; in 2009 that is 46812 km (ERA 2009). Ethiopian Roads Authority (ERA), 2009

The rise in the length of road is due to the emphasis given to the sector. In particular, the current government, the Federal Democratic Republic of Ethiopia, has placed increased emphasis on improving the quality and size of the road infrastructure. To address the constraints in the road sector, related to restricted road network coverage and low standards, the Government formulated the road sector development program in 1997. The RSDP has been implemented in four separate phases, as follows:

- RSDP I – Period from July 1997 to June 2002 (5-year plan)
- RSDP II – Period July 2002 to June 2007 (5-year plan)
- RSDP III – Period July 2007 to June 2010 (3-year plan)
- RSDP IV – Period July 2010 to June 2015 (5-year plan)

Ethiopian Construction Works Corporation/ECWC/ was established as a public enterprise since Dec 18, 2015. It has been incorporated according to Council of Ministers Regulation No 366/2008. The establishment brought about merging former giant construction corporations.

Ethiopian Water Works Corporation is now responsible to serve water infrastructure construction sector of ECWC and, the former Ethiopian Road Construction Corporation/ERCC/ is in charge of commissioning transport infrastructure construction sector for newly established corporation, ECWC. According to the regulation, the Transport Infrastructure Construction Sector of ECWC has the following purposes for its establishment, as same as former ERCC.

- To engage in domestic and overseas construction works as a contractor in constructing, upgrading and maintaining roads, bridges and other civil works,
- To be engaged in the business of maintaining construction equipment and machinery
- To be engaged in the rental business of construction equipment and machinery
- To produce and sell construction materials
- To undertake in any other related activities necessary for the attainment of its purposes.

The Corporation's head office is based in Addis Ababa, and transport infrastructure construction sector is undertaking several road construction project offices and ten road maintenance offices throughout the country. As it had been in charge of operation department of ERA, the sector has 60 years of experience on road construction and maintenance, also has sufficient experience on bridge construction and maintenance, international and domestic air ports, air strips and other civil service constructions. It has 5275 permanent and 9790 contract which over all 15065 employees. Today, the Corporation is undertaking construction and maintenance activities of over 14,000 kilometers of roads in 2015/16 throughout the country. (ERCC Web Page, www.ercc.com)

1.4 . Statement of the Problem

Construction industry now-a-days is facing severe problem of poor cost management resulting in huge amount of cost overrun. The problem of poor cost management and overrun in project cost is serious issue in both developed and developing countries. The success measure for a project is defined by completing it within specified cost, time and quality. However, the construction industry is full of projects that were completed with significant cost deviation (Amhed, Zahara & Juma, 2010).

In Ethiopia, though the construction sector is given high prominence, several defects are being noted in the sectors that need immediate action. One significant problem is the fact that current infrastructure and construction projects show significant cost variation (ECIDP, 2014). This is

occurring in spite of the fact that the Ethiopian Government played significant role in assisting contractors by providing training, supplying machinery, and by developing supportive guidance (ECIDP, 2014). (Zinabu & Getachew, 2015)

Turkey Wakjira (2012), in his study of the risk factors leading to cost overrun in Ethiopia federal road construction projects and its consequences, examined the effects of cost on the delivery of construction projects in the country. To obtain expert opinions from the sector, he listed fifty four (54) factors and 16 possible effects. The result of the desk study indicated that out of 30 upgrading and rehabilitation road construction projects investigated, 24 projects (80%) suffered cost overrun in their execution. The average rate of cost overrun in these projects was 26.95% of the contract amount. And 100% of the respondents to the questionnaire have recognized cost overrun as one of the major problems in Federal road construction projects. 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 identified as major factors leading to cost overrun.

Abubeker (2015) conducted a research on the factors that cause time and cost overrun during construction and their effects on road construction projects in Addis Ababa. The work had concluded that 100% of the road construction projects suffered both time and cost overrun. The rate of time overrun ranges from a minimum of 25% to the maximum of 264.38% of the contract amount and cost overrun ranges from a minimum of 4.11% to the maximum of 135.06% of the contract amount. The most important causes of cost overrun were found to be delay in construction, inadequate supply of raw materials and equipment by contractors, design changes, incomplete design at the time of tender.

The main purpose of this thesis was to look at scenarios of potential factors, which are also the research specific questions, contributing to construction and maintenance cost overrun with regard to their type and level of severity in the ECWC, Transport Infrastructure Construction Sector, as a result. An assessment of the study would enable the Corporation would be able to identify the dominating factors leading to undesired higher road construction cost.

1.5 . Research questions

The study questions

1. What major factorswouldhave a leading position to cost overruns in road construction and maintenance projects in ECWC, Transport Infrastructure Construction Sector?
2. What it look like the relative perception of industry wise stakeholders of ECWC, TIC, Client, Contractor and Consultant about major factors of Construction projects cost overrun?

1.6 .The Objectives of the Study

The objective of the study was to identify the factors influencing cost overruns and rank them in order of significance to raise the level of awareness among stakeholders of the problem. The objective was achieved through a questionnaire survey. From the existing research finding, it was tried to identify the factors that influence cost overruns. The questionnaire was supported by, informal interviews and discussions with some of the respondents. The study aimed to realize the following majorobjectives stemmed from the research question.

1. To assess factors influencing ECWC, Transport Infrastructure Construction Sector, tocost overruns while undertaking road construction and maintenance activities.
2. To determine the severity rank amongst the factors.
3. To outline coexistence of mutual understanding between clients, consultants and contractors regarding ranking cost overrun factors.

1.7 Significance of the study

An assessment of the study would enable the Corporation and its stakeholders; Clients, Contractors and Consultants, toidentify the major factors leading to high construction and maintenance cost overrun while executing road projects as well as to trace where their common understanding about the cost overrun factors of road construction.

1.8 . Scope and Limitations of the study

The study will only try to identify key causes of cost overrun of road construction projectscommenced in 2011 till 2015,undertaken by the Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector, formerly known as Ethiopian Roads Construction Corporation.

As it has been tried to point out in the scope of the study, the prospect of the study was limited only on assessment of factors of construction and maintenance cost overrun in ECWC, TICS level.

1.9 . Organization of the Thesis

On the basis of creating awareness to consequences of high cost overrun of construction, the aim of this study was, mainly, to identify the factors affecting road construction cost overrun in the study area, and their severity rank as conceived by major stakeholders; the client, the contractor and consultants. So as to succeed in attaining the goal of the objectives, the thesis organized in the following order

Primarily, Formulation of statement of the problem, research question and overall objectives was determined in chapter one. Next, in Chapter Two, background of the study and literatures review was carried out and, list of various factors causing cost overrun from various authors' perspectives and scenarios was sorted out. Research methodology adopted to address the research objectives to answer the research question was illustrated and reasoned out. Then, in Chapter Four: analyses of the results were made and described findings from desk study and questionnaire survey data analyses about factors of cost overruns perceived by Ethiopian Construction Works Corporation, road construction projects from client, contractor, and consultants viewpoints. Finally, key thesis Findings was discussed and conclusion and inferences were extracted to the problem with respect to the objectives of the thesis. Contribution of the study, its limitation and recommendation was also forwarded in this last chapter of the thesis.

CHAPTER TWO
Literature Review

2.1 . Introduction

The construction industry is truly the engine of national economy through which the total of physical development is achieved. The construction industry is a vital element of the economy and has a significant effect on the efficiency and productivity of other industry sectors. One cannot think of widespread investment in manufacturing, agriculture, or service sectors unless the construction results of infrastructure facilities are in place. In some of the developing countries, the growth rate of construction activity exceeds that of population and of GDP (Chitkara, 2004).

2.2 . Cost Overrun; Extent and Causes

2.2.1 Extent of Cost Overrun

As (Ashebir, Wubshet & Murad, 2017) organized review of literatures, the construction project cost estimation helps either public or private organ to plan the self-financial capacity. But due to different conditional or unconditional situations the project may not complete within budgeted costs.

The amount of cost overrun is not the problem of specific areas and from country to country is variable, either in developing or developed countries. In Palestine 76% of the projects are averagely underestimated which was pushing the country to the unplanned financial crises (Charles, Jahren, 1990). This percentage also related with 77% of the highway projects of US which have 50% of cost overrun, cited by (Meduri, 2013). It also linked to the investigated magnitude of cost overrun in Dutch infrastructure projects in their series of studies. The road projects experience 18.6% of the total costs (Azhar, 2008). The project cost over-run in developing countries is one of the problems seen mostly in different public projects. Public Private Partner-ship (PPP) infrastructure projects in India nearly 69% of the project experience's cost overrun which cost around $76.49 million.

Construction industry now-a-days is facing severe problem of poor cost management resulting in huge amount of cost overrun. The problem of poor cost management and overrun in project cost is serious issue in both developed and developing countries. This needs serious attention for

improving the construction cost performance as rarely projects are completed within budget (Chimwaso, 2001). In order to explore the problem of cost performance in construction projects worldwide, Flyvbjerg et al. (2003) studied 258 projects in 20 nations with an approximate worth of US$ 90 billion (size of projects range from US$ 1.5 million to 8.5 billion) and found that cost escalation was a common practice and happens in almost nine out of 10 projects with an average of 28% higher than forecast costs. They concluded that average cost escalation in Europe was 25.7%, North America 23.6% and other geographical areas was 64.6%, while cost performance in construction projects has not improved over time and it is in the same order of magnitude today as it was 70 years ago. World Bank also reported that 63% of the 1778 construction projects financed faced poor performance with overrun in budget at an average of 40% as cited by Amehet al. (2010) and Zujoet al. (2010). By conducting questionnaire survey on cost study in United Kingdom, Olawale and Sun (2010) reported that many construction projects still suffer cost overruns. Only 41% of respondent participating in survey experienced cost overrun less than 10% of their cost projects. This indicates about 59% of respondents experienced cost overrun more than 10%. In Bosnia and Herzegovina, a study of 177 projects of structures indicated that the 41.23% of structures contracted price was not met and another investigation of 29 building construction structures showed that contracted price overruns were noted at 17 (58.62%) of the structures with maximum contracted price overrun of 29.16% at an average of 6.84% (Zujoet al., 2010). In Ghana, 75% of the projects exceeded the original project cost whereas only 25% were completed within the budget (Frimpong, Oluwoye, & Crawford, 2003). Similarly, in Malaysia also, the problem of cost overrun is a serious issue. Abdullah et al. (2009) mentioned that 90% of large MARA construction project were suffered delay with significant effect of time and cost overrun since 1984.

The academic study conducted in Ethiopia on 24 projects by (Shane, 2009) shows 80% of the projects are experiencing the cost overrun. There could be many reasons behind the problems of costs. To control the project cost, it needs an investigation to identify the inherent variables that could be the source of the problems

2.2.2 Causes of Cost Overrun

Cost overruns do not just occur naturally, there are a number of factors during the construction process that when not managed properly can lead to cost overruns. Cost overrun in construction

projects can occur due to many reasons. Sriprasert (2000) pointed out that cost overrun is caused by ineffective construction management and poorly established cost control systems. Apart from these, Frimpong, Oluwoye, & Crawford (2003) studied 26 factors that cause cost overruns in construction of ground water projects in Ghana and found that monthly payments difficulties was the most important cost overruns factor as indicated by contractors and consultants, while owners ranked poor contractor management as the most important factor. Despite of some difference in viewpoints among the three groups surveyed, there was high degree of agreement among them with respect to their ranking of the factors. The overall ranking results indicate that the three groups felt that the major factors that can cause excessive cost overruns in developing countries are poor contractor management, monthly payment difficulties, material procurement, poor technical performances and escalation of material prices.

Kaming, Olomolaiye, Holt, and Harris (1997) together conducted questionnaire survey in Indonesian high-rise construction projects and found that materials cost increased by inflation, inaccurate quantity take-off and labor cost increased due to environment restriction were the most critical causes of cost overruns. Lee (2008) examined cost overrun problem in Korean social overhead capital projects. In a study of 161 completed projects the causes of cost overruns were found as changes in scope, delays during construction, unreasonable estimation and adjustment of project costs and no practical use of the earned value management system. Sriprasert (2000) studying cost overrun problems in construction industry of Thailand mentioned that low quality materials cause higher construction cost than expected because of the loss of materials during construction. This is resulted from a lack of standards for materials and management systems. Also, lack of ability of management to prevent cost overruns or to control construction costs caused many Thai construction companies to fail in achieving effective cost performance in projects. In Malaysia, Ali and Kamaruzzaman (2010) through questionnaire survey indifferent projects at Klang Valley found that main factors that contribute to cost overruns include inaccurate/poor estimation of original cost, construction cost underestimation, improper planning, poor project management, lack of experience, poor contract management, inflation of project costs, high cost of machineries, fluctuation in price of raw materials, unforeseen site conditions, insufficient fund, obsolete/unsuitable construction equipment and methods and mistake in design, while in study of MARA large projects (Memon., 2010) found that cash flow and financial difficulties faced by contractors, contractor's poor site

management and supervision, inadequate contractor experience, shortage of site workers, incorrect planning and scheduling by contractors were most severe factors while changes in scope of project and frequent design changes are least affecting factors on construction cost. This leads to the need of serious attention to understand the contributors of cost overrun in depth and provide solution to control these factors.

a) **Contractor's Site Management (CSM):** Site management category is the most significant contributor as agreed by (90%) respondents This finding is in line with previous research studies which highlight that improving site management is very critical for reducing cost overrun as it affects productivity significantly (Ibrahim *et al*., 2010). Site management of contractor affects overall progress of project (Chan and Kumaraswamy, 1997; Fong *et al*., 2006). Koushki*et al*. (2005) also state that contractor related factors are main contributors to cost overrun.

b) **Information and Communication (ICT):** This representing 81% of the total respondents agreed that ICT category has significant impact on cost overrun. This category is crucial because in implementing construction project, different groups of companies are involved which include civil engineering contractors, subcontractors, and others, in such cases advance information and communication systems are very important as to provide faster data sharing and making practitioners to take decision at earliest in solving any problem occurring during the project execution without delaying the activities. ICT has great impact on economic development (Ameh*et al*., 2010) but unfortunately in construction projects information and communication technology is not properly used and it was found as major reason causing cost overrun. Slow information flow is found as important cause of construction cost overrun (Kaliba*et al*., 2009). Proper implementation of ICT will help in improving coordination and communication among all the personnel involved in construction project which can reduce mistakes and discrepancies. Consequently, successful project can be achieving.

c) **Project Management and Contract Administration (PMCA):** Project management emphasizes on application of knowledge, skills, tools and techniques to project activities to meet project requirements (PMI, 2004) and its role starts from the feasibility study of the project which continues till the commissioning of the project. Project management and contract related issues are also commonly accounted in many countries such as

Pakistan (Azhar*et al*., 2008). These issues are avoidable and can be prevented but unfortunately construction industry experiences poor project management which affects significantly to the overall performance (Ali and Kamaruzzaman, 2010; Meeampol and Ogunlana, 2006). Besides this, poor contract administration also contributes to cost overrun (Elinwa and Buba, 1993; Frimpong, Oluwoye, & Crawford, 2003; Omoregie and Radford, 2006).

d) **Labor related factors (LAB):** Since, construction industry is regarded as labor intensive sector which is highly dependent on labor for execution of the study. Success of any construction project not only depends on the number of labor but also subjected to efficiency of the labor force. Hence, effective labor management is important area which needs serious attention in avoiding cost overrun. Labor related issues are major problems of cost overrun in many countries such as in Kuwait (Koushki*et al*., 2005), Nigeria (Jackson and Steven, 2001) and also Indonesia (Kaming, Olomolaiye, Holt, and Harris, 1997).

e) **Material and Machinery (MMF):** Material and machineries are very important resources of any projects.. Materials are considered as the backbone of construction projects, which accounted for nearly 70% of the total value of project (Elinwa and Buba, 1993). Efficient material management is very critical in achieving successful completion of project as any issue related to material will significantly contribute to cost overrun (Koushki*et al*., 2005). Similarly, machinery resources are also important in assisting manpower resources in stepping up the efficiency of the study by saving huge amount of time and cost. Hence, adequate and efficient equipment use is more advantageous for project as compared to the application of obsolete and inadequate equipments (Kaliba*et al*., 2009).

f) **External factors (EXT):** External factors, like climate, geography of the construction areas, are regarded as un-controllable factors which are usually difficult to control and sometimes it is beyond the control (Olawale and Sun, 2010).

g) **Design and Documentation (DDF):** Design is the road map and systematic guide in leading to the objective of any project while documentation plays an important project. Poor design and documentation issue could leads to poor project performance (Moura *et al*., 2007). This issue can be resulted from lack of either consultants' or contractors' skill

in providing clear working drawings and detailed specification that can be used on site. Documentation focuses on recording all activities during the construction process. These records allow the contractors to identify their performance in the past by looking at the weaknesses and could be used as a guide to improve their future performance (Alwi and Hampson, 2003).

h) **Financial management (FIN):** Financial management is also important criteria in achieving successful construction project but if not well management it could lead to serious problem of cost overrun. Chan and Park (2005) states that most of the contractors are lacking in financial management which do not plan well in distributing the cost of the projects that might lead to poor cost performance. Hence, it is advisable to monitor financial spending thoroughly (Enshassi*et al*., 2009; Koushki*et al*., 2005). Financial difficulties could also occur from the owner side where there is a delay payment of monthly valuations to the contractors (Ogunlana and Promkuntong, 1996) which affect the cash flow of contractors. This leads to slower the project progress. Hence, appropriate funding level should be determined at the very inception of a construction project so that regular periodic payments may be made to the contractor for work done (Choudhury and Phatak, 2004).

In Ethiopia, a study conducted by Nega (2008) on predominant factors for cost overrun in public building construction projects are identified the following major cost overrun factors. These are inflation or increase in the cost of construction materials, poor planning and coordination, change orders due to enhancement required by clients, and excess quantity during construction.

This problem is quite serious and further study on this issue is needed to reduce the problems. (Abubakar, 2015) found some factors that contribute to cost overrun in construction industry which he extracted from different researchers' study.

a) **Inaccurate or Poor Estimation of Original Cost**: Peeters and Madauss (2008) stated that the biggest factor that contributes to overruns of budget is inaccurate estimation of original or initial cost of a project. It is because of technical problem on how to estimate project costs and also not enough project information in the early stage of project.

b) **Inflation of Project Costs**: - Harrison (1981) stated that inflation of project costs cause increasing of costs. Inflation of materials, equipment, and labors costs may vary

geographically within a country, from country to country, and contracts of subcontractors with suppliers may involve different inflation protection terms that agreed with a client. As inflation goes up, interest rates will go up and the costs will increase too.

c) **Improper Planning**: - According to Frimpong (2003), improper planning and management experience limitation causes time and cost overrun.

d) **Poor Project Management**: Poor of site supervision and management and poor project management assistance contribute to problem of cost overrun in construction projects. Poor of site management reflected the weakness and incompetency of contractors. Skillful and experience human resource is insufficient in site management (Long et al., 2008).

e) **Lack of Experience**: Chan and Park (2005) found that most of the contractors are lack of experience especially in financial management. The distribution of the costs does not plan well in the projects. It might cause over of costs budgeted.

f) **Obsolete or Unsuitable Construction Equipment and Methods**: Obsolete and incompatible equipment and methods cause the progress of construction works become slower. Some countries try to import or transfer the modern technology into their countries. However, the method is unsuccessful because lack of skillful human to operate the technology (Long et al., 2004a).

g) **Unforeseen Site Conditions**: Nega (2008) found that actual site conditions of a project are not usually determined until excavation is completed. It is sometimes possible that site conditions are overlooked by the initial review or conditions have changed due to change of weather conditions or sub-soil conditions. The unexpected conditions on sub surface sometimes require fundamental redesign of projects with high expense. Changes of site conditions become a problem for machinery and supplies to move in and out of the site. This also increase costs required.

h) **Mistake in Design**: According to Long et al. (2008), mistakes in design or poor design are caused by the low- competence designer. The approval design or drawing process becomes low quality and ineffective especially for those with government funded projects. The unrealistic design which found after the start the construction projects has to change and it could lead to cost overrun.

i) **Insufficient Fund**: Long et al. (2008) noted that delay of the projects followed by cost increasing to cover all the expenses during construction. Owners are not preparing sufficient fund for project and pay on time as shown in contract agreement to contractor.

j) **Poor Contract Management:** Ogunlana and Olomolaiye (1989) mentioned that many contractors in developing countries have organizes their own commercial undertaking. They are good in managing expense because they are familiar with the business of making money. They pay low wages; submit low bids and low ability to plan and coordinate contracts. They do not follow the agreement that stated in contract.

k) **High Cost of Machineries**: Chan and Park (2005) found that high cost of machineries is one of the market related problems. Construction industry is mainly market driven where it is influenced by current market style. For example, when the oil needed to run machineries increasing, the rental cost of machineries also increasing.

l) **Construction Cost Underestimation**: According to Nega, (2008) some parties have deliberately underestimating of costs for their project in order to get project approval. It is quite serious situation that occurred on some project.

2.3 . Effects of Construction Projects Cost Overruns

Effects are the consequences that will be encountered when cost overruns occur on a construction project. Nega (2008) states that cost overruns have obvious effects for the key stakeholders in particular, and on the construction industry in general. To the client, cost overrun implies added costs over and above those initially agreed upon at the onset, resulting in less returns on investment. To the end user, the added costs are passed on as higher rental or lease costs or prices. To the professionals, cost overrun implies inability to deliver value for money and could well tarnish their reputations and result in loss of confidence reposed in them by clients. To the contractor, it implies loss of profit for non-completion, and defamation that could jeopardize his or her chances of winning further jobs, if at fault. To the industry as a whole, cost overruns could bring about project abandonment and a drop in building activities, bad reputation, and inability to secure project finance or securing it at higher costs due to added risks.

The study of Nega (2008) further identified the following as the major effects of cost overruns: delays during construction, supplementary agreement, additional cost, budget short fall, adversarial relationship between participants of the project, loss of reputation to the consultant,

the consultant will be viewed as incompetent by project owners, high cost of supervision and contract administration for consultants, delayed payments to contractors, the contractor will suffer from budget short fall of the client and poor quality workmanship.

2.4 . Magnitude of Cost Overrun

(Ashebir,2017) has overviewed comparative analysis of cost overruns between different projects or districts which interesting trends and useful for comparison of the magnitude of costs among the projects. As the different study describes majority of ERA projects experience cost overruns and the cost overrun amounts vary among the projects. The extents of cost overrun were dependent on the volume of contract and the range was varying between the projects. His (their) study tested the magnitude of cost overrun of selected projects. 1 The percentage rate of cost overrun among these projects extended from 4.16% to 83.2%. While the average percentage of cost overrun was nearly 21.52%, this costs the owner around 462.6 million of ETB – which was a significant amount when compared with the number of projects.

Turkey Wakjira (2012), in his study of the risk factors leading to cost overrun in Ethiopia federal road construction projects and its consequences, examined the effects of cost on the delivery of construction projects in the country. To obtain expert opinions from the sector, he listed fifty-four (54) factors and 16 possible effects. The result of the desk study indicated that out of 30 upgrading and rehabilitation road construction projects investigated, 24 projects (80%) suffered cost overrun in their execution. The average rate of cost overrun in these projects was 26.95% of the contract amount. And 100% of the respondents to the questionnaire have recognized cost overrun as one of the major problems in Federal road construction projects. 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 identified as major factors leading to cost overrun. The problem of projects delays and cost overruns can nearly be noticed in every project in Ethiopia road construction indicating that this problem didn't receive enough attention by both researches and responsible authorities. The accomplishment of the first 10 years Road Sector Development Program reveals that the execution of most of the Federal road projects resulted in cost and time overruns.

(Ashebir, 2017) argued that identification and management on failure of cost were not exercised in different local construction partners of Ethiopia. As well no formal system of planning,

mitigation and monitoring on failure of place at the project level. The following are some of the highlighted key reasons for project cost overrun, as researchers understood from the case study.

The first reason was the variations that happen throughout implementation. It was mainly caused from design output incompetence, and resultant extra completion project time and cost. As a result of inaccurate planning and insufficient investigation of the project during pre-construction phase of the projects, the actual earth material and rock scoured quantity was much more than predicted. The case study also shows that the lack of attention for the utility (due to the failed pipe structure, constructing an access road, retaining wall at cut sides, paved ditch along box cut sections) resulting major variation in quantities, leading to project schedule and cost overrun.

The second reason is the problem of right of way acquirement, which is a fundamental component of the overall planning and implementation of road construction projects. The process was more difficult, need time, expensive and socially complex over the project. The interference of the extra stakeholders, other than community, the local government officials for the compensation, and lack of awareness of the community were the challenges that volatile the project cost.

The third reason is inadequate and delay of resources. Delayed in the supply of cement, skilled labor and machineries and breakdown of machineries have been a major bottleneck in road projects under this case study. Because of limited suppliers of construction machineries' and machineries' spare parts that create intolerable idle time on projects. This leads the contracting company to pay for the employee without works. Both lack of cement and lack of skilled labor were the jam during the project execution. While the inadequate cement appeared due to limited cement manufacturing capacity and could not meet the supply schedule of various coexisting projects under execution by different governmental and private firms. Skilled and experienced project workforces are unusual assets for an organization and mostly, the migration of professionals was a common problem. Thus, to hold the available workforce and invite new talent, companies need to focus on compensations. These were led to slippage in achievement of critical resulted.

The last reason is material price escalation. Material price escalation was a business possibility faced by all contractors. In latest years, costs of vital inputs such as steel, cement, bitumen, fuel, etc. have fluctuated suddenly. The possibility of material cost fluctuation was a characteristic in projects, and to some extent was taken into consideration in the whole project cost estimate.

However, the unpredictability in material prices escalation made estimate a challenge and leads to inaccurate forecasts. Moreover, the cost estimate adopts the project accomplishment as per the schedule and consider tolerable inflation rate. However, any interruption in project completion and the material price escalation made the initially estimated cost outdated which leading to cost overruns.

They also conducted the overall ranking and rating from different parties; clients consultants and contractors. A combination of questionnaire surveys and case study (archival review) had been used to provide helpful evidence on issues related to the project cost performance. Popularity of the problem of project cost overrun, rating the significance of identified factors, enlarging the top rated factors and the most commonly used mitigating techniques were main issues. One of the basic outcomes that project material price fluctuation plays a significant role on project cost status. The client, consultants and contractor's ignorance of these factors potentially affects the overall project cost performance.

2.5 Empirical Literature Review

Cruthers, Kuotcha, McCaffer and Edum (2008) stated that the management of costs begins with the financial feasibility study, progresses through all the costs that are required to purchase all the resources needed by the project, through to using cost control to ensure that all work that is done is properly completed. The cost implications of scope creep need to be rigorously controlled by way of formal variation orders (Caruthers et al., 2008).

Cost overruns are very common in the construction industry. Hardly few projects get completed within original costs. Al-Najjar (2002)] defines cost overruns as the change in contract amount divided by the original contract award amount. Olawale and Sun (2010) stated that despite the availability of various control techniques and project control software many construction projects still do not achieve their cost objectives. Hence, despite its proven importance it is not uncommon to see a construction project failing to achieve its objectives within the specified cost. Park and Papadopoulou (2012) argued in their joint journal that construction cost overruns mean negative publicity for the design team and loss of client confidence. The impacts for contractors are similar as they see their profit margins shrink. (Mukuka, Aigbavboa, and Thwala 2014)

Many studies have been conducted to find out and address the questions of "why the project didn't achieve its goal within pre-estimated cost? What are the main reasons behind this?" Researches on construction projects in some developing countries indicate that by the time a project is completed, the actual cost exceeds the original contract price by about 30 % . Mahamid et al. investigated the statistical relationship between actual and estimated cost of road construction projects using data from road construction projects implemented in the West Bank in Palestine over the years 2004–2008. They found that 100% of projects suffering from cost diverge, it is found that 76.33% of projects have cost over estimation while 23.67% have cost underestimation. They also concluded that the discrepancy between estimated and actual cost has average of 14.56%, ranging from -39.27% to 98.04%.

Oko, Aliu & Koleola (2010) jointly concluded six important factors affecting the accuracy of a pre tender cost estimate. The six factors are: expertise of consultants, quality of information and information flow requirements, the project team's experience of the construction type, the tender period and market condition, extent of completion of pre- contract design, and the complexity of design and construction. Okpala & Aniekwu (1989) studied the causes of high costs of construction in Nigeria, the results indicated that: High costs can be minimized.

Hence, this study mainly focuses on the potential problem behind the road project cost overrun prevailing in and around the construction operation premises of the Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector, i.e. road.

Abubeker (2015) conducted a research on the factors that cause time and cost overrun during construction and their effects on road construction projects in Addis Ababa. The work had concluded that 100% of the road construction projects suffered both time and cost overrun. The rate of time overrun ranges from a minimum of 25% to the maximum of 264.38% of the contract amount and cost overrun ranges from a minimum of 4.11% to the maximum of 135.06% of the contract amount. The most important causes of cost overrun were found to be delay in construction, inadequate supply of raw materials and equipment by contractors, design changes, incomplete design at the time of tender.

2.6 . Summary of Literatures Review

In general, the literatures reviewed covered mostly what are major factors of cost overrun in road construction projects and, how and why it is becoming a recurrent problem in most of the

countries where survey was conducted, especially in developing countries. Basically, literatures studied, primarily focusing on factors of cost overrun in road construction projects performed in Ethiopia, were reviewed. In addition, recent literatures, published by both from domestic and foreign scholars, have also revealed that this problem has been recurring more and more serious and frequent.

2.7 . Research Need (Gap)

The development of the research model is based on the research question and literature review. Construction cost overrun related theory will be used because the subject has not been won due attention by respective researchers and governing bodies of Ethiopia despite the fact that a longer time, more than 60 years back, since thesector was introduced to contribute for the overall socio-economic development of the country.

Cost overrun is a very common phenomenon and majority of projects in construction industry are facing this problem. Cost overrun occurs when the final cost or expenditure of the project exceeds the original estimation cost, (Avots, 1983). Angelo and Reina (2002) pointed out that cost overrun is one of the main problems in construction industry. The problem may be found in both developing and developed countries. This problem is quite serious and further study on this issue is needed to reduce the problems. There are some significant contributor groups to cost overrun in construction industry which I took them from Malaysian researchers' study for this research thesis on the subject. I took them because; asI have been working in the field for more than twelve years, I usually observe that they are routine, butneglected factors of cost overrun. They could have been easily corrected, using even ordinary measures if identified first. Secondly, previous domestic scholars merely focused on identifying factors in the industry as a whole, instead. The researcher thought there were gaps to focusing on very specific recurrent situations and, the study tried to answer the questions regarding factors of cost overrun related to those specific but recurrent situations.

2.8 Conceptual Framework of the Study

Conceptual framework was adopted to investigate research questions of the study. The dependent variable was cost overruns, measured by the mean score indexes ofdeviation from the initial project time and cost estimates. The independent variables were the factors cost overrun in

road construction projects in Ethiopian Construction Works Corporation, Transports Infrastructure Construction Sector.Hence, this study mainly focuses on the potential problem behind the road project cost overrun prevailing in and around the construction operation premises of the Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector, i.e. road

CHAPTER III
The Research Methodology

3.1 . Introduction

The main topics included in this chapter are research strategy, research design and data collection. The objective of this thesis is to identify factors affecting cost overruns in Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector projects and to determine the severity rank of the factors amongst clients, contractor and consultants working with the Corporation, and finally, makes conclusions and recommendations based on the findings.

3.2 . Hypotheses of the Thesis

The research aimed to test the hypothesis that:

1. Clients and Contractor have mutual consensus on the severity rank of the factors affecting construction cost overrun prevailed in projects undertaken by ECWC, TIC.
2. Clients and Consultants mutual consensus on the severity rank of the factors affecting construction cost overrun prevailed in projects undertaken by ECWC, TIC.
3. Consultants and Contractors mutual consensus on the severity rank of the factors affecting construction cost overrun prevailed in projects undertaken by ECWC, TIC.

3.3 . Research Design

Research design is the blueprint for fulfilling research objectives and answering research questions. In other words, it is a master plan specifying the methods and procedures for collecting and analyzing the needed information.MathiosEnsermu, (2016).

The research design for this thesis was cross – sectional survey design. Cross – sectional survey design was believed to be suitable for the research problem, questions and objectives to achieve. Cross-sectional studies, also known as one-shot or status studies are the most commonly used design in the social sciences. The design is simple to find out, identify the study population, select sample (if you need to) and contact your respondents to find out the required information and best suited to studies aimed at finding out the prevalence of a phenomenon, situation, problem, attitude or issue, by taking a cross- section of the population.

3.4 . Data Type and Source

To obtain the data related to the research study, I employed both the primary and secondary data sources for the study. The primary data was collected through open and close ended questionnaires. The questionnaire, the close ended questionnaire was administered to collect data from the Client, Contractor and Consultants staffs. Some of them are road construction and maintenance projects managers, team leaders, engineers, and other employees who are directly involved in resource/cost mobilization, and secondly HQ Department Managers and other pertinent team leaders who are in charge of decision making.

As mentioned earlier, the subject is too fresh for countries like ours that it would be difficult to obtainrelevant secondarydata helpful to the study proposed. Nevertheless, some projects data was selected and investigated, and desk study was made about their cost performance at project completion.

3.5 . Sampling Technique and Procedure

3.5.1 Sampling Technique

Clients, contractors and consultants were selected for the effective conduct of this research, a hundred respondents from whichfortystaffs/officials from each of client and contractor, twenty staff/officials from consultants were randomly selected using stratified random sampling technique as a type of probability sampling in order to give everyone that falls into any of these identified target groups equal and independent chance of being included in the sample. In addition to considerable higher officials, there were also a sizeable amount of lower level, but identified as stratified group, employees who directly involve in and responsible to resource/cost mobilization and road construction project contact administration.

3.5.2 Sample Size

Sample size determination is the act of choosing the number of observations or replicates to include in a statistical sample. The sample size is an important feature of any empirical study in which the goal is to make inferences about a population from a sample.

The target population consisted of 7 successfully completed road projects undertaken by the Corporation since establishment of 2011until merger. Major actors were the Ethiopian Roads authority, as a sole client and, the ECWC, as a sole Contractor. There were also 5/five/ consulting firms supervising the projects on behalf of the client, namely; CORE Consulting Engineers, Transport Construction Design Share Company (TCD S.C.), Best Consulting Engineers(couple of projects), Sheladia Associates and Beza Consulting Engineers (couple of projects).

A sampling is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure the researcher would adopt in selecting items for the sample (Kothari, 2011). Four respondents were selected from each consulting firms who had been in charge of supervising the projects. The selection was based on the time available for conducting the research work and the reliability of the respondents, so that the overall research work would indicate the reality of the situation.However, only 60% of querieswas responded from the consultant side due to unavailability of the respondents during collection stage of the research work. On other hand, since both the Ethiopian Roads authority and, the ECWC, in which the study area confined, are sole client and sole contractor respectively, it was not necessary to calculate sample size.

3.6 . Methodology of the Study

The methodology used for this study is using questionnaire and desk study. The qualitative method via semi structured interviews was used after the questionnaire survey. Semi structured interviews were used because they provide a wide deal of freedom to probe various areas and to raise specific queries (Naoum, 1998, p.58). In addition, they can also provide insights and in-depth explanations (Saunders, Lewis, and Thornhill, 2009, p.323). Thus, the semi structured interviews were invaluable as a tool to investigate further. The interviews were conducted with a selected number of participants who were determined based on the outcome of the questionnaire survey.

A questionnaire of 31 factors was carefully designed from literatures conducted in road construction projects. It was organized in the form of a priority scaling (1 = not significant, 2 = slightly significant, 3 = moderately significant, and 4 = very significant).

The procedure used in analyzing the results aimed at establishing the mean score of the various factors responsible for project cost overruns. The score for each factor is calculated by summing up scores assigned to it by respondents. Therefore, the level of significant as indicated by the client, contractor and consultants were used to measure the mean score of each factor.

The mean score (MS) for each variable of time and cost overrun is computed by using the formula (Appendix-C)

Spearman's coefficient of rank order correlation was used to analyze the agreement or disagreement among each pair of parties. (I.e. Client& Contractors, Client & Consultants and, Contractors & Consultants.), and it was calculated using Statistical Package for Social Sciences (SPSS). This was crucial to measure and compare the association between the rankings of two parties (Wakijara, 2011).

Procedure for hypothesis testing:

1. Define the null hypothesis (H0) and the alternative hypothesis (HA)
2. Choose a value for ρ. (i.e. choose the significance level)
3. Calculate the value of the test statistic, Rho (ρcal).
4. Compare the calculated value with a table of the critical values of the test statistic.
5. If the calculated value of the test statistic is less than the critical value from the table, accept the null hypothesis (H0). If the absolute (calculated) value of the test statistic is greater than or equal to the critical value from the table, reject the null hypothesis (H0) and accept the alternative hypothesis (HA).

3.7 . Questionnaire Design and Approach

A questionnaire was developed to assess the perceptions of client, consultants, and contractors. A preliminary questionnaire based on the literature reviews was pre-tested on a small sample population. This was mainly to check to ensure that the wording of the question is not ambiguous (Royer and Zarlowski, 2001&Ramabhadran 2018). Factors influencing time and cost overruns in road construction projects were first examined and identified through a relevant literature review and by conducting experienced professionals in road construction sector.

From literature review it has been discussed factors which affect cost overruns in road construction projects in various aspects and locations. I selected (31) thirty-one major

factorswere selected that assumed to have an impact in Ethiopian Construction Works Corporation.

The draft questionnaire was discussed with the advisor of the thesis, Ass Prof AbebeYitayew (PhD). The final questionnaire contains31factors influencing cost overruns. The respondents were asked to fill the questionnaire and they have assured that the information will be confidential and only for research purpose.

3.8 . Data Measurement

In this research, ordinal scales were used. Ordinal scale is a ranking or a rating data that normally uses integers in ascending or descending order. It must be understood that the numbers assigned to the agreement or degree of influence (1, 2, 3, 4,) do not indicate that the interval between scales are equal.

The questionnaire was designed to have overall information on the following:

- The respondent's organization type they are working
- The respondent's professional background
- For how long the respondent has been engaged in work
- An assessment of the severity of likely factors affecting construction cost from not significant to very significant. See Appendix-A for list of factors affecting construction cost overrun.

The questionnaire was confirmed by my advisor before its administration.

3.9 . Administration of the Data Collection

The questionnaires were delivered by hand to those target groups; staffs of client, contractor and consultants.

3.10 Method of Data Analyses

Having collected respondents' response through questionnaires delivered voluntarily, which were distributed among the stakeholders of road constructionsectorworking with the Corporation namely; the client, the contractor and the consultants. Frequency and mean score were used for the descriptive data. Coded broad sheets were thereafter used for extracting data from the returned questionnaires. These were analyzed by SPSS (Statistical Package for Social Science)

having carefully completed the variable view and imputed the extracted data appropriately on the data view. Mean score and spearman rank order correlation was used to achieve the stated objectives. The study employed ordinal scales so as to measure the result and make analyses. Ordinal scale is a ranking or a rating data that normally uses integers in ascending or descending order; like 1, 2, 3, and 4.

CHAPTER FOUR

Discussions andThesis Findings

4.1 . Introduction

This chapter focuses on analyzing the desk study and various responses from the administered questionnaires and conclusions made from the analysis.

4.2 . Result of Desk Study

Desk study was presented seven road construction projects completed or provisionally completed after the Corporation was established. The thesis used this as an empirical evidence for the reason that it would supplement factual substance to better reinforce arguments of the study. In addition, before identifying the causes of cost overrun it has to be identified weather cost overrun exist or not. During the desk study the certified executed amount (ETB) amount and actual cost(ETB) were considered, then calculated the ratio of cost overrun. The data was collected via reviewing completed project documents of annual project completion report of 2015 of the before its merger with the newly established as a governmental developmental Corporation. As we can see on table below, all of theprojectshad experienced cost overrun. The rate of actual cost overrun ranges from a minimum of 14.85% to the maximum of 37.32% for individual projects.

Table: 4.2. Certified Executed amount and Actual Cost at Completion of Selected Road Construction Projects contracted and built by Ethiopian Road Construction, Transport Infrastructure or formerly known as Ethiopian Road Construction Corporation (ERCC)

No.	Project Name	Certified Executed Amount(ETB) in ,000	Actual Completed Cost (ETB) in ,000	Actual Cost Overrun (ETB) in ,000	Rate of Cost Overrun (%)
1	Gambella-Itang-Jikawo Road Project	850,072.90	976,308.67	(126,235.78)	**14.85%**
2	Wezeka-Gidole Road Project	380,817.04	491,380.89	(110,563.85)	**29.03%**
3	Degahabure –Shekosh Road Upgrading Project	398,079.35	546,648.00	(148,568.65)	**37.32%**
4	Shekosh-Kebridehar Road Upgrading Project	558,934.37	692,261.56	(133,327.19)	**23.85%**
5	Mytsebri-Shire Road Project	919,516.83	1,158,041.84	(238,525.01)	**25.94%**
6	Kebridehar-Denen Road Upgrading Project	489,770.18	580,104.03	(90,333.85)	**18.44%**
7	Denen-Gode Road				**28.31%**

	Upgrading Project	582,755.68	747,724.48	(164,968.80)	
Total		**4,179,946.35**	**5,192,469.47**	**1,012,523.12**	**24.22%**

Source: ERCC Seven Projects Completion Report, June 2015

From the above summarized cash flow table, ERCC has completed around 592 kms in the past years since establishment to ERA. It has spent around 5.2 billion birr to complete these seven projects however ERCC was able to complete them after their contract periods and collected only around 4.2 billion birr. This shows that the Corporation has lost of around 1.0 billion birr financially for executing the projects. Major costs components were consisted of four major cost categories; labor cost, equipment& machinery, materials and overhead costs.

As discussed in the report, managing and forecasting the cash inflows and outflows of a construction project is crucial to ensuring the success of a project. Due to the project specified problems discussed in the nextillustrations, all the completed construction projects had negative net cash flows.

The majorcausative factors for loses and cost overrun is justified and summarized in the reportas follows, and the researcher took it as it was;

- Security problems: Four projects in Somali and Gambela project had security problems and due to that the working hours and mobilizations were highly affected. This affected the project progress and productivity.

- Construction material scarcity:
    - Four projects in Somali faced hardly Surface aggregate, water and construction machineries.
    - Renting agencies were not willing to rent their machineries in Somali and Gambella region for security issues due to that ERCC was forced to deploy most of its machinery in Somali & Gambela region projects.
    - Shortage of sub-base and fines for asphalt works were very significant in Gambella projects and the problems resulted project dalliance and larger costs for fulfilling the required material with the required quality

- Remoteness of the project sites.
    - All the seven projects are located far from Addis Ababa and as a result of this it was difficult for the corporation to fulfill the required resources easily and economically. So ERCC was forced to mobilize machineries and manpower from remote areas by spending more money and time.
- Difficult terrains like for Wezeka and Shire projects
    - Especially the Shire and the Wezeka projects terrain are mostly mountainous and escarpment types and due to these terrain types, unexpected events were entertained like significant number of design changes, additional retaining walls and land sliding problems. These problems significantly increased workloads and reworks subsequently increased construction time and running costs.
- Longer Wet weather
    - Gambella projects have suffered a lot due to larger rainy season. The rainy period in the project area was around six months and the project was forced to stop its construction activities in the rainy season. This caused the project to spend higher overhead cost and to do mobilization and demobilization of machineries by scarifying time and energy.
- Right of Way Issues: Right of way of the road corridors were not big challenges for most roads, however, For Gambella, Shire and Wozeka projects, ROW issues were challenging during dealing with the property owners in the ROW corridors. Even though it was solved peacefully the projects have sacrificed significant time for facilitating ROW agents and the compensation payment processes.
- Inflation of currency: Even though all the projects were reimbursed as price escalation for inflation for Fuel, Reinforcement bars, cement and Asphalt due to inflation of the currency, this payment could not address the impact on the cost rise in rental machinery and labor cost and some materials for inflation. Therefore, all the project costs are highly affected by the yearly inflation of the currency.

4.3 . Data Presentation and Analysis

The causes of time and cost overrun from the questionnaire survey are identified based on respondents' response on each variable of time and cost overrun. For example, causes of time overrun identified by the different researchers, as indicated in the literature review part of this thesis, might not be causes of cost overrun for the cases of the Corporation, hence it is important to ask the respondents for their agreement on each particular variables of cost overrun, then this is accompanied by identification of causes of cost overrun base on their occurrence. To clearly identify the most common causes of cost overrun it is important first to identify the causes of cost overrun in road construction projects of the Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector, and then identify their rate of occurrence.

4.3.1 Rate of Responses

Hundred questionnaires were randomly administered (Twenty to Consultants, Forty to Contractors and Forty Clients). As at the time of compiling this report, a total of Eighty two usable responses were received, representing 82% effective response rate. The maximum responses from each sampling frame are shown in table 4.3.1.

Table: 4.3.1 Response Rate

		Client	Contractor	Consultant	Total
Valid N = 82	#Distributed	40	40	20	100
	#Responded	32	38	12	82
	Percentage	80%	95%	40%	100.0

Source: Author (SPSS)

However, only 60% of queries were responded from the consultant side due to unavailability of the respondents during collection stage of the research work.

4.3.2 Respondent Organization Type

The demographic profiles of the respondents in table 4.2.2 above show that 46.3% were in the Contractor category, 14.6% in the Consultant category and 39.1 % in the Client category.

Table: 4.3.2. Respondent organization type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Client	32	39.0	39.0	39.0
	Contractor	38	46.3	46.3	85.4
	Consultant	12	14.6	14.6	100.0
	Total	82	100.0	100.0	

Source: Author (SPSS)

4.3.3 Respondents' Title or Designation

Table: 4.3.3. Respondents designation

Respondents designation	Frequency	Percent	Valid Percent	Cumulative Percent
Engineering Team Leader	13	15.9	15.9	15.9
Other	5	6.1	6.1	22.0
Division Manager or Directorate Director Audit	1	1.2	1.2	23.2
Audit Team Leader	1	1.2	1.2	24.4
Deputy Director General	3	3.7	3.7	28.0
Division Manager or Directorate Director	10	12.2	12.2	40.2
Project Manager	10	12.2	12.2	52.4
Site Engineer	12	14.6	14.6	67.1
Office Engineer	20	24.4	24.4	91.5
Site Supervisor	2	2.4	2.4	93.9
Resident Engineer	2	2.4	2.4	96.3
Acting Resident Engineer	1	1.2	1.2	97.6
Missed	2	2.4	2.4	100.0
Total	82	100.0	100.0	

Source: Author (SPSS)

It is obvious from the figure 4.3.3 above that Office Engineers make the largest portion for this research with 24.4%. Engineering Team Leaders are next with 15.9%, followed by Site Engineers accounting for 14.6%. Division Manager or Directorate Director and Project Managers both represent 12.2 %.

4.3.4 Respondents'Designation Per Organization

Table: 4.3.4 shows that 28.94 % (11) of respondents from the contractor were office engineers, project managers and engineering team leaders each of which constituted 21.05 % (8). As the result portraits, 28.12 % (9) of clients' respondents were site engineers and 18.75 % (6) were directorate directors. It has been founded that 16.67 % (2) of the consultant's company's respondents were Resident Engineers and 33.33 % (10) were office engineers.

Totally out of82 respondents for the three parties, 24.39 % (20) of the respondents were office engineers, 15.85% (13) were engineering team leaders, and each project managers and directorate directors/division managers were 12.20 % (10). It has been founded that 2 respondents were missing from the result.

Table: 4.3.4 Respondents' designation * Respondent organization type Cross tabulation

Respondents designation	Respondent organization type			Total
	Client	Contractor	Consultant	
Office Engineer	5	11	4	20
Engineering Team Leader	5	8	0	13
Site Engineer	9	1	2	12
Division Manager or Directorate Director	6	3	1	10
Project Manager	2	8	0	10
Other	2	2	1	5
Deputy Director General	2	1	0	3
Site Supervisor	0	1	1	2
Resident Engineer	0	0	2	2
Division Manager or Directorate Director Audit	0	1	0	1
Audit Team Leader	0	1	0	1
Acting Resident Engineer	0	0	1	1
Total	31	37	12	80

4.3.5 Respondents' Work Experience

The table below illustrates that 34.15 % (28) of the respondents firm have experience between 4 to 8 years at construction works and 30.49 % (25) of the respondents experience between 8 to 12 years, 19.51 % (16) of respondents have experience less than 4 years, and 14.63 %(12) are who have experience more than 12 years .

Table: 4.3.5. Respondents Working Experience * Respondent organization type Cross tabulation

Respondents Working Experience	Respondent organization type			Total
	Client	Contractor	Consultant	
< 4 Years	7	6	3	16
4-8 Years	13	14	1	28
8-12 Years	9	12	4	25
> 12 Years	3	6	3	12
missed	0	0	1	1
Total	32	38	12	82

Source: Author (SPSS)

Generally, the result found that most of the respondents hold a working experience above four years. However, those who served the industry from 4 to 8 years of experience as well as 8 to 12 years of experience takes for about 65% combined. These ranges of experience are relatively well enough to provide a reliable data.

4.4 . Data Presentation and Analysis of Findings with Respect toSpecified Objectives

4.4.1 Major Factors of Cost Overruns

Table 4.4.1 shows the rank of top ten factors of cost overruns that have been investigated in this research from contractor, consultant and client viewpoints. A total of 31 factors which influence cost overruns have been studied and discussed (Appendix-B). The rank was based on mean score of the factors.

Table: 4.4.1. Top tenmeanscore rank of factors affecting construction cost overrun in the Ethiopian Construction Works Corporation, Transport Infrastructure.

Factors affecting construction cost overrun	Mean Score	Rank	Std. Deviation
Ineffective way of management of Material and Machinery resources at project	3.56	1	.742
Skill of Site Management Crew	3.53	2	.691
System/Approach employed to manage site activities	3.44	3	.755
Inadequate knowledge and skills of Project Management and Contract Administration teams	3.43	4	.861
Design Errors	3.40	5	.829
Frequent Design Changes	3.38	6	.764
Poor Quality or unmatched Surveying Data used during and after feasibility study of the project	3.37	7	.901
Lack of cost planning/monitoring during pre and post contract stages	3.29	8	.762
Appropriateness of tools and techniques to undergo Project Management and Contract Administration to optimize project cost/budget	3.28	9	.758
Cost of Material and Machinery Cost	3.26	10	.863
High Cost of labor	2.36	31	.931
Valid N (listwise)			

The result shows that Ineffective way of management of Material and Machinery resources at project (3.56), Skill of Site Management Crew (3.53), wrong method of System/Approach employed to manage site activities (3.44), contract management (Inadequate knowledge and skills of Project Management and Contract Administration teams) (3.43) and Design errors (3.4) are the five most important factors affecting cots of construction projects .The table also reveal High Cost of labor as the least factor affecting cost of construction in the Corporation. This is likely since a good proportion of labor in the Ethiopia construction industry is indigenous especially (unskilled) labor which is locally sourced as such this factor does not have any significant effect on the cost of construction.

4.4.2 Determination of Severity Rank of the Variables amongst Client, Contractor and Consultants

Table 4.4.2 shows the most important factor affecting construction cost as perceived by clients, consultants and contractors. A total of 31 factors were selected for the purpose of the study, as per my advisor's consultation, which have been believed to have significant influence over cost overruns in Ethiopian Construction Works, Transport Infrastructure have been studied and discussed. The rank was based on mean score of the independent variables, i.e. factors.

Table: 4.4.2. Top ten factors affecting Cost Overrun from major stakeholder of Client, Contractor and Consultants Perspective

Descriptive Statistics								
	Weighted Average		Client		Contractor		Consultant	
Factors Affecting Construction Projects Cost overrun	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank
Ineffective way of management of Material and Machinery resources at project	3.56	1	3.41	3	3.78	1	3.25	7
Skill of Site Management Crew	3.53	2	3.42	2	3.58	2	3.67	1
System/Approach employed to manage site activities	3.44	3	3.41	4	3.42	9	3.58	2
Inadequate knowledge and skills of Project Management and Contract Administration teams	3.43	4	3.38	5	3.55	3	3.17	11
Design Errors	3.40	5	3.50	1	3.32	14	3.42	3
Frequent Design Changes	3.38	6	3.28	9	3.47	7	3.33	5
Poor Quality or unmatched Surveying Data used during and after feasibility study of the project	3.37	7	3.26	10	3.53	4	3.17	15
Lack of cost planning/monitoring during pre and post contract stages	3.29	8	3.19	13	3.42	8	3.17	13
Appropriateness of tools and techniques to undergo Project Management and Contract Administration to optimize project cost/budget	3.28	9	3.28	8	3.29	16	3.25	9
Cost of Material and Machinery Cost	3.26	10	3.19	11	3.47	6	2.75	25

High Cost of labor	2.36	31	2.19	31	2.45	31	2.55	30
Valid N (list wise)								

Source: Author (SPSS)

4.4.2.1 Clients' view

"Design errors" and "poor skill of Site Management Crew" were the first factors to cause cost overruns with a mean score of 3.50 and 3.42 respectively. Design changes are considered as one of major factor for increasing the cost of project. As any design modification resulted from errors in the design will affect the budget allocated for the project, the volume of required materials, type of required materials and needed labor. Sometimes, design changes cause the rework of already completed items, which might lead loss of materials.

The third factor was "Ineffective way of management of Material and Machinery resources at project" with a mean score of 3.41. System/Approach employed to manage site activities was put in the fourth place by the clients with a mean score of 3.41. Table 4.4.2 shows that clients ranked the "High Cost of labor "as the least influencing factor of construction cost overrun with a mean score of 2.19.

4.4.2.2 Contractors view

The study found that contractor ranked "Ineffective way of management of Material and Machinery resources at project "at the first place with mean score of 3.78. This would be true because of the fact that these resources, construction machines and materials, contribute a lions' share to undertake any construction activities. Unless managed in an effective way, cost overrun would be inevitable and, even punitive blow.

"Skill of Site Management Crew " was ranked as the second major factor of cost overruns by contractors with a mean score of 3.58. The study also revealed that "Inadequate knowledge and skills of Project Management and Contract Administration teams" and "Poor Quality or unmatched Surveying Data during design" placed third and fourth by the contractor as noticeable causes of cost overrun with mean value of 3.55 and 3.53 respectively.

As we can easily see the result table, the contractors, like the clients, ranked the "High Cost of labor "as the last factor of construction cost overrun with a mean score of 2.45.

4.4.2.3 Consultants view

The first important factor that cause cost overrun according to consultants' view was "Skill of Site Management Crew" with a mean score of 3.67", System/Approach employed to manage site activities" and "Design errors" were the second and third factors of cost overruns ranked by consultant with a mean score of 3.58 and 3.42 respectively.

The result shows that consultants ranked "Government Policies" as the least factor that cause cost overruns with a mean score of 2.42. Even if it is not the last factor as that of client's and contractor's view, consultants, likewise, has also put "high cost of labor" 30th place out of 31 factors questioned and examined by this thesis.

4.5 . Test of Hypothesis

One of the purposes of this thesis is to investigate whether there is agreement or not on the attitudes of stakeholders towards the causes of time and cost overrun on road construction projects in Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector. Hence in this section respondents' reaction will be tested for correlation using Spearman rank correlation coefficients, to see if there is difference in ranking between two groups of respondents; these are Clients vs Contractors, Clients vs Consultants and Contractors vs Consultants; and, on the variables of cost overrun and their rate of occurrence.

The hypotheses was set up to test if there is any agreement on the severity rank of the factors affecting construction cost overrun in construction projects undertaken by Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector as discussed by the different groups to be hypothesized three combinations.

The Null Hypothesis (H0) is: -There is no sharedconsensus regarding the severity ranking of factors of cost overrun between two groups of respondents of client, contractor and consultants

The Alternative Hypothesis (H1) is: -There is shared consensus regarding the severity ranking of factors of cost overrun between two groups of respondents of client, contractor and consultants

The spearman correlation coefficient (ρ) is calculated using Equation (Appendix-C) and tabulated(Appendix-D) as shown below in Table 4.4.

In order to decide whether to accept or reject the null hypothesis, the level of significance 95% (P = 0.05) is used. This allows to state whether or not there is "agreement" between respondents' response.

If the calculated value of ρ is greater than the critical value, H0 is rejected, i.e. there is evidence of a statistically significant agreement between the groups. If the calculated value of ρ is less than the critical value, H0 is accepted**,** i.e. there is no evidence of a statistically significant agreement between the two groups.

Table 4.5: Summary of correlation test on the ranking of causes of cost overrun

Respondents	Rho (ρcal) = 1 –6 x (Σdi2)/ N x (N2– 1) Appendix-C	Critical value of ρ (Appendix E) N=31	Significance for P < 0.05
Client Vs Contractor	0.7246	0.301	H0 rejected
Client Vs Consultant	0.5621	0.301	H0 rejected
Contractor Vs Consultant	0.4706	0.301	H0 rejected

Source: Author (SPSS)

Table: 4.5 found that the result of the computation of Spearman's rank correlation coefficient, the t- values, and the decision rule of rejection of null hypotheses for the severity rank of the factors affecting construction cost in Transport Infrastructure Construction Sector of Ethiopian Construction Works Corporation, by the different groups working with the Corporation.

As displayed in the Table 4.5 significance level of 95% (P = 0.05), the calculated value of ρ for all the three group cases are greater than the critical values of ρ, so the hypothesis that there is no shared consensus between the respondents is refuted i.e. the null hypothesis is rejected.

It can be concluded that there is a general agreement between the different groups i.e. clients, contractors and consultants with respect to their perceptions of the severity rank of the factors affecting construction cost overrun. The result recognized that the contractoris more correlated with the client than the consultants. This might be due to the reason that the contractor was part of the client's own force operation wing (road construction and maintenance wing) for nearly 60 years before it was split and established as a government contracting corporation. Therefore,

from their lengthy joint experience, theyarehighly expected to have common perception about the factors than they would have had with that of the consultants. However, in the ranking of the important factors there were minor differences; as illustrated above rated the three most important factors in the following order of severity: Design errors, poor skill of Site Management Crew and Ineffective way of management of Material and Machinery resources at project. Consultants opinion was in the following order: Skill of Site Management Crew, System/Approach employed to manage site activities and Design errors, whereas, and Contractors' perceptions were in this order: Ineffective way of management of Material and Machinery resources at project, Skill of Site Management Crew and Inadequate knowledge and skills of Project Management and Contract Administration teams.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 . Summary

With the orientation of three main objectives of the study; to mention them, 1) identifying factors influencing ECWC, Transport Infrastructure Construction Sector, to cost overruns while undertaking road construction and maintenance activities, 2) determining the severity rank amongst the factors and, 3) outlining coexistence of mutual understanding between clients, consultants and contractors regarding ranking cost overrun factors inthe Corporation studied. The literatures reviewed covered mostly what are major factors of cost overrun in road construction projects and, how and why it is becoming a recurrent problem. The researcher tried to utilize literatures studied, primarily focusing on factors of cost overrun in road construction projects performed in Ethiopia. The study focused on 31 variables that were deemed to have had significant contribution to cost overruns. Having collected data from 82 out of 100 respondents' response through questionnaires delivered voluntarily, which were distributed among the stakeholders of road construction sector working with the Corporation namely; the client (40), the contractor (40) and the consultants (20). Frequency and mean score were used for the descriptive data. Coded broad sheets were thereafter used for extracting data from the returned questionnaires. The analysis of the variables' mean scores were computed using statistical package for social science (SPSS), mean score formula ranked and test of hypothesis was undertaken using Spearman's ranking correlation coefficient. Desk study was used to identify the existence and extent of cost overrun on road construction projects completed by the Corporation.

From the result of the study, the rootcauses of the cost overrunwere identified ineffective way of management of material and Machinery resources at project, Skill of Site Management Crew, wrong method of System/Approach employed to manage site activities, contract management (Inadequate knowledge and skills of Project Management and Contract Administration teams), and Design errors are the five most important factors affecting costoverrun of road construction projects. It is hypotheticalthat these factors are mostly a result of deficient intellectual and managerial capacitywithin the experts and management team in charge managing resource at site. Thus, the top management of the Corporation should consider to scheduledifferent kinds of relevant packages of capacity building sessions to improve their managerial and expertise role

from design to construction stages so that they can, at least, become cost-conscious, efficient, and effective for the good of the Corporation's future performance.

The result also reveals High Cost of labor as the least factor affecting cost of construction in the Corporation. This is likely since a good proportion of labor in the Ethiopia construction industry is indigenous especially (unskilled) labor which is locally sourced. The researcher initial thought was that cost of labor would have been one of the prominently significantfactors on the cost overrun of road construction. Despite the researcher expectation, the respondents 'argument went with or responded as non-significant for labor cost. So, the researcher would like to argue that it would better to seeit basedon more practical experience.

5.2 Conclusion - Key Thesis Finding

The article examined factors affecting construction project cost overruns. The result of the study showed that the causes of cost overruns range from those highly influenced by mismanagement of material and machinery resources to those that are rarely influenced by labor related factors (e.g. high cost of labor). Further, desk study was used to identify the existence and extent of cost overrun on road construction projects in Ethiopian Construction Works Corporation, Transport Infrastructure Construction. The data gathered from the survey was analyzed using the SPSS mean score (MS) and Spearman rank correlation coefficient.

Based on the results of the analysis of desk study and respondents' responses the following conclusions are drawn.

5.2.1 Research Objective 1

This first objective was to assess factors influencing ECWC, Transport Infrastructure Construction Sector, to cost overruns. A total of 31 factors were identified through various literature reviews and listed in appendix A. It was classified under eight categories. The data was collected via reviewing the Corporation's completed project documents of annual project completion report of 2015, all (100%) of the projects had experienced cost overrun. The rate of actual cost overrun ranges from a minimum of 14.85 % to the maximum of 37.32% for individual projects.

5.2.2 Research Objective 2

The second objective was to rank cost overrun factors in terms of severity. 31 causes of cost overrun listed in appendix B were ranked based on the rating of respondents in the questionnaire survey. The highly significant causes of cost overrun are Ineffective way of management of Material and Machinery resources at project (3.56), Skill of Site Management Crew (3.53), wrong method of System/Approach employed to manage site activities (3.44), contract management (Inadequate knowledge and skills of Project Management and Contract Administration teams) (3.43) and Design errors (3.4) are the five most important factors affecting cost of construction projects .The result also unveils High Cost of labor as the least factor affecting cost of construction in the Corporation.

5.2.3 Research Objective 3

The third objective was to outline coexistence of mutual understanding between clients, consultants and contractors regarding ranking cost overrun factors were identified using SPSS software mean score(value) and spearman's rank table. Correlation matrix was made for factors of cost overrun which has been ranked by the following three key stakeholders.

- Correlation between rank of Client and Contractor.
- Correlation between rank of Client and Consultant.
- Correlation between rank of Contractor and Consultants.

All of them are correlated regard to their perspectives about causes of cost overrun according to the results of study:

Finally, the main factor affecting cost of road construction projects as reflected by the three key players, mainly working in collaboration with the Corporation are identified. The management of the Corporation must act to reverse and improve these concurrent problems it faced with respect to cost overrun prevailed in almost every road construction projects undertaken and are undertaking even right currently by addressing the common factors to sustain its vision mission. Stakeholder, especially the Ethiopian Roads Authority, the sole Client, and the Consultants are supposed to provide a constructive support and consult so that the Corporation be able to identify the dominating factors leading to cost overrun.

5.3 . Contributions of the Study

Though this thesis didn't assess measures to be taken to minimize or eliminate the impacts of major cost overrun factors, corrective actions should be designed to counter the adverse effects the cost overrun, like proper project management methodology which were discussed by several scholars. The main contribution of this research study is that it tried to identify some of the major factors influencing the cost overrun of road construction projects in the Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector. Their mean value as well as severity is ranked. The result would be used as a checklist to other projects various construction stages and scenarios to ward off cost overrun.

5.4 . Research Limitations

This research is limited to assessing factors of construction cost overrun at projects at only one public contracting body i.e. The Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector. It is clear that a study of this magnitude should include a survey of sizeable number of road projects over a wider time span so as to be reliable as possible. However, as discussed in background of the study, since thecorporation was established recently; both the former Ethiopian Road Construction Corporation which was establishment in 2011 and merged with newly established the Ethiopian Construction Works Corporation in late 2015of Dec 18thwith the purpose of establishing mega government developmental Corporation, the time and material resources did not make this possible, the study forced to depend on limited data gathered about cost performance of road project by the Corporation.

In addition, the researcher had to manage bothoffice duties and the field simultaneously during data collection. This was really a major challenge. On few occasions, some of the respondents were to careless and reluctant that the candidate had to spent more time and attemptto find additional respondents to substantiate the study during the data collection. The participants of this research were mostly from major stakeholders of the corporation, staffs and higher officials of the Corporation itself, the client, the and the consulting, in most of the cases which were responsible for project supervision and consulting on behalf of the client, the ERA, for the projects of the Corporation was awarded and, to make sure that the project would deliver at

feasible quality and cost initially proposed by the project feasibility study. Hence the results and the recommendations of this research would appear to be more appropriate for the case of the Corporation.

On the spot, now days, the researcher believes that corruption and lack of equitable governance had been introduced as a chronicproblems to our problem which has a direct impact on cost overrun and should have been included in the study. Nevertheless, though only little was justified and charged with crime and many unjustified, strong roamers have been usually heard about such misconducts within the Corporation while undertaking huge machine renting, and bulk materials procurement and in many other cases. But, corruption was dropped from the queries due to the reason that the participants might not be interested to respond, especially those are higher officials.Not to mention, it was stated in the methodology of this study that interview with some higher officials would be conducted. In fact the researcher had few of them, but it is considered not a take respondents' individual subjective view so that it would not to deceive from the mean response value outcome of study, at large.

5.5 . Recommendation

Besides the researcher tiresome endeavors to figure out indicators for the research problem, this paper recommends that identifying road projects cost overrun factors is very important for addressing as early as possible. The indication thereof would be used for devising a mitigation measure to minimize the occurrence of cost overruns and improve the cost performance of the Corporation. Thefindings of this study point out thechallenges facing with regard to the performance of road projects by theCorporation and their economic impact; consequently, the study makes the following recommendations. The top management and the board of directors of the Ethiopian Construction Works Corporation need to formulate strategies towards mitigating the impact of these factors as they are easily foreseeable and recurring in future road projects.

Due to the fact that the Corporation was newly emerged and infant for the industry, major stakeholders, mainly the 70 years Ethiopian Roads Authority which is a leader of construction industry in Ethiopia and supposed to have proven experience, and other consultant firms working with the Corporation are expected to support, be closer and consult in order to help it endeavor so that the Corporation could be able to enhance its cost performance gaps.

5.6 . Suggestions for Further Research

There are, somehow, similarity of the important factors that influencing cost overruns. But some of the major factors, previously identified severe in many literaturesand, identified and documented in project completion report of the Corporation, are found to influence less contrasting the expectations of the candidate, e.g. external environmental factors like climate, and labor related factors. Therefore, I suggest further research could include more factors, the chronic problem of grand corruption which is believed to be a disastrous for the industry's performance and for our country's economic as well, with depth looking and taking wider span of time and by capturing more relevant, reliable and timely data, and, also mitigation measures for the problem should be part of it.

Another area for future research could be to measure the extent of top five most significant factors identified by the finding and formulate way out using effective mitigation measures for their effect on cost overrun. This will enable the higher management to make a necessary decision to take steps towards further feasible approaches.

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APPENDICES

Appendix – A

Questionnaires for Thesis Study

This questionnaire is prepared to obtain information from key informants with semi-structured questions. The information is required for the academic research entitled "Factors Cost Overrun in Road Construction Projects in the case of Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector", which is being conducted as partial fulfillment of for the Degree of Master of Business and Administration (MBA in Finance). The mainobjective of the research is to identify the main factors that lead to cost overruns, andmake recommendations based on the findings.

The questionnaire consists of two sections; Section A general organization information. Section B contains factors and of cost overruns in Road construction projects in the case of Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector. At the end there is a space that left for general comments regarding the research topic.

Your response, in this regard, is highly valuable and contributory to the outcome of the research. All feedback will be kept strictly confidential and utilized for this academic research only.

Thank you,

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SECTION A: General Organization Information

1. Name of organization: ----------

2. State respondent organization/company type.

Client ☐ Contractor ☐ Consultant ☐

3. Respondents designation:

Director General ☐ Deputy Director General ☐ Division Manager ☐

Project manager ☐ Site Engineer ☐ Office Engineer ☐

Site Supervisor ☐ Other _____

4. Relevant working experience (Years):

1-4Yrs ☐ 4-8Yrs ☐ 8-12Yrs☐>12Yrs ☐

SECTION B: Factors Influencing Cost Overrun of Construction Projects in Ethiopian Construction Works Corporation, Transport Infrastructure Construction Sector

Please indicate the significance of each factor by marking ✓ in the appropriate boxes. Add any remarks relating to each factor on the last column of additional comment.

V.S. = very significant (4); M.S. = moderately significant (4);
S.S. = slightly significant (3); N.S. = not significant (2);
W. of S. = Weight of Severity in percent (%)

No	Factor	V.S. (4)	M.S. (3)	S.S. (2)	N.S. (1)	Additional comment (If any)
1	**Poor Site Management**					
	1.1. System/Approach employed to manage site activities					
	1.2. Skill of Site Management Crew					
	1.3. Lack of experience of Site Management Crew					
	1.4. Discipline/Character of Site Management Crew					
2	**Improperly implemented, or absence of, Information and Communication**					
	2.1. poor Information and Communication infrastructure, poor(no) network connectivity facility					
	2.2. Lack of attention by stakeholders for Information and Communication systems					
	2.3. Insufficient budget allocation for Information and Communication systems					
3	**Weakened Project Management and Contract Administration**					
	3.1. Inadequate knowledge and skills of Project Management and Contract Administration teams					
	3.2. Appropriateness of tools and techniques to undergo Project Management and Contract Administration to optimize project cost/budget					
	3.3. Inattentive attitude for the need of Project Management and Contract Administration by itself					

4	**Labor related factors (Ineffective and Inefficient)**					
	4.1. Efficiency/skill of labor					
	4.2. High Cost of labor					
	4.3. Poor Labor Management					
5	**Inefficient Material Management and Machinery Utilization**					
	5.1. Cost of Material and Machinery Cost					
	5.2. Ineffective way of management of Material and Machinery resources at project					
	5.3. Fluctuation of prices of materials					
	5.4. Cost of Machinery Maintenance					
6	**Poor Design and Documentation practice**					
	6.1. Poor Quality or unmatched Surveying Data used during and after feasibility study of the project					
	6.2. Mistake of Design					
	6.3. Unforeseen Situations during design					
	6.4. Frequent Design Changes					
	6.5. Fraudulent actions,i.e., Deliberate misstating of design quantity to inflate cost of the project					
	6.6. Poor Documentation (lack of records of all activities during construction process					
7	**Poor Financial management System**					
	7.1. Lack of proper Financial management skill by the Contractor that might lead to unfavorable cost performance					
	7.2. Lack of cost planning/monitoring during pre and post contract stages					
	7.3. Delay of Periodic Payments					

	7.4. Unhealthy Cash flow to satisfy construction process financial need					
8	**Limiting External factors and uncontrollable Phenomenon or force majeure**					
	8.1. Climate of the area where the project is undertaking					
	8.2. Tougher Topography					
	8.3. Destabilized Situation around the project area					
	8.4. Government Policies, like monetary law, tax laws, valuation policy of foreign currency exchange….					

Do you feel there are any factors that would have significant impact on cost overrun of road construction other than that of questioned above? Please list them down and briefly explain how they affect cost overrun.

_____

_____

_____

_____

If you have comments regarding cost overrun kindly request to write here,

_____

_____

_____

_____

_____

Appendix – B

Rank of Factors Mean Score

Mean Score Value (Index) - Identification of the rank main factors affecting construction cost overrun in the Ethiopian Construction Works Corporation, Transport Infrastructure.

Factors affecting construction cost overrun	Mean Score	Rank	Std. Deviation
Ineffective way of management of Material and Machinery resources at project	3.56	1	.742
Skill of Site Management Crew	3.53	2	.691
System/Approach employed to manage site activities	3.44	3	.755
Inadequate knowledge and skills of Project Management and Contract Administration teams	3.43	4	.861
Design Errors	3.40	5	.829
Frequent Design Changes	3.38	6	.764
Poor Quality or unmatched Surveying Data used during and after feasibility study of the project	3.37	7	.901
Lack of cost planning/monitoring during pre and post contract stages	3.29	8	.762
Appropriateness of tools and techniques to undergo Project Management and Contract Administration to optimize project cost/budget	3.28	9	.758
Cost of Material and Machinery Cost	3.26	10	.863
Lack of proper Financial management skill by the Contractor that might lead to unfavorable cost performance	3.26	11	.798
Unforeseen Situations during design	3.25	12	.724
Fluctuation of prices of materials	3.24	13	.854
Unhealthy Cash flow to satisfy construction process financial need	3.22	14	.837
Lack of experience of Site Management Crew	3.22	15	.875
Efficiency/skill of labor	3.20	16	.867
Delay of Periodic Payments	3.11	17	.806

poor Information and Communication infrastructure, poor(no) network connectivity facility	3.11	18	.832
Poor Labor Management	3.09	19	.951
Discipline/Character of Site Management Crew	3.07	20	.881
Inattentive attitude for the need of Project Management and Contract Administration by itself	3.04	21	.829
Cost of Machinery Maintenance	3.03	22	.837
Insufficient budget allocation for Information and Communication systems	2.98	23	.889
Lack of attention by stakeholders for Information and Communication systems	2.95	24	.784
Climate of the area where the project is undertaking	2.94	25	.807
Destabilized Situation around the project area	2.88	26	.862
Poor Documentation (lack of records of all activities during construction process	2.87	27	.872
Fraudulent actions,i.e., Deliberate misstating of design quantity to inflate cost of the project	2.86	28	1.040
Tougher Topography	2.80	29	.886
Government Policies, like monetary law, tax laws, valuation policy of foreign currency exchange…	2.67	30	.903
High Cost of labor	2.36	31	.931
Valid N (listwise)			

Appendix - C

⇒ **Mean Score Formula**

$$MSi = \frac{\Sigma (f \times s)}{N}$$

Where; *S* = score given to each cause of delay by the respondents;

F = frequency of responses to each score for each cause of delay;

N = total number of responses in the respective cause of delay.

Weighted Average is calculated by using the following formula;

Weighted Avg. = waxa + wbxb + wcxc

Where; *w*= relative weight (%)

x= mean score

a, b & c represent contractor, consultant and client respectively.

⇒ **The Spearman (rho) Rank Correlation Coefficient Formula**

The Spearman (rho) rank correlation coefficient is used for measuring the differences in ranking between two groups of respondents scoring for various factors (i.e. clients versus consultants, clients versus contractors, and consultants versus contractors).

The Spearman (rho) rank correlation coefficient for any two groups of ranking is given by the following formula.

$$\text{Rho } (\rho cal) = 1 - \frac{6 \times (\Sigma di2)}{N \times (N2 - 1)}$$

Where:

Rho (ρcal) – Spearman rank correlation coefficient

di– The difference in ranking between each pair of factors

N– Number of factors (variables)

Appendix-D

Table: Factors Affecting Cost Overrun from major stakeholder of Client, Contractor and Consultants Perspective

Descriptive Statistics								
	Weighted Average		Client		Contractor		Consultant	
Factors Affecting Construction Projects Cost overrun	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank
Ineffective way of management of Material and Machinery resources at project	3.56	1	3.41	3	3.78	1	3.25	7
Skill of Site Management Crew	3.53	2	3.42	2	3.58	2	3.67	1
System/Approach employed to manage site activities	3.44	3	3.41	4	3.42	9	3.58	2
Inadequate knowledge and skills of Project Management and Contract Administration teams	3.43	4	3.38	5	3.55	3	3.17	11
Design Errors	3.40	5	3.50	1	3.32	14	3.42	3
Frequent Design Changes	3.38	6	3.28	9	3.47	7	3.33	5
Poor Quality or unmatched Surveying Data used during and after feasibility study of the project	3.37	7	3.26	10	3.53	4	3.17	15
Lack of cost planning/monitoring during pre and post contract stages	3.29	8	3.19	13	3.42	8	3.17	13
Appropriateness of tools and techniques to undergo Project Management and Contract Administration to optimize project cost/budget	3.28	9	3.28	8	3.29	16	3.25	9
Cost of Material and Machinery Cost	3.26	10	3.19	11	3.47	6	2.75	25
Lack of proper Financial management skill by the Contractor that might lead to unfavorable cost performance	3.26	11	3.06	16	3.39	10	3.33	4
Unforeseen Situations during design	3.25	12	3.29	7	3.32	13	2.90	21
Fluctuation of prices of materials	3.24	13	3.34	6	3.32	12	2.75	24
Unhealthy Cash flow to satisfy construction process financial need	3.22	14	2.97	20	3.47	5	3.08	18

Lack of experience of Site Management Crew	3.22	15	3.16	14	3.29	17	3.17	12
Efficiency/skill of labor	3.20	16	3.19	12	3.26	19	3.00	19
Delay of Periodic Payments	3.11	17	2.88	23	3.27	18	3.25	10
poor Information and Communication infrastructure, poor(no) network connectivity facility	3.11	18	3.13	15	3.11	23	3.08	17
Poor Labor Management	3.09	19	2.74	26	3.32	15	3.25	8
Discipline/Character of Site Management Crew	3.07	20	3.04	17	3.18	21	2.70	26
Inattentive attitude for the need of Project Management and Contract Administration by itself	3.04	21	2.97	19	3.23	20	2.67	28
Cost of Machinery Maintenance	3.03	22	2.77	25	3.35	11	2.60	29
Insufficient budget allocation for Information and Communication systems	2.98	23	2.88	22	2.95	25	3.33	6
Lack of attention by stakeholders for Information and Communication systems	2.95	24	2.97	18	2.89	28	3.08	16
Climate of the area where the project is undertaking	2.94	25	2.94	21	2.97	24	2.83	22
Destabilized Situation around the project area	2.88	26	2.67	29	3.11	22	2.67	27
Poor Documentation (lack of records of all activities during construction process	2.87	27	2.69	27	2.92	27	3.17	14
Fraudulent actions,i.e., Deliberate misstating of design quantity to inflate cost of the project	2.86	28	2.81	24	2.89	29	2.91	20
Tougher Topography	2.80	29	2.68	28	2.92	26	2.75	23
Government Policies, like monetary law, tax laws, valuation policy of foreign currency exchange…	2.67	30	2.63	30	2.79	30	2.42	31
High Cost of labor	2.36	31	2.19	31	2.45	31	2.55	30
Valid N (list wise)								

Source: Author (SPSS)

Appendix - E

Spearman Rank Table

α(2):	0.50	0.20	0.10	0.05	0.02	0.01	0.005	0.002	0.001
α(1):	0.25	0.10	0.05	0.025	0.01	0.005	0.0025	0.001	0.0005
n									
4	0.600	1.000	1.000						
5	0.500	0.800	0.900	1.000	1.000				
6	0.371	0.657	0.829	0.886	0.943	1.000	1.000		
7	0.321	0.571	0.714	0.786	0.893	0.929	0.964	1.000	1.000
8	0.310	0.524	0.643	0.738	0.833	0.881	0.905	0.952	0.976
9	0.267	0.483	0.600	0.700	0.783	0.833	0.867	0.917	0.933
10	0.248	0.455	0.564	0.648	0.745	0.794	0.830	0.879	0.903
11	0.236	0.427	0.536	0.618	0.709	0.755	0.800	0.845	0.873
12	0.217	0.406	0.503	0.587	0.678	0.727	0.769	0.818	0.846
13	0.209	0.385	0.484	0.560	0.648	0.703	0.747	0.791	0.824
14	0.200	0.367	0.464	0.538	0.626	0.679	0.723	0.771	0.802
15	0.189	0.354	0.446	0.521	0.604	0.654	0.700	0.750	0.779
16	0.182	0.341	0.429	0.503	0.582	0.635	0.679	0.729	0.762
17	0.176	0.328	0.414	0.485	0.566	0.615	0.662	0.713	0.748
18	0.170	0.317	0.401	0.472	0.550	0.600	0.643	0.695	0.728
19	0.165	0.309	0.391	0.460	0.535	0.584	0.628	0.677	0.712
20	0.161	0.299	0.380	0.447	0.520	0.570	0.612	0.662	0.696
21	0.156	0.292	0.370	0.435	0.508	0.556	0.599	0.648	0.681
22	0.152	0.284	0.361	0.425	0.496	0.544	0.586	0.634	0.667
23	0.148	0.278	0.353	0.415	0.486	0.532	0.573	0.622	0.654
24	0.144	0.271	0.344	0.406	0.476	0.521	0.562	0.610	0.642
25	0.142	0.265	0.337	0.398	0.466	0.511	0.551	0.598	0.630
26	0.138	0.259	0.331	0.390	0.457	0.501	0.541	0.587	0.619
27	0.136	0.255	0.324	0.382	0.448	0.491	0.531	0.577	0.608
28	0.133	0.250	0.317	0.375	0.440	0.483	0.522	0.567	0.598
29	0.130	0.245	0.312	0.368	0.433	0.475	0.513	0.558	0.589
30	0.128	0.240	0.306	0.362	0.425	0.467	0.504	0.549	0.580
31	0.126	0.236	0.301	0.356	0.418	0.459	0.496	0.541	0.571
32	0.124	0.232	0.296	0.350	0.412	0.452	0.489	0.533	0.563
33	0.121	0.229	0.291	0.345	0.405	0.446	0.482	0.525	0.554
34	0.120	0.225	0.287	0.340	0.399	0.439	0.475	0.517	0.547
35	0.118	0.222	0.283	0.335	0.394	0.433	0.468	0.510	0.539
36	0.116	0.219	0.279	0.330	0.388	0.427	0.462	0.504	0.533
37	0.114	0.216	0.275	0.325	0.383	0.421	0.456	0.497	0.526
38	0.113	0.212	0.271	0.321	0.378	0.415	0.450	0.491	0.519
39	0.111	0.210	0.267	0.317	0.373	0.410	0.444	0.485	0.513
40	0.110	0.207	0.264	0.313	0.368	0.405	0.439	0.479	0.507
41	0.108	0.204	0.261	0.309	0.364	0.400	0.433	0.473	0.501
42	0.107	0.202	0.257	0.305	0.359	0.395	0.428	0.468	0.495
43	0.105	0.199	0.254	0.301	0.355	0.391	0.423	0.463	0.490
44	0.104	0.197	0.251	0.298	0.351	0.386	0.419	0.458	0.484
45	0.103	0.194	0.248	0.294	0.347	0.382	0.414	0.453	0.479
46	0.102	0.192	0.246	0.291	0.343	0.378	0.410	0.448	0.474
47	0.101	0.190	0.243	0.288	0.340	0.374	0.405	0.443	0.469
48	0.100	0.188	0.240	0.285	0.336	0.370	0.401	0.439	0.465
49	0.098	0.186	0.238	0.282	0.333	0.366	0.397	0.434	0.460
50	0.097	0.184	0.235	0.279	0.329	0.363	0.393	0.430	0.456