



FACTORS AFFECTING TIME AND COST OVERRUN IN ROAD CONSTRUCTION PROJECTS IN ADDIS ABABA

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DECLARATION

I declare that this thesis entitled “**FACTORS AFFECTING TIME AND COST OVERRUN IN ROAD CONSTRUCTION PROJECTS IN ADDIS ABABA**” is my original work. This thesis has not been presented for any other university and is not concurrently submitted in candidature of any other degree, and that all sources of material used for the thesis have been duly acknowledged.

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Abstract

In Addis Ababa the number of road construction projects is increasing from time to time. However, it becomes difficult to complete projects in the allocated cost and time. Taking this into consideration, time and cost overrun is one of the major problems in Addis Ababa road projects. Therefore, this research was carried out to get information on the factors that cause time and cost overrun during construction and their effects on road construction projects in Addis Ababa. Questionnaire surveys together with desk study were used to collect data on time and cost overrun. A total of 94 questionnaires from client, consultants and contractors were collected and a desk study of 10 completed road construction projects in Addis Ababa were investigated. From the results it was found 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.

Respondents identified 47 causes of time and cost overrun for Addis Ababa case. The most important causes of time overrun were delay to furnish and deliver the site (Right of way problem), financial problems and improper planning. Whereas 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 most common effects of cost overrun identified by this research are delay, supplementary agreement, adversarial relations among stakeholders, and budget shortfall of project owners. It is hoped that these findings will guide efforts to improve the performance of the construction industry in the future.

Key words: cost overrun, cause, effect, rate, time overrun.

CHAPTER ONE: INTRODUCTION

1.1. Construction industry background

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 outstrips that of population and of GDP (Chitkara, 2004).

Cost, time, and quality are used to measure the project performance and success. Generally, the success of a project is defined by accomplishing it within specified cost, time and quality. However, the construction industry is full of projects that are completed with significant time and cost overruns (Amhel et al., 2010). According to Faridi et al. (2006) delays have an adverse impact on project success in terms of time, cost, quality and safety. The effects of construction delays are not confined to the construction industry only, but influence the overall economy of a country.

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.

For the purpose of this research, time overrun is defined as the time difference between the actual completion time and the estimated completion time, agreed by and between the client and the contractor during signing of the contract. And cost overrun is the cost difference between the actual completion cost and the estimated completion cost.

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)

1.2. Road Construction Development in Ethiopia

During 17th and 18th centuries there were a number of small road trails and foot paths, in addition to the traditional shoulder portage, animals like mules, donkeys, horses and camels were used as a means of transportation in Ethiopia.

In the 18th century, especially during the reign of Emperor Tewodros, although the technology was primitive it was believed that planned road construction efforts were made. It is also believed that Emperor Yohannes IV, who succeeded Tewodros, was engaged in road building. However due to the danger of invasion by Egyptians, Sudanese and Turkish the Emperor was not able to achieve his desires (Organizational back ground of ERA, 2007).

It was prior to the second Italian occupation i.e. between the years 1896 and 1936 that a great success was made in road construction. Emperor Menilik was said to be a successful road builder participating himself in the construction. In 1903 the road from Eritrea to Addis Ababa and the road from Addis Ababa to Addis Alem were built. In addition it was during this time that the first Asphalt roads appeared in Addis Ababa (Organizational back ground of ERA, 2007).

During the Italian occupation roads were built by them and they were established to meet the requirements of the military control rather than to promote the overall development of the country's economy. In addition, the roads lacked most of the modern design and construction features desirable for present day high speed traffic. The roads and trails built and improved during the 5 year Italian occupation were about 6000km. Approximately 2500 km of them were given a single asphalt surface treatment, drainage structures were usually of stone masonry and at least three tunnels were built. However, when Ethiopia regained its independence, the Italians in their fleeing attempt almost undid what they created by blasting bridges and dynamiting roads (Organizational back ground of ERA, 2007).

The decade (1941-1951) after the Italian occupation is considered a period of stagnation for the construction and maintenance of the road system. During this post war period, it was felt that a grass root reunification and restructuring program of the already destroyed governmental organizations and systems was required which in turn accelerated considerable stagnation in the whole range of social and economic sectors. Significant magnitude of Italian built road network was deteriorated within a period of 10 years. In 1951 only 1000 kms of road was traffic worthy of the total stock of about 6000 kms.

In 1951, the Government established a strong and specialized road agency, the Imperial Highway Authority (currently called Ethiopian Roads Authority). The immediate responsibilities entrusted to the newly formed Authority were, first to rehabilitate the already deteriorated road network and second to construct additional road network. From its year of establishment in 1951, the Organization managed to undertake various physical and policy issue assignments.

A program development of road started in 1951 with establishment of IHA. There were six highway programs (ERA, 2009). These were:-

- a) **First highway program (1951-1957):-**The program involved a total capital investment of birr 77 million and largely consisted of the reconstruction and maintenance of 1525 km of badly damaged and 2686km of all weather roads. The road constructed during this time include: - Addis –Assab (860km), Addis-Jimma (355km) and Addis- Nekempt (331km). Moreover, road maintenance was carried out on Addis-Adigrat, Addis –Blue Nile and Addis-Shasemene trunk roads.
- b) **Second Highway Program (1957-1966):-** The program provided for the continued maintenance and improvement of 4500km of main highways, for the construction of 800km of new roads and improvement of 1000km of other existing roads. The amount disbursed in this program is 110 million birr.
- c) **Third Highway Program (1965-1968):-** The program involved a total outlay of Birr 60 million which went into the construction of 700km of primary and secondary roads, 1000km of feeder roads and 1040km of asphalt surfacing works.

- d) **Fourth Highway Program (1968-1973):-** During the Fourth Highway Program 820 km of new, primary and secondary roads was constructed. It is during this program that four feasibility studies of future road works and technical assistance and advisory service in the reorganization of the Authority started. The program also included expert assistance in the area of engineering, operation and maintenance, overseas training with practical orientation for equipment superintendents, foremen and mechanics and others. Out of the total program of the planned 2246km roads 1600km were completed.
- e) **Fifth Highway Program (1974-1976):-** In this program great emphasis was given to the construction of feeder road network to support the agricultural development, strengthening the institutional capability of the Road Agency and providing assistance to the local contracting industry. The program covered the construction of 539km of feeder road and 322 km of asphalt surfacing projects. It also involved the construction of road maintenance projects worth Birr 14 million and further strengthening of the organization and developing the domestic construction industry.
- f) **Sixth Highway Program (1976-1978):-** During this time the rehabilitation 284 km of primary roads, 280 km of secondary roads, construction of 809 km new gravel feeder road, 657km of service-to traffic and 1660km of rural roads were executed.

Beginning 1970, the program of rural road expansion was commenced with major emphasis to improving accessibility and mobility to agricultural potentials.

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). 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)

1.3. Road Development in Addis Ababa

Addis Ababa city was founded by Minellik II and Empress Taitu in 1887. The history of the city's road development also begins from the inception of the city.

Minellik II constructed the first ever two roads in the city as well as in the country that stretch from Addis Ababa to Addis Alem and from his palace to England Embassy in 1902. In 1904 the first roller was imported by the emperor and was being pulled by many people for its operation.

Emperor Minellik was also believed to be the first in importing two cars in Addis Ababa and introduced the car technology in the city for the first time in 1907. The country's modern road construction is highly interlinked with Emperor Haile Sellase's ruling period. During the regime of Haile Sellase I a number of contractors were organized to carry out road construction.

The first one to be established by the government to construct roads was public works department. It was established to construct road in Addis Ababa and in its surrounding. After a few years this department was raised to a minister level and Addis Ababa also got the chance to establish its road development organizational structure.

When it was decided for Addis Ababa to have a mayor and a council in 1942, the city roads construction and maintenance was organized under the municipality. To fulfill the road construction activities together with building works the “Road and Building works” department was established. This department stayed till the replacement of the Haile Sellase regime by the derge regime performing its duties. But no fundamental organizational change of the department was observed in the derge regime.

In 1993 the existing government (EPRDF) has established regional governments and gave them power to administer their regions with autonomy. During this time Addis Ababa was also established as one of the regions. The Addis Ababa administration during this period established the “bureau of works and urban development” and the bureau organized a department under it to carry out the road construction and maintenance works. The newly established road department constructed and maintained the city roads till the establishment of the Addis Ababa City Road Authority in March 15, 1998 by regulation no. 7/1998 to be administered by board of directors to construct maintain and administer the road works in Addis Ababa by the city administration. The total length of road construction in the city till the establishment of the authority in March 1998 was 1300km of which 900km was gravel road and the remaining 400km was asphalt surfaced road. The Addis Ababa city roads authority has done remarkable progress in the city roads expansion and upgrading since it’s established.

1.4. 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 custom 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 monumental [Gould, et al, 2002].

Time and cost are the primary measures of a project's success. This is true, especially for public projects in developing countries like Ethiopia, because public construction projects in these countries are executed with scarce financial resources. Most literature review on construction projects suggested that the common criteria for project success are generally considered to be cost, time and quality [Arditi et al, 1997; Frimpong et al, 2003]. Generally, a project is considered successful if the project is completed within a stated cost or budget, getting the project into use by a target date, meets the technical specification, and if there is a high level of satisfaction concerning the project outcome among the project participants.

Completion alone does not constitute success for the project owner. For the owner, much of the success of a project depends on many factors, the most important of which is project completion within specified cost and time as delays in completion of facilities often directly equate to financial losses due to lack of revenue from facility operation [Darrell, 1995].

In Ethiopia, the present state of the construction industry falls short of meeting domestic and international quality standards and the performance demand expected from the sector [MoWUD, 2006]. Construction projects have problems with construction techniques and management as well as limitation of funds and time. The critical problems are inability to complete the projects on schedule, low quality work and cost overrun. In general, most (if not all), construction projects experience time overrun and cost overruns during their execution phase. An examination of the records of more than four thousand construction projects by Morris et al, (1998), showed that projects were rarely finished on time or within the allocated budget. Other researchers have also observed that time and cost overruns are common in the construction industry worldwide [Arditi et al, 1985].

1.5. Research problem

Completion of a project is considered as the most important factors of successful projects, which help to decrease problems for all parties and give new chances to construct other related projects. It also helps to increase the profits and development of construction industry. 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 have also ascertained that the projects were not completed on time, within budget, and desired quality

(Becker and Behailu, 2006) causing loss of project's profit, increasing cost and leading to technical and managerial problems between project's parties. Cost overrun is also considered another big problem, which hinders project's progress, since it decreases the contractor profit leading to huge losses leaving the project in a big trouble.

This problem is a result of lack of managerial skills, low labor productivity, lack of planning, price increment of materials, environment, type of project and others. For that it is of key importance to exert the utmost effort to accomplish such study, to detect the previously mentioned factors and to treat all the weakness points and from all sides and so giving specific priorities in order to avoid time and cost overruns at construction projects.

1.5. Objectives of the study

This thesis has the following main objectives:-

1. To evaluate to what extent the time delay and cost increases in Addis Ababa road construction.
2. To identify factors influencing time and cost overruns in road construction in Addis Ababa.
3. To discuss the effect of delay and time overrun in road construction in Addis Ababa.
4. To formulate recommendations based on the result obtained.

CHAPTER TWO: LITERATURE REVIEW

2.1. General

The inability to complete projects on time and within budget continues to be a chronic problem worldwide (Ahmed et al., 2002). According to Azhar and Farouqui (2008) observation that the trend of cost overruns is common worldwide. The debate in the construction industry on how to minimize or eliminate delays and cost overruns has been on for some time among professionals, clients and/or end users, and policy makers. As the construction industry continues to grow in size, so do planning and budgeting problems. This is because it is common for projects not to be completed on time and within the initial project budget. There are quite a number of examples at the national and international scene. For instance, most of the construction projects in Ethiopia have had problems with time and cost overruns and this has caused a lot of concern (Becker and Behailu, 2006). Because of construction delays and cost overruns, less and less work is performed despite the increase in construction budgets.

It is common to see construction projects failing to achieve their mission within the specified cost and time. Hardly few projects get completed on time and within budget since construction projects are exposed to uncertain environments because of such factors as construction complexity; presence of various interest groups such as the project owners, end users, consultants, contractors, financiers; materials, equipment, project funding; climatic environment; the economic and political environment and statutory regulations.

Time and cost overruns occur in most construction projects and the magnitude varies considerably from project to project. So it is essential to define the actual causes of time and cost overruns in order to minimize and avoid the delays and increasing cost in any construction project. This chapter review literatures concerning the major issues of time and cost overruns in order to recognize the factors that affect cost and time overrun in construction.

2.2 Definition of time and cost overruns

2.2.1 Time overruns

Inability to complete a project either by the original planned time or budget, or both, ultimately results in project delay. The social and economic costs of delay can be amazingly high and to a certain extent cannot be absorbed by the industry. When a delay can no longer be absorbed by the client, it will result in the project being abandoned. Thus, it is important to predict and identify problems in the early stages of construction and diagnose the main causes and implement the most appropriate and economical solutions to prevent further negative impacts of delay.

In construction delay could be defined as the time over run either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rent-able space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and due to labor cost increases.

Completing projects on time is an indicator of effectiveness, but the construction process is subject to many variables and unpredictable factors, which result from many sources. These sources include the performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations. Stumpf (2000) defined delay as an act or event that extends the time required to perform the tasks under a contract. It usually shows up as additional days of work or as a delayed start of an activity. He showed, in his article, that delay does matter, and that different methods for analyzing schedule delay lead to different results for the owner and contractor. Construction delays became an integral part of the project's construction life. Even with today's advanced technology, and management understanding of project management techniques, construction projects continue to suffer delays and project completion dates still get pushed back (Stumpf, 2000).

Choudhry (2004) and Chan (2001) defined the time overruns as the difference between the actual completion time and the estimated and agreed completion time. It is measured in number of days. Project delays are those that cause the project completion date to be delayed (Al- Gahtani and Mohan 2007). From above, time overruns is defined as the time increased to complete the project after the planned date which is caused by internal and external factors surrounding the project.

2.2.2 Cost overruns

Cost overrun is the amount by which actual costs exceed the baseline or approved costs. For the purpose of this research cost overrun is defined as the positive difference between the final or actual cost of a construction project at completion and the contract amount agreed by the client and the contractor during signing of the contract.

2.3. Types of Delays

The type of delay has an impact on critical activities which need a more detailed analysis to determine whether additional time extension is warranted or not. Excusable delays can be further classified into excusable with compensation and excusable without compensation. Terry Williams (2003) revealed that there are four basic ways to classify delays: Excusable or non excusable delay, Concurrent or non concurrent delay, and Compensable or non compensable delay.

The types of delays mentioned above have internal or external sources on project process. Internal causes of delay include causes that come from the owner, designers, contractors, and consultants. External causes of delays are originated from outside of construction projects such as utility companies, government, subcontractors, suppliers, labor unions, nature, etc.

2.3.1. Excusable or non-excusable delay

All delays are either excusable or non-excusable. An excusable delay is a delay that is due to an unforeseeable event beyond the contractor's or the subcontractor's control. If the delay is considered compensable, then the contractor is entitled to additional financial compensation as well as extra project time. Under certain circumstances where non-compensated excusable delays occur, the contractor receives extra time but not extra money for the additional completed work.

Excusable delays are known as “force majeure” delays, and commonly called “acts of God” because they are not the responsibility or fault of any particular party. Most contracts allow for the contractor to obtain an extension of time for excusable delays, but not additional money (Alaghbari et al 2007). Delays resulting from the following events would be considered excusable:

- i. General labor strikes
- ii. Fires
- iii. Floods
- iv. Acts of God
- v. Owner-directed changes
- vi. Differing site conditions or concealed conditions
- vii. Unusually severe weather
- viii. Intervention by outside agencies
- ix. Lack of action by government bodies, such as building inspection

Non-excusable delays are events that are within the contractor’s control or that are foreseeable. These are some examples of non-excusable delays (Al- Gahtani and Mohan 2007):

- i. Late performance of sub-contractors
- ii. Untimely performance by suppliers
- iii. Faulty workmanship by the contractor or sub-contractors
- iv. A project-specific labor strike caused by either the contractor’s unwillingness to meet with labor representative or by unfair labor practices

2.3.2 Concurrent or non-concurrent delays

If only one factor is delaying construction, it is usually fairly easy to calculate both the time and cost resulting from that single issue. A more complicated but also more typical situation is one in which more than one factor delays the project at the same time or in overlapping periods of time. These are called concurrent delays (Alaghbari et al 2007).

Concurrent delays occur when both owner and the contractor are responsible for the delay. Generally, if the responsible parties of the delays are intertwined, neither the contractor can be

held responsible for the delay (force to accelerate, or be liable for liquidated damages) nor can he recover the delay damages from the owner. Until the development of CPM schedule analysis, there was no reliable method to differentiate the impact of contractor caused delays from owner-caused delays. (Alwi et al 2002).

Concurrent delays arise when one event causes a delay simultaneously with another event. For example, if an owner denies access to a project site for two weeks, and a severe storm prevents a contractor from working on the project for one of two weeks as well, there will be a concurrent delay of one week. The contractor will be able to recover for delay damages for one week, as a severe storm is not a cause of delay that is compensable and would have prevented the contractor from performing even if the owner did not deny access to the site.

2.3.3 Compensable or non-compensable delays

A compensable delay is a delay where the contractor is entitled to a time extension and to additional financial compensation. Relating back to the excusable and non-excusable delays, only excusable delays can be compensable. Non-compensable delays mean that although an excusable delay may have occurred, the contractor is not entitled to any added compensation resulting from the excusable delay. Thus, the question of whether a delay is compensable must be answered. Additionally, a non-excusable delay warrants neither additional compensation nor a time extension.

In addition to the compensable delays that result from contract changes by change notice, there are compensable delays that can arise in other ways. Such compensable delays are excusable delays, suspensions, or interruptions to all or part of the work caused by an act or failure to act by the owner resulting from owner's breach of an obligation, stated or implied, in the contract. If the delay is compensable, then the contractor is entitled not only to an extension of time but also to an adjustment for any increase in costs caused by the delay (Al-Gahtani and Mohan, 2007).

Whether or not a delay is compensable depends primarily on the terms of the contract. In most cases, a contract specifically notes the kinds of delays that are non-compensable, for which the contractor does not receive any additional money but may be allowed a time extension.

2.4. Implication of Time and Cost Overrun

Time and cost overrun have an implication and affection to the construction project performance and to the client or project owner. Time and cost certainty is known to be the top priorities of construction clients (Davenport, 1997). Although affected by many internal and external factors, construction time and cost is considered a good and measurable indicator of project performance. However, low cost and speedy project are not always the main concern of clients today; instead time and cost certainty are becoming increasingly important (Flanagan *et al.*, 1998) and it is one of the most important contractor performance criteria for clients' satisfaction (Soetanto *et al.*, 2001 and Construction Industry Board, 1996).

Client satisfaction is an important determinant of contractor performance evaluation and comparison (Sidwel, 1988) and it is the driving force for continuous improvement of contractor performance (Ahmed and Kangari, 1995). Companies differentiate themselves from competitors and maintain a competitive edge by providing and keeping clients satisfied (Torbica and Stroh, 2001).

Client long term interest to the performance of contractor is in the work performed. It must conform to the specifications established for the project. Low cost and speedy construction should be achieved because it has significant implication to the client's interest about the way of contractor work in the project performance (Xiao and Proverbs, 2001). Besides that, delays (time overrun) and cost overrun are costly and often result in disputes and claims, impair the feasibility for project owners, and retard the development of the construction industry (Odeh, A. M and Battaineh, H. T, 2002).

2.5. Causes of cost overrun

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 factors that contribute to cost overrun in

construction industry which are found from the researchers' study. The major factors are listed as follow:

- 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, equipments, 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. Skilful 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 Equipments and Methods:-**Obsolete and unsuitable equipments 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 skilful 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 (Nega, 2008).

Chimwaso(2001) listed 18 factors from the existing research findings. Those were then divided into two groups of nine critical factors and nine other factors, which are usually ignored, but perceived to be of equal significance.

The nine factors which are listed by Chimwaso(2001) as critical factors are the following:-

1. Incomplete design at the time of tender.
2. Additional work at owner's request.
3. Changes in owner brief.
4. Lack of cost planning/monitoring during pre-and-post contract stages.
5. Site/poor soil conditions.
6. Adjustment of prime cost and provisional sums.
7. Re measurement of provisional works.
8. Logistics due to site location.
9. Lack of cost reports during construction stage.

The nine factor which are listed by Chimwaso(2001) as major factors that are usually ignored are the following:-

1. Delays in issuing information to the contractor during construction in delays.
2. Technical omissions at design stage.
3. Contractual claims, such as, extension of time with cost claims.
4. Improvements to standard drawings during construction stage.
5. Indecision by the supervising team in dealing with the contractor's queries in delays.
6. Delays in costing variations and additional works.
7. Omissions and errors in the bills of quantities.
8. Ignoring items with abnormal rates during tender evaluation, especially items with provisional quantities.
9. Some tendering maneuvers by contractors, such as front-loading of rates.

The prime variables of cost overruns have been commonly identified as: unpredictable weather, inflationary material cost, inaccurate materials estimates, complexity of project, contractor's lack of geographical experience, contractor's lack of project type experience, and non-familiarity with local regulations (Kaming et al 1997).

Morris (1990) studied the factors influencing cost overruns in public sector projects and found that escalation in costs is attributable partly to the fact that the original estimates were prepared at the current prices, and partly to delays which enhance the effect of inflation and to direct escalation in costs arising out of change in scope, errors etc. Based on certain assumptions with regard to the pace of expenditure on projects Morris have roughly computed that for the 133 projects which were studied only about 25 to 30% of the cost increase can be attributed to inflation. The remaining 70 to 75% have to be explained in terms of delays, inefficiencies, scope changes, changes in statutory levy, variations in exchange rates and to the combined effect of these factors with inflation.

Morris (1990) has sited ten factors that influence cost overruns of construction projects. These factors are:

1. Inadequate project preparation, planning and implementation, delay in construction.
2. Supply of raw materials and equipment by contractors.
3. Change in the scope of the project.
4. Resources constraint: funds, foreign exchange, power; associated auxiliaries not ready.
5. Delays in decisions making by government, failure of specific coordinating bodies.
6. Wrong /inappropriate choice of site.
7. Technical incompetence and poor organizational structure.
8. Labor unrest.
9. Natural calamities and
10. Lack of experience of technical consultants, inadequacy of foreign collaboration agreements, monopoly of technology.

Chimwaso (2001) evaluated ten projects to assess their cost performance. The results have shown that seven out of ten projects had reported cost overruns. The factors that influence cost overruns have been identified and ranked in order of significance. These factors have further been classified into four categories. The four categories arrived at are: variations, measurement of provisional works, contractual claims and fluctuations in the cost of labor and materials, with variations being the most significant.

The amount of cost- increase (overruns), increased with an increase in the total cost of a project. However, clients who spent more time on the preplanning phase spent more money on the design phase; issued less change orders; selected more experienced contracting companies; and hired a supervising engineer to independently supervise the progress of work and ensure the delivery of materials during the implementation phase of their projects. (Koushki et al 2005).

2.6. Measures to Control Construction Cost

There are some measures which are found from the researchers' study to control the construction costs or to overcome the problems of cost overruns. The researchers have their own opinion on how to solve the problems (Kaliba et al., 2009). The measures are presented as below:

- a) **Proper Project Costing and Financing**:-Kaliba et al. (2009) stated that delays of schedule may occur caused of delayed in payments due to complex financial processes in client organizations. Delay in payment would cause financial difficulties to contractors and subsequently delay the schedule to complete the activities on site. Interest could be charged on delayed payments hence inducing cost overruns in the project.
- b) **Competent Personnel**:-Kaliba et al. (2009) mentioned that contractors, consultants, and clients should ensure that they have the right personnel with appropriate qualifications to manage their projects efficiently. It is better if construction manager have experience and qualifications in project or construction management.
- c) **Appropriate Scope Definition**:-Nega (2008) agreed that only concern on the works required completing the project successfully. Guard against incomplete identification of scope is important to avoid frequent changes. Also, do not incorporate the works out of scope to avoid unnecessary works.
- d) **Proper Cost Control**: - Ashworth (1994) mentioned that one of the client's requirements in respect of construction project is assessment of its expected cost. Proper cost control is important as it is the general trend towards greater cost-effectiveness and ensures construction costs not solely in the context of initial costs, but in terms of life-cycle costs or total cost appraisal.

- e) **Risk Management during Project Execution:** - Peeters and Madauss (2008) found out some approach to avoid cost overruns. In any development project, there must be contain certain amount of risks. Therefore, a risk management function needed to be performed by project manager to determine and reduce the risks of the particular project. The aim of risk management is to minimize any risk that might result failure to meet the project requirements.
- f) **Appropriate Contractual Framework:**-Peeters and Madauss (2008) has supported that once the objective of cost has been estimated, it is followed by choosing an appropriate contract model where there are techniques to make a relationship between the initial estimate and final price.
- g) **Increase Supply of Materials:**-Frimpong et al. (2003) found that there should prepare adequate allowance for any emergency case in order to cover increasing in material cost due to inflation.
- h) **Realistic Cost Estimation:**-The initial cost estimates should be as accurate as possible. Accuracy of cost estimation allows clients to check and determine the required funds for executing the project are made available when required (Kaliba et al., 2009).
- i) **Efficient Management:**-Gould (2002) stated that efficient management is important to produce a productive and cost efficient site. Scope may changes due to inadequate planning and feasibility studies. In order to control the project effectively, the project manager must follow up the schedule to avoid additional costs and ensure the building can be occupied on time as planned.

2.7. Effects of Cost Overrun

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/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/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 construction activities, bad reputation, and inability to secure project finance or securing it at higher costs due to added risks [Mbachu and Nkado, 2004]. All these consequences undermine the viability and sustainability of the construction industry.

The effects of cost overrun are not confined to the construction industry but are reflected in the state of the overall economy of a country. They state that delays and cost overruns in construction projects prevent the planned increase in property and service production from taking place, and this phenomenon in turn affects, in a negative way, the rate of national growth[Arditi, et al, 1985].

2.8. Causes of time overruns

Many studies have been conducted in different countries to identify the factors affecting time overrun in construction projects. Mahamid(2011) indicated that the most severe factors affecting time delay in road construction projects in the West Bank in Palestine from the owner perspective are: poor communication between construction parties, poor resource management, delay in commencement, insufficient inspectors, and rework.

Odeh and Battaineh (2002) found that contractors and consultants agreed that owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and subcontractors are among the top ten most important factors of construction delay in Jordan.

Assaf and Al-Hejji (2006) discussed the delay in large construction project in Saudi Arabia. Seventy-three factors affecting time overrun were identified during the research. They concluded that the most common factor of delay identified by the contractors, the consultants and the owners is “change order”.

Koushki et al. (2005) conducted a study in Kuwait to study the causes of time and cost overrun in construction projects. They concluded that the main causes of delays are change orders,

owners' financial constraints, and owners' lack of experience. They stated the following recommendation to the owners in order to minimize time delays:

- 1) Project owners should require the availability of adequate funds,
- 2) Allocation of sufficient time and money at the design phase,
- 3) Selection of a competent consultant and reliable contractor to carry out the work.

Asnaashari et al. (2009) presented the result of an investigation into the main factors which cause construction delay in Iran. The results reveal that most of construction projects in Iran are subject to delay. Cash constraints, shortage of resources, high inflation rate, delay in payments, and disputes in the supply chain are the top causes of delay in the Iranian construction industry.

Faridi and El-Sayegh (2006) studied the delay in construction projects in UAE and concluded that 50% of the construction projects encounter delays and are not completed on time. The top significant causes of construction delays are approval of drawings, inadequate early planning and slowness of the owners' decision-making process.

Mezher and Tawil (1998) conducted a survey of the factors affecting time overruns in the construction industry in Lebanon. It was found that owners had more concerns with regard to financial issues; contractors regarded contractual relationships the most important, while consultants considered project management issues to be the most important factors affecting time overruns.

Kaliba et al. (2009) concluded from their study that the major causes of delay in road construction projects in Zambia were delayed payments, financial deficiencies on the part of the client or contractor, contract modification, economic problems, material procurement, changes in design drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site, changes in specifications, labour disputes, and strikes. It can therefore be concluded that the most important factors vary from one region to another.

There are many factors that contribute to causes of delays in construction projects. These range from factors inherent in the technology and its management, to those resulting from the physical, social, and financial environment. According to Jomah, (2008) time overruns can be divided into three categories:

1. Those over which neither party to the contract has any control;
2. Those over which the owner (or his/her representative) has control;
3. Those over which the contractor (or any subcontractor) has control.

There is a lot of time overrun factors over which consultants has control. But those factors included in owners control. Design changes, poor labor productivity, inadequate planning and resource shortages are the predominant factors influencing time overruns.

Ahmed et al (2003) studied two kinds of cause for delay in construction projects:

1. External causes; and
2. Internal causes.

Internal causes of delay include causes arising from three parties involved in the project. These parties include the owner, contractors, and consultants. Other delays, which do not arise from these four parties, are based on external causes for example from the government, materials suppliers, or the weather.

Ahmed et al (2003) and (Theodore, 2009) identified the following factors causing delays in construction projects. They have categorized the factors that cause delays in the four categories, those are due to:

1) Contractor's responsibility

The factors that are related to contractor's responsibility are;

- Poor qualification of the contractor's technical staff;
- Shortage of materials on site;
- Construction mistakes and defective work;
- Poor skills and experience of labor;
- Shortage of site labor;
- Low productivity of labor;
- Financial problems;
- Coordination problems with others;
- Conflicts in sub-contractors schedule in execution of project;

- Lack of site contractor's staff;
- Poor site management; and
- Delays in site mobilization.

2) Consultant's responsibility

The factors that are related to consultant's responsibility are;

- absence of consultant's site staff;
- lack of experience on the part of the consultant;
- Inadequate experience of consultant;
- Delay in approving major changes in the scope of work;
- Mistakes and discrepancies in design documents.

3) Owner's responsibility

The factors that are related to owner's responsibility are;

- Delay to furnish and deliver the site;
- Lack of working knowledge;
- Slowness in making decisions;
- Lack of coordination with contractors;
- Change orders by owner during construction(replacement and addition of new work to the project and change in specifications);
- Financial problems (delayed payments, financial difficulties, and economic problems)
- Slowness in decision making process; and
- Poor communication and coordination.

4) External factors:

The factors that are related to external factors are;

- Delay in obtaining permits from municipality
- Lack of materials on the market;
- Lack of equipment and tools on the market;
- Poor weather conditions; poor site conditions (location, ground, etc.);
- Poor economic conditions (currency, inflation rate, etc.);

- Changes in laws and regulations; transportation delays;
- External work due to public agencies (utilities and public services); and
- Delay in providing services from utilities (such as water, electricity)(Alghbari et al 2007).

Chan et al (2002), Alwi et al (2002), Assaf (2006), Odeh and Battaineh (2002) and Alghbari et al (2007) Classified factors that cause time overrun into eight groups (owner, contractor, consultant, material, labor and equipment, contract, contractual relationships and external factors). Table 2.1 illustrates the factors that cause time overruns.

Table 2.1: Factors that influence time overruns (Alwi et al, 2002)

Category	Factor
Owner	Finance and payments of completed work.
	Owner interference.
	Slow decision-making by owners.
	Change orders.
	Unrealistic imposed contract duration.
Contractor	Subcontractors.
	Site management.
	Construction methods.
	Improper planning.
	Mistakes during construction.
	Inadequate contractor experience.
	Quality of material.
	Shortage in material.
	Labor supply.
	Labor productivity.
	Equipment availability and failure.
Consultant	Contract management.
	Preparation and approval of drawings.
	Quality assurance/control.
	Mistakes and discrepancies in contract documents.
	Waiting time for approval of tests and inspections.

Contractors working in developing economies work under special constraints due to the technological and skilled manpower differences with developed countries. Their differences can be a cause for time and cost overrun.

Owners and consultants usually assign the major responsibility for delay to the contractor but the contractor placed it mostly back to the owner. On average, the contractor is assigned most responsibility, but when considering that part of the responsibility of the consultant and others may be transferable to the owner, the owner may carry the prime responsibility for delay. It may also be argued that the contractor is not primarily responsible because of the high rate of approval for contractors' requests for time extension.

Aibinu and Jagboro (2002), in their study of the growing problem of construction delay in Nigeria, examined the effects of delays on the delivery of construction projects in the country. Utilizing a questionnaire survey of 61 construction projects, the authors identified, and assessed the impact of delays on the delivery of construction projects. Time and cost overruns were found to be frequent effects of delay. Acceleration of site activities coupled with improved owners' project management procedures and the inclusion of an appropriate contingency allowance in the pre contract estimate were recommended as a means of minimizing the adverse effect of construction delays in Nigeria.

Odeh and Battaineh (2002) studied the causes of construction delay at traditional contracts in Jordan, they used questionnaire procedure in this study; the questionnaire was distributed to a random sample of 100 contractors and 50 consultants. The study illustrated that; according to contractors, labor productivity was the most important delay factor. Inadequate contractor experience, however, was the most important delay factor to consultants. All parties generally agreed on the ranking of the individual delay factors. They agreed that inadequate contractor experience, owner interference, and financing of work were among the top five most important factors. Moreover, delays caused by subcontractors, slow decision making by owners, improper planning, and labor productivity were among the top ten most important factors for both parties. Operational factors such as labor productivity, construction methods, site management, and equipment availability and failure were important to contractors than to consultants.

Ahmed et al (2003) found that the most common type of delay is excusable compensable at 48%, followed by non-excusable delays with 44% and 8% for excusable non-compensable delays. In most of the cases, it is found that when the contractor has the responsibility, the type of delay is non-compensable; when the responsibility is the owner's or the consultant's it is an excusable compensable delay; and when the government is responsible, the delay is considered an excusable compensable.

Consultants play a very important role in design-related delays because as they are in charge of the design process in conjunction with the owner of the project. On the other hand, the government plays the most important role in code-related delays. Contractors have the major responsibility for delays in construction-related delays. Delays due to financial / economical causes as well as management / administrative causes share an intermediate position of importance, just presenting one key delay – delayed payments. These categories do not have the same negative impact on project completion times as other factors considered in this study such as code, design and construction related issues (Kessing; 2003).

Design related issues such as changes in drawings, incomplete and faulty specifications and change orders have a very damaging effect on project completion times and invariably lead to cost escalations as well. These are issues that can be controlled with proper design process management and timely decision making. It is a well known fact that decisions made early in the life of a project have the most profound effect on the project's objectives of delivering a safe, quality project within the time and budget allocated (Ahmed et al 2003) .

Alghbari et al (2007) examined factors that cause delay in construction projects in Malaysia. The results of the analysis show that from a total of 31 variables examined, separated into four categories by responsibility, the major factors causing delay in construction projects are factors due to the contractor, followed by factors due to the consultant, factors due to the owner, and finally external factors.

Further examination of factors causing delay in construction projects in Malaysia based on four categories; contractor, consultant, owner, and external factors; the study shows that on the contractor's side, financial problems are the major factor in delaying construction projects. Poor site management and, as a consequence, construction mistakes, delay in the delivery of materials

to the site, and coordination problem were the subsequent factors causing delay in construction projects in Malaysia. The study also shows that the main factor on the owner's side causing delay in construction projects is financial problems. From the consultant's side, the first component that seems to be the cause of delay in construction projects is ineffective or lack of supervision, followed by "slowness in giving instructions" and "lack of consultant's experience" (Chan et al 2002).

2.9. Effects of Delay

Aibinu and Jagboro (2002) studied the effects of construction delays on project delivery in Nigerian construction industry. The five effects of delay identified were:

1. Cost overrun;
2. Dispute;
3. Arbitration;
4. Total abandonment; and
5. Litigation.

In the study of Manavazhia and Adhikarib (2002), delays in the delivery of materials and equipment to construction sites are often a contributory cause to cost overruns in construction projects in developing countries. The actual impact of these delays on project costs was found to be on average, only about 0.5 per cent of the total budgeted cost of the projects.

2.10. Project Time and Cost Management

2.10.1. Project Time

Project time has been defined as duration of the project on the date stated in the contract, or interim completion dates required for phases of the work (Clough *et. al.*, 2000).

It is also defined as the duration that is needed to complete the work starting from site handover until finished. "Duration" is the time, usually in days, taken to complete the entire project, from starting the first task to finishing the last one (Sunny and Kim Baker, 2003). Estimating the duration of tasks is the most important. This is like trying to predict the future. It is only a guess,

but there are better ways to guess than others. It can be concluded that project time is the duration or time schedule that needed to complete all the project work.

2.10.2. Project Cost

Project cost has been defined as the amount of commitment in terms of money that is required to produce a construction product such as building. Project cost represents all those items included under the heading of the expenditures (Ashworth, 2004). Project cost is quantitative assessments of the likely costs of the resources (labor, materials, supplies, etc) required to complete all project activities (Duncan, 1990). It can be concluded that project cost is the amount of money that is required to complete all project activities.

2.11. The Definition of Project Time and Cost Management

Project Management Body of Knowledge (Spinner, 1997; Badiru and Pulat, 1995) identified the function of management in construction projects where nine major functional areas are including in it, they are: integration management, scope, quality, time, cost, risks, human resources, contract/ procurement and communications management.

Project management defined as the application of knowledge, skills, tools and techniques to ensure the project is completed on time, within cost and fulfills the quality standard. George T. Hendry in Degoff and Friedman, (1999), defines management in construction project as a group of management activities and engineering services related to a program, carried out during the pre-design, design and construction phase that contributes to the control of time and cost in a new facility.

Construction project sites are generally complex because of the extensive use of sophisticated plant, equipment, modern methods of construction, multidisciplinary and multitasked aspects of its project workforce (Evelyn Ai Lin Teo, *et.al*, 2004). That is why management in construction project is needed to organize, arranges every function, actions and everyone involved. Management will help to settle everything in the right place (Cartin, 1993).

Application of this principle (management in construction project) to construction has resulted in the development of techniques for management control of construction cost, time, resources and project finance.

What is project time and cost management? Generally, time and cost management in construction project is defined as centralized of time and cost planning, organizing and controlling in the fieldwork or in the construction sites to meet the goals of schedule, cost and quality estimation (Ritz, 1994).

2.11.1. Project Time management

PMBOK's (1996) defines project time management as the effective and efficient use of time to facilitate the execution of project, which starts from planning, scheduling and controlling the project to achieve the time objectives. Degoff and Friedman, (1999) defines project time management as the development of a project time schedule, to manage that schedule, and to ensure the project completes within the approved time schedule. Therefore, schedule is important to manage time, which involves defining project activities, sequencing the activities, developing the schedule, executing the schedule and controlling the plans during project execution.

Project time management includes the processes required to ensure timely completion of the project (Duncan, 1990). Overviews of the major processes in project time management are as follows:

- Activity definition; identifying the specific activities that must be performed to produce the various project deliverables.
- Activity sequencing; identifying and documenting interactivity dependencies.
- Activity duration estimating; estimating the number of works periods which will be needed to complete individual activities
- Schedule development; analyzing activity sequences, activity durations, and resources requirements to create the project schedule.
- Schedule control; controlling changes to the project schedule.

Techniques that are usually used in managing project time are as follow:

- **Critical Path Methods (CPM);** Calculated a single, deterministic early and late start and finish date for each activity based on specified, sequential network logic and a single duration estimate. The focus of CPM is on calculating float in order to determine which activities have the least scheduling flexibility, (Clough, et. Al., 2000).
- **Program Evaluation and Review Technique (PERT);** uses sequential network logic and weighted average duration estimate to calculate project duration. Although there are surface differences, PERT differs from CPM primarily in that uses the distribution's mean (expected value) instead of money likely estimate originally used in CPM, (PMBOK, 1996).
- **Bar Chart;**it's the simplest project management technique for scheduling, planning and controlling. It shows graphically or in tabular form the daily costs and accumulated costs over a designated period. In projects of normal delivery or stable performance, the general contractor creates the bar chart once an award is made and each bar represents the beginning, duration and completion of some designated segment of total project. Together, the bars make up a time schedule for the entire job, (Ritz, 1994 and Degoff & Friedman, 1999).

2.11.2. Project Cost Management

In PMBOK's (1996) defines project cost management as a requirement for financial control of the project, which is accomplished through accumulating, organizing and analyzing data and reporting the cost information. Clough *et. al.*, (2000) defines project cost management as the process of determining the total cost of the project, to manage that cost, and to ensure that the project is completed within the approved budget or cost. Keeping within the budget, and knowing when and where the costs are deviating are the keys to efficient and effective cost management and profitable operations.

Project cost management includes the processes required to ensure that the project is completed within the approved budget (Duncan, 1990). Although management discretion may occasionally dictate otherwise, an effort is usually made to achieve gains in time with the least possible increase in project cost. If project management has to make schedule adjustments at an additional cost, it is necessary to understand how the costs of construction operations vary with time (Clough *et. al.*, 2000).

Two techniques that are usually used in managing project cost are as follow (Clough *et. al.*, 2000):

Cash Flow; One of managing cash flow activities is to make sure that there is still enough money to cover the cost of performing project-employees payment, charges for material, subcontractor invoices and others suitable with the established estimation. The key to manage cash flow is to ensure that cash comes in balance with what goes out. Key effective in cash flow control is aggressively addressing negative cost variance and cost inefficiencies as soon as they are identified, rather than hoping that things will get better as the project goes on. Even when projects have only positive cash flow and cost variances, it is important not to let that flow and variance become worse. A concentrated effort should be made to keep it that way because as stated above it becomes difficult to get back on track.

Cost Plan; Spinner (1997) and Gido and Clement (1999) mentioned that the cost planning starts with the proposal for the project. The cost section of a proposal may consist of tabulations of the contractor's estimated costs for such elements as labors, materials, subcontractors, equipment and others. In addition, the proposal might also include an amount for contingencies, to cover unplanned expenses. It can conclude that cost plan is the task of allocating sums to the various project activities scheme from starting the first task to finishing the last one.

According to Gido and Clement (1999), allocating total project costs for the various elements, such as labor, materials and equipment, to the appropriate work packages in the work breakdown structure (WBS) will establish a total budgeted cost (TBC) for each work package. Once a total budgeted cost has been established for each work package, the second step in the project budgeting process is to distribute each TBC over the duration of its work packages in order to determine how much of money should be spent at any point in time. This amount is calculated by adding up the budgeted costs for each time period up to that point in time. This total amount, known the cumulative budgeted cost (CBC), will be used in analyzing the cost performance of the project. The CBC for the entire project for each work package provides a baseline against which actual cost and work performance can be compared at any time during the project.

Once the project starts, it is necessary to keep track of actual cost and committed cost so that they can be compared to CBC. After this has been done, the project cost performance can be analyzed by looking at the total budgeted cost, the cumulative budgeted cost, the cumulative

actual cost and the cumulative earned value. They are used to determine whether the project is being performed within budget and whether the value of the work performed is in line with the actual cost.

2.12. Delay mitigation in the construction industry

It is important to improve the estimated activity duration according to the actual skill levels, unexpected events, efficiency of work time, and mistakes and misunderstandings. Mitigation efforts are necessary to minimize losses and this can be achieved by many procedures such as protection of uncompleted work, timely and reasonable re-procurement, and timely changing or cancellation of purchase orders. It is important to predict and identify the problems in the early stages of construction and diagnose the cause to find and implement the most appropriate and economical solutions (Abdul-Rahman et al 2006).

It was indicated from the survey findings derived from different levels of management that the major causes of delay are due to financial problems followed by manpower shortage and changes in the project requirements. All parties involved in the project also agreed that delay occurs mostly during the construction phase. Therefore, in resolving those problems, the units of analysis suggested to increase the construction productivity, followed by increase the expertise and skill of human resources, and conducted site meetings more frequently. A strategic view of solving delay problems should consider the importance of the management aspects, the effects of knowledge and information flow between the organization levels, and the importance of top management contribution in solving the problems.

2.13. Time and Cost Overrun in Ethiopian Road Construction

Time and cost overruns in road construction projects in Ethiopia is one of the most significant problems in the field construction management. Research and studies in this field in Ethiopia are few compared to the problem of time and cost overrun. Having this in to consideration this research is done on factors affecting time and cost overrun in Addis Ababa road construction projects. Despite the importance and the significant of the construction sector in Ethiopia, it is noted that the parties of project {owner, consultant, and contractor} didn't give sufficient evaluation for time and cost overruns at the end of the project.

Fetene (2008), examined factors that cause cost overrun during construction and their effects on public building construction projects in Ethiopia. Utilizing questionnaire survey of 70 completed public building construction projects in Ethiopia. The authors identified, and assessed the impact of cost overrun on the delivery of construction projects. From the results it was found that 67 out of 70 public building construction projects suffered cost overrun. The rate of cost overrun ranges from a minimum of 0% to the maximum of 126% of the contract amount for individual projects. The most important causes of cost overrun were found to be inflation or increase in the cost of construction materials, poor planning and coordination, change orders due to enhancement required by clients, excess quantity during construction.

Getachew Tsegaye, (2009), in his study of the design risk management in Ethiopian federal road projects, pointed out that the major factors influencing time and cost overrun were errors in estimation of Quantities, inadequate subsurface investigation and interpretation, poor pavement investigation and interpretation, inadequate/inaccurate topographic survey data, lack of design details, omission of works, change of alignment, poor specification, late implementation of design and poor drainage assessment.

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 delay 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. The following table shows some sample projects that shows time and cost overrun.

Table 2.2: Physical and Financial Accomplishment of some Road Projects(ten year performance report, RSDP III, 2007)

No	Projects	Total Length (km)	Type of Surfacing /work	Physical Length (km)		Financial (Million Br)		Completion Time (Month)		Phy. Accom.	Fin. Disb. (%)	Comp. Time (%)
				Plan	Accom	Budget	Disb.	Plan	Accom			
1	A.A - Jimma	342	AC	342	342	405.9	650.1	36	73	100	160.16	203
2	A.A – Modjo - Awassa	263	AC	263	263	310.1	386.1	36	49	100	125.00	136
3	Modjo – Awash Arba	160	AC	160	160	227.4	375.4	36	68	100	165.00	188
4	Gewane - Mille	146	AC	146	146	249.0	357.6	40	51	100	143.61	128
5	Awash - Hirna	141	AC	141	141	256.5	297.4	36	62	100	115.94	172
6	Hirna - Kulubi	91	AC	91	91	188.1	225.0	30	64	100	119.62	213
7	Kulubi-Dengego-Dire Dawa& Dengego-Harar	80	AC	80	80	162.2	220.5	36	63	100	135.94	210
8	Tarmaber - Kombolcha	187	AC	187	187	289.8	383.2	36	60	100	132.22	166
9	Weldia - Alamata	78	AC	78	78	150.3	230.9	36	62	100	153.63	172
10	Betemariam - Wukro	117	AC	117	117	203.4	240.5	36	67	100	118.24	186
11	Debremarkos - Merawi	220	AC	220	220	327.0	575.8	36	39	100	176.09	108
12	Awash Arba - Gewane	136	AC	136	136	192.0	192.0	30	38	100	100.00	131
	Total					2961.7	4134.5	424	696	100	139.60	164

Source: Ethiopian Roads Authority (Projects' completion report)

From the above table we can see clearly most road construction projects exceed from the estimated time and cost. Though there may be various reasons for such divergence, nonconformity to plans is observed. And there are presumptions that design problems or risks contribute to deviations from plan with a notion that the basic elements of a project plan, time and cost, are derivatives of design. ERA (2005) indicated that design consultants lack own quality assurance system; they do not strive to create a methodology for the local conditions, instead, copy or adopt what has been previously developed. In some cases they don't have deep knowledge on the type of services ERA needs, and do not feel accountable for the services they render. Moreover, most of the consultants are newly formed and desperate to have a job at significantly lower price and win, consequently ending up producing low quality work. The study further reveals that Terms of Reference issued by ERA is not precise and clear. Hence, it is apparent that these problems reflect the existence of design risks which need to be addressed.

2.14. Summary of literature review

The literature review was done through privies studies, internet, construction management books, and engineering journals. By referring to the previous literature, the information from the causes of construction delays, effects of construction delays, and the method of rectification of construction observed. This would be used to develop the questionnaire survey in order to collect data from the targeted respondent.

Time overrun is late completion of works as compared to the planned schedule or contract schedule and cost overrun occurs when the final cost of the project exceeds the original estimates. It may be caused by any party to the contract and may be a direct result of one or more circumstances. A contract time or cost overrun have adverse effects on both the owner and contractor (either in the form of lost revenues or extra expenses) and it often raises the contentious issue of delay responsibility, which may result in conflicts that frequently reach the courts.

The main causes of time and cost overrun differ from country to country. For example in Palestine poor communication between construction parties, poor resource management, delay in commencement and insufficient inspectors are the main causes for time overrun. But in Kuwait

the main causes of delays are changing orders, owners' financial constraints, and owners' lack of experience.

Literatures found that the main causes of cost overrun in Ethiopia public building construction were found to be inflation or increase in the cost of construction materials, poor planning and coordination, change orders due to enhancement required by clients, excess quantity during construction. The main cause for cost overrun in Ethiopia federal road construction were 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.

Delays occur in every construction project and the magnitude of these delays varies considerably from project to project. Some projects are only a few days behind the schedule; some are delayed over a year. So it is essential to define the actual causes of delay in order to minimize and avoid the delays in any construction project. There is a wide range of views for the causes of time delays for engineering and construction projects. Some are attributable to a single party, others can be ascribed to several quarters and many relate more to systemic faults or deficiencies rather than to group or groups. The successful execution of construction projects and keeping them within estimated cost and prescribed schedules depend on a methodology that requires sound engineering judgment.

In Ethiopian context the problem of projects delay and cost overruns can nearly be noticed in every road construction projects. This indicates that this problem didn't receive enough attention by both researchers and responsible authorities. Even if few researches are made in Time and cost overrun in Ethiopia, these researches are focused mainly on federal road projects. Since Addis Ababa is a large city and there is huge road construction there should be a research on factors affecting cost and time overrun on Addis Ababa road projects. By taking this in to consideration this thesis mainly focus on factors affecting time and cost overrun in Addis Ababa road construction projects.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter describes the methodology of the thesis. 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 and time overruns in Addis Ababa road construction projects and makes conclusions and recommendations based on the findings. The research strategy and design to be followed towards this end are discussed as follows.

3.2 Research strategy

Naoum (1998) defined the research strategy as the way in which the research objectives can be questioned. Two types of research strategies are used at studies, quantitative and qualitative research. Quantitative approach is used to gather factual data and to study relationships between facts and how such facts and relationships accord with theories and the findings of any research executed previously, but the qualitative approach seek to gain insights and to understand people's perception of "the world" whether as individuals or groups (Fellows and Liu, 1997). The research strategy adapted for this research is quantitative research. Quantitative research is chosen to know stakeholders perception regarding time and cost overrun.

3.3 Research design

"Research design" refers to the plan or organization of scientific investigation, designing of a research study involves the development of a plan or strategy that will guide the collection and analyses of data (Poilt and Hungler, 1985). This research consists of five phases; the first one is the proposal for identifying and defining the problems and establishment of the objectives of the study. The second phase of the research includes literature review. Literatures of time and cost overruns in road construction were reviewed.

The third phase of the research included a methodology of the thesis. The fourth phase of the research includes result and discussion. In this phase the result of desk study and questionnaires will be discussed. The last phase of the research includes the conclusions and recommendations.

3.4 The research type

This research can be categorized as applied, exploratory, descriptive and co-relational type. It is applied and exploratory because the research finds whether time and cost overrun exists or not. It is also descriptive because it tried to describe the actual rate of time and cost overrun and the variables of time and cost overrun and tries to draw relationship between contract amount and rate of cost overrun in the Addis Ababa road construction projects.

3.5 Scope and limitation

There are many factors for time and cost overrun in road construction projects. Each cause of time and cost overrun has different rates of occurrences and their impact on the final cost of the construction project also varies. Therefore, this thesis will identify key causes of time and cost overrun based on their occurrence and their impact on road construction projects.

In this thesis there were limitations which were encountered throughout the preparation of this research. Unavailability of adequate documented information and unwillingness in the construction firms (Clients, Consultants and contractors) are some of the limitations.

3.6 Data Collection

The study has used the data sources to produce the following basic documents: respondents' documents and archival documents. The respondents' documents were collected using questionnaire from client, contractors and consultants. Archival documents were mostly from completed projects, in which contract documents, project reports, correspondence letters and payment certificates were investigated thoroughly which were very important in identifying the recurrent problems related to time and cost in the Addis Ababa road construction projects. In addition, they helped to judge how problems on causes of time and cost overrun arise and how they are documented.

According to Addis Ababa City Road Authority, 2005 yearly book sixty main roads are constructed in Addis Ababa for the past 20 years. Out of those roads ten recent road construction projects in Addis Ababa were selected and investigated. Some of the selected road projects are

not completed. But the rate of cost and time overrun of these projects calculated by extrapolation of the current status. These projects discussed information regarding the estimated time and actual completion date as well as estimated amount and actual amount.

3.7 Sample Size Distributions

Wood and Haber (1998) defined the sampling as the process of selecting representative units of a population for the study in research investigation. A sample is a small proportion of a population selected for observation and analysis. The samples were selected randomly from contracting companies, consultant offices & client.

Statistical equations were used in order to calculate the sample size for the contractors. Equation 3.1 was used to determine the sample size of the unlimited population (creative research system, 2001, www.cdb.riken.jp):

$$SS = \frac{Z^2 \cdot P \cdot (1-P)}{C^2} \dots\dots\dots \text{Equation 3.1}$$

Where SS = Sample size

Z = Z value (e.g. 1.96 for 95% confidence level)

P = Percentage picking a choice, expressed as a decimal (0.50 used for sample size needed).

C = Margin of error (9%)

$$SS = \frac{1.96^2 \times 0.5 \times (1-0.5)}{0.09^2} = 118.57 \approx 119$$

Correction for Finite Population

$$SS_{\text{new}} = \frac{SS}{1 + \frac{SS - 1}{POP}} \dots\dots\dots \text{Equation 3.2}$$

Where POP is the population = 38 match the proposed classes of contracting companies (only grade 1 road contractors were considered)

$$SS_{\text{new}} = \frac{119}{1 + \frac{119 - 1}{38}} = 28.9 \approx 29$$

The total number distributed to contractors was 72 questionnaires were 72 (two professional for each contracting firms). The total number returned were 58 questionnaires.

POP (Consultants) = 18

$$SS_{new} = \frac{119}{1 + \frac{119 - 1}{18}} = 15.75 \approx 16$$

The total number distributed was 30 questionnaires. The total number returned was 26 questionnaires.

Since the client of Addis Ababa roads is one no need of calculation for sample size. I simply distribute for ten engineers in clients side. And all questionnaires were returned.

3.8 Methodology used in this study

The methodology used for this study is using questionnaire and desk study. A questionnaire of 47 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, 4 = very significant, and 5 = extremely significant).

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

The mean score (MS) for each variables of time and cost overrun is computed by using the following formula;

$$MS_i = \frac{\sum (f \times s)}{N} \dots\dots\dots \text{Equation 3.3}$$

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;

$$\text{Weighted Avg.} = w_a x_a + w_b x_b + w_c x_c \dots\dots\dots \text{Equation 3.2}$$

Where; w = relative weight (%)

x = mean score

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

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.

$$\text{Rho } (\rho_{\text{cal}}) = 1 - \frac{6 \times (\sum d_i^2)}{N \times (N^2 - 1)} \dots\dots\dots [\text{Eq. 3.3}]$$

Where:

$\text{Rho } (\rho_{\text{cal}})$ – Spearman rank correlation coefficient

d_i – The difference in ranking between each pair of factors

N – Number of factors (variables)

Procedure for hypothesis testing:

1. Define the null hypothesis (H_0) and the alternative hypothesis (H_A)
2. Choose a value for p . (i.e. choose the significance level)
3. Calculate the value of the test statistic, $\text{Rho } (\rho_{\text{cal}})$.
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 (H_0). 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 (H_0) and accept the alternative hypothesis (H_A).

3.8.1 Questionnaire approach

A questionnaire was developed to assess the perceptions of client, consultants, and contractors due to the importance index of causes and effects of delay in Addis Ababa road construction projects. Factors influencing time and cost overruns in road construction projects in Addis Ababa were first examined and identified through a relevant literature review and by conducting experienced professionals in road construction industry.

3.8.2 Questionnaire design

From literature review it has been discussed factors which affect time and cost overruns in road construction projects in various countries around the world and at intervals of time, but not all of these factors are the cause of time and cost overrun in Addis Ababa road construction projects, so it has been selected (47) factors that has an impact in Addis Ababa projects.

The draft questionnaire was discussed with the supervisor of the thesis. The final questionnaire contains 32 factors influencing time overruns, and 15 factors 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.

3.8.3 Questionnaire content

The questionnaire included three parts that are related to the factors of time and cost overruns at construction projects in Addis Ababa, these parts are general organization information, factors influencing time overruns and factors influencing cost overruns.

3.8.3.1 Organization profile

Four items were prepared for asking information about organization such as the name of organization, company type (client, consultant or contractor), respondents designation and his/her experience. (The questionnaire is included in annex 1)

3.8.3.2 Factors affecting time overruns at construction project

This part of questionnaire consist of 8 groups related to time overruns, the groups included 32 factors that influencing time overruns, these groups are project related factors, Owner

responsibility, Contractor's responsibility, Consultant responsibility, Materials, Labor and equipments, Contractual relationship and external factors. (The questionnaire is included in annex 1).

3.8.3.3 Factors influencing cost overruns

This part illustrates the factors influencing cost overruns in road construction project, these factors are the harvest of previous studies. 15 factors were included in this part. (The questionnaire is included in annex 1).

3.9 Data Measurement

In order to be able to select the appropriate method of analysis, the level of measurement must be understood. For each type of measurement, there is an appropriate method that can be applied and not others. 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. The numbers assigned to the agreement or degree of influence (1, 2, 3, 4, 5) do not indicate that the interval between scales are equal, nor do they indicate absolute quantities. They are merely numerical labels. Based on Likert scale researcher has the following:

Table 3.1; Scales that represent chances of occurrence

Chances of occurrence	Extremely significant	Very significant	Moderately significant	Slightly significant	Not significant
Scale	5	4	3	2	1

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter describes the results and discussion of desk study and questionnaire survey concerning time and cost overruns in Addis Ababa road construction projects from contractors, consultants and client view points. Finally, the effects of time and cost overrun in construction on the various stakeholders, on the construction industry, and on the national economy in general will be dealt.

From the desk study ten road construction projects in Addis Ababa were surveyed. During the desk study the contract amount, contract time during signing of the contract, actual cost and actual completion time at completion of the project were investigated. These help to know whether there is time and cost overrun exist or not, and to investigate how the actual time and cost at completion deviates from the contract period and contract amount.

4.2 Results of Desk Study

Before identifying the causes of time and cost overrun it has to be identified whether time and cost overrun exist or not. During desk study ten road projects are selected and evaluated their estimated completion time and actual completion date then calculated the rate of time overrun if any. This is also done for cost overrun in the same approach. The data was collected via reviewing project documents. On the basis of data gathered from the desk study, the entire project evaluated in desk study registered time and cost overrun. The rate of time overrun ranges from a minimum of 25% to the maximum of 264.38% of the contract time. And cost overrun ranges from a minimum of 4.11% to the maximum of 135.06% of the contract amount for individual projects.

Based on the result found in desk study; name of selected road projects, contractors name, contract time, contract amount, actual completion time, actual completion cost, rate of time overrun and rate of cost overrun of selected road are described as shown in Table 4.1 and 4.2.

Table 4.1: Contract time and Actual completed time of some Addis Ababa Road Projects.

No	Selected Addis Ababa Road Projects name	Contractors name	Contract Time (days)	Actual Completed Time (days)	Rate of Time Overrun (%)
1	Winget Aseco Bridge	Tidhar Earth Moving and Excavation Works	330	1048	217.58
2	Yekatit 12 square – Afenchober – Semen hotel urban street	CRBC Addis Engineering	365	1330	264.38
3	Dama Hotel – Hanamariam	Enyi construction	365	1155	216.44
4	Megenagna – Meskel Square – Torhilo (Lot 1 & Lot 2) Contract 1	CRBC Addis Engineering	550	726	32
5	Meskel flower – Bole Ruwanda	Hazi II	575	2370	58.42
6	Shola Gebeya – Lemhotel – Anbessa Garage	Enyi construction	575	1232	114.26
7	Mekanisa roundabout – Addis sefer	CRBC Addis Engineering	90	270	200
8	Abunepetros square - pastuer	Tidhar Earth Moving and Excavation Works	224	763	240.63
9	Megenagna – Ayat	CRBC Addis Engineering	420	709	68.81
10	Gotera – Wellosefer	CRBC Addis Engineering	180	225	25

Source: Addis Ababa City Road Authority (Projects' Progress and completion report)

Table 4.2:Contract amount and Actual completed amount of some Addis Ababa Road Projects.

no	Selected Addis Ababa Road Projects name	Contractors name	Contract Amount (Eth. Birr)	Actual Completed Cost (Eth. Birr)	Rate of Cost Overrun (%)
1	WingetAseco Bridge	Tidhar Earth Moving and Excavation Works	154,485,787.41	181,139,826.67	17.25
2	Yekatit 12 square – Afenchober – Semen hotel urban street	CRBC Addis Engineering	36,213,579	54,334,900	50.04
3	Dama Hotel – Hanamariam	Enyi construction	54,214,003.00	68,563,420.00	26.47
4	Megenagna – Meskel Square – Torhiloch (Lot 1 & Lot 2) Contract 1	CRBC Addis Engineering	1,162,448,900.69	1,214,586,635.23	4.49
5	Meskel flower – Bole Ruwanda	Hazi II	49,587,265.63	78,558,144.39	135.06
6	Shola Gebeya – Lemhotel – Anbessa Garage	Enyi construction	109,512,767.87	145,311,625.22	32.69
7	Mekanisa roundabout – Addis sefer	CRBC Addis Engineering	36,554,500.46	41,654,715.37	13.95
8	Abunepetros square - pastuer	Tidhar Earth Moving and Excavation Works	144,440,764.43	150,374,645.56	4.11
9	Megenagna – Ayat	CRBC Addis Engineering	224,055,813.14	265,104,212.54	18.32
10	Gotera – Wellosefer	CRBC Addis Engineering	30,000,000	32,450,000	8.17

Source: Addis Ababa City Road Authority (Projects’ Progress and completion report)

Tables 4.1 and 4.2 clearly show that, the rate of time and cost overrun has significantly high in Addis Ababa road construction projects. From the projects' completion report it was found that the main reasons for time and cost overruns are right of way problem, design change, contractors' financial problem.

4.3 Results of Questionnaire for causes of time and cost overrun

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 time overrun for the Addis Ababa road construction industry cases, hence it is important to ask the respondents for their agreement on each particular variables of time and cost overrun, then this is accompanied by identification of causes of cost overrun based on their occurrence. To clearly identify the most common causes of cost overrun it is important first to identify the causes of cost overrun for Addis Ababa road construction projects, and then identify their rate of occurrence.

4.3.1 Population characteristics

This part mainly designed to provide general information about the respondents in terms of the name of organization, company type, position and experience contact person.

4.3.1.1 Type of respondent's organization

In this study, 61.70 % (58) contractors, 27.66 % (26) owners, 10.64 % (10) consultants participated in the questionnaire. The general response rate for contractors, owners and consultants was 83.93 % and the total number of respondents for the three parties was 94 out 112 respondents. The response rate of contractors was 80.56 % (58 out of 72 respondents), for the owner 100 % (10 out of 10 respondents) and 86.67 % (26 out of 30 respondents) for consultants.

Table 4.3: Type of respondents' organization

No. of respondents	Questionnaire distributed	Questionnaire Returned	Response Rate
Contractor	72	58	80.56 %
Client	10	10	100%
Consultant	30	26	86.67

4.3.1.2 Respondents designation

Table 4.4 shows that 48.28 % (28) of contracting companies respondents were site engineers, 20.69 % (12) were projects managers and 31.03 % (18) were office engineers. It has been found that 40.0 % (4) of clients respondents were site engineers and 60 % (6) were projects managers. It has been founded that 38.46 % (10) of the consultants companies respondents were resident engineers, 38.46 % (10) were site engineers and 23.08 % (6) were office engineer. Totally out of 94 respondents for the three parties, 44.68 % (42) of the respondents were site engineers, 29.79 % (28) were projects managers and 25.53 % (24) were office engineers.

Table 4.4: Respondents designation

Respondents designation	Contractor	Consultant	Client
Project manager/ Resident engineer	12	10	6
Site engineer	28	10	4
Office engineer	18	6	0

4.3.1.3 Experience of respondents

The above table shows that 40.43 % (38) of the respondents firm have experience between 1 to 4 years at construction works and 36.17 % (34) of the respondents experience between 4 to 8 years, 15.96 % (15) of respondents have experience from 8 to 12 years, and 7.45 % (7) who have experience more than 12 years .

Table 4.5: Experience of respondents (years)

Experience of respondents	Contractor	Client	Consultant	Total
1 – 4 Yrs	28	3	7	38
4 – 8 Yrs	23	2	9	34
8 – 12 Yrs	5	4	6	15
>12 Yrs	2	1	4	7

4.3.2 Factors influencing time overruns at construction projects

This part consists of results and discussion of factors that influence time overruns. These factors include; project related factors, contractors' responsibility, consultants' responsibility, client's responsibilities, and external factors.

4.3.2.1 Contractors view

Table 4.6 shows that the contractors ranked "Delay to deliver the site (Right of way problem)" in the first position with a mean score of 4.483. This indicates how right of way problem affect the project time. If there is a right of way problem in construction project it will lead to a significant delay in a project. As observed from desk study some projects delay for years only due to right of way problem. This result is in line with the results of Tadesse (2009). The suitable description of this agreement is that the delay to deliver the site (Right of way problem) has a high impact in delaying Ethiopian road construction projects.

The second important factor ranked by contractors was "Financial problems" with a mean score of 4.207. This is a strong indication that financial problem will cause delay. This result coincides with the results of Tadesse (2009). The suitable description for this consensus is that cash is very necessary for contractor to construct the project within specified time. Any shortage of cash for the contractor will cause many problems such as slow progress and work decline in productivity. Also the contractors will not be able to purchase the needed equipment for work. The client pays advance payment before the project starts. So the financial problem is due to contractor's mismanagement. Improper planning is ranked by contractor as the third important factor that can cause time overrun with a mean score of 3.897. Proper planning is important for accomplishing the project successfully. If the contractors fail to plan their work properly it will affect the project completion time and it will be a big loss for contractor and end users.

The respondents from contractors ranked "Weather condition" in the fourth with mean score of 3.845. It is known that July and August are the rain period and most road projects are taking this in to consideration. But sometimes the rain might extend up to October or might start early in June. This will affect the project completion time significantly. Road construction can be

constructed in the rainy season by using shades. But the shading should be done properly so as to avoid water entering to sites that affect optimum moisture content.

Site management problem is ranked as the fifth important factor that can cause time overrun with a mean score of 3.759. Poor management cause many constrains at the projects, such as poor following up of progress, incorrect distribution of works, un commitment of employees at the site, poor monitoring of project --etc. These factors above contribute to delay the project.

Table4.6: Factors influencing time overruns from point view of contractors, consultants and client

Factors affecting time overrun	Contractor		Consultant		Client		Weighted average	
	MSi	Rank	MSi	Rank	MSi	Rank	MSi	Rank
Delay to deliver the site (Right of way problem)	4.483	1	4.231	2	4.4	1	4.404	1
Financial problems	4.207	2	4.385	1	4.3	2	4.266	2
Improper planning.	3.897	3	3.962	5	4.3	2	3.958	3
Weather condition	3.845	4	3.731	6	4	6	3.830	5
Site management.	3.759	5	4.115	3	4.2	4	3.904	4
Unrealistic imposed contract duration.	3.233	6	3.423	8	4.1	5	2.895	7
Suspension of work by client or contractor	2.966	7	4.038	4	3.9	7	3.287	6
Contract Administration.	2.914	8	3.385	10	3.5	11	3.107	8
Change orders	2.914	8	3.577	7	3.6	8	2.723	8
Shortage in material.	2.69	10	3.269	11	3.5	11	3.107	11
Quality assurance/control.	2.69	10	3.038	16	3.5	11	2.872	21
Absence of consultant's site staff	2.622	12	3.115	14	3.3	15	3.149	16
Equipment availability and failure.	2.592	13	3.423	8	3.6	8	2.844	13
Labor productivity.	2.459	14	3.346	11	3.6	8	2.702	26
Unforeseen ground condition	2.424	15	2.962	21	3.2	16	2.760	14
Quality of material.	2.311	16	3	18	3	21	2.724	12
Discrepancies between contract documents	2.311	16	3.231	13	3.4	14	2.853	25
Waiting time for approval of tests and inspections.	2.269	18	2.962	21	3.1	20	2.670	22

Factors affecting time overrun	Contractor		Consultant		Client		Weighted average	
	MSi	Rank	MSi	Rank	MSi	Rank	MSi	Rank
Slow decision-making by consultants and owners.	2.269	18	3.038	16	3.2	16	2.669	20
Poor communication and coordination	2.245	20	2.731	24	2.9	21	2.682	10
Lack of experience on the part of the consultant	2.228	21	3.115	14	3.2	16	2.638	18
Subcontractors	2.184	22	3	18	3.2	16	2.713	15
Finance and payments of completed work.	2.184	22	3	18	2.8	22	2.742	29
Mistakes during construction.	2.152	24	2.462	31	2.7	24	2.450	24
Inadequate contractor experience.	2.152	24	2.846	23	3.1	20	2.568	23
Regulatory changes	2.136	26	2.538	29	2.5	27	2.532	26
Owner interference.	2.136	26	2.577	28	2.4	29	2.534	28
Preparation and approval of drawings.	2.136	26	2.731	24	2.4	29	2.532	19
Labor supply.	2.122	29	2.654	27	2.8	22	2.463	17
Major disputes and negotiations.	2.102	30	2.5	30	2.5	27	2.380	31
Lack of communication between the parties.	2.086	31	2.731	24	2.3	31	2.383	30

4.3.2.2 Consultants view

Table 4.6 shows that the consultants ranked financial problems with a mean score of 4.385 as the first factor that causes delay. This indicates the high importance of cash for the progress of project. Any shortage of cash for the contractor will cause many problems such as slow progress and work decline in productivity. Also the contractors will not be able to purchase the needed equipment for work. More over the problem of cash also expanded to traders and suppliers, which in turn leads to slow the work, then to occurrence of project's delay.

The second factor that causes delay was "Delay to deliver the site (Right of way problem)" with a mean score of 4.231. This directly delays site hand over. Domestic contractors tolerate delayed hand over of construction sites but foreign contractors do not tolerate delayed hand over of construction sites by employers; foreign contractors claim to be compensated for idle hours of man power and equipments due to the delay. These are due to cultural differences between domestic contractors and foreign contractors; domestic contractors which suffered from delayed

payments and late site hand over, say that such tolerance is to avoid adversarial relationship with the stakeholders on that project and hence to create conducive working environment [Fetene, 2008].

The third important factor ranked by consultants was Site management problem with a mean score of 4.115. Poor management cause many constrains at the projects, such as poor following up of progress, incorrect distribution of works, un commitment of employees at the site, poor monitoring of project --etc. These factors contribute to delay the project.

The consultants ranked "the suspension of work by owner or contractor" in the forth position with mean score of 4.038, which indicates the high importance of work continuity in order to complete the project on time. The suspension of work creates disputes between the parties of the project. The sequence of project activities will be affected, which lead to delay. The fifth important factor ranked by consultants was "Improper planning" with a mean score of 3.962. This result shows the importance of planning and time scheduling to deliver the project on time. When the activities execution is without priorities of tasks and without knowledge of critical path activities, it certainly causes the delay of project.

4.3.2.3 Clients view

Table 4.6 shows that clients ranked Delay to deliver the site (Right of way problem) as the first factor that cause delay with a mean score of 4.4. Late hand over of construction sites, sometimes may happen and substantially increase the cost of construction projects. In most international projects in Ethiopia late site hand over is a common form of claim source for compensation for contractors [Girmay, 2003]. But site hand over problem still a major reason for time overrun according to contractors and clients while consultants ranked second. The second important factor was improper planning and financial problems with a mean score of 4.3. The first result is the same with the contractor, which support the importance of this factor. This result shows the importance of planning to deliver the project on time. When the activities execution is without priorities of tasks, it certainly causes the delay of the project. The fourth important factor was poor site management with a mean score of 4.2. This result is in full conformity with the contractors and client but in the case of consultant, the value of the mean score is higher.

The fifth factors ranked by client were "unrealistically imposed contract duration" with a mean score of 4.1. This is a strong indication of the importance of proper estimation of project duration. Sometimes the project duration determined roughly, therefore the project may be delayed. One of the important obligations of consultant is to determine the duration of project according to the volume of activates. The seventh important factor ranked by client was "Weather condition" with mean score of 4.00.

4.3.3 Factors influencing cost overruns at construction projects

Table 4.7 shows the rank of all factors of cost overruns that have been investigated in this research from contractor, consultant and client view points. A total of 13 factors which influence cost overruns in Addis Ababa have been studied and discussed. The rank was based on mean score of the factors.

4.3.3.1 Contractors view

Table 4.7 shows that contractors ranked "Design changes" in the first position with mean score of 4.207. There are many possible reasons for design changes. Some of possible reasons are; the client may need additional work, the quality of material may need change, the alignment may need change due to different reasons or omission of some work may be needed due to financial reason. Design changes in particular and contract change or modification in general is one of the important reasons that cause delay. As any modification in the technical specification, bill of quantities or replace any work with another one, it would lead to disputes between the contractor's and client's teams. Change order refers to changes that are generated by unanticipated causes, for example, scope changes from the owner, Incomplete/in consistent drawings, design error/defect, omissions of site conditions, and changes in codes and regulations. To solve these disputes and develop new agreements, it takes additional time that affects the project schedule and hence affects the total duration of the project. Therefore design change would significantly affect the cost of the project.

Table 4.7: Factors influencing cost overruns from point view of contractors, consultants and client

Factors affecting cost overrun	Contractor		Consultant		Client		Weighted average	
	MSi	Rank	MSi	Rank	MSi	Rank	MSi	Rank
Design changes	4.207	1	4.143	1	4.1	1	4.178	1
Inadequate review for drawings and contract documents by consultants.	3.897	2	3.714	2	3.7	3	3.825	3
Fluctuations in the cost of materials	3.845	3	3.714	2	4.1	1	3.836	2
Lack of cost planning/monitoring during pre and post contract stages	3.328	4	3.571	4	3.7	3	3.435	4
Indecision by the supervising team in dealing with the contractor's queries resulting in delays.	3.292	5	3.342	7	3.5	6	3.328	5
Contractual claims, such as, extension of time with cost claims.	3.224	6	3.286	8	3.5	6	3.271	7
Delays in issuing information to the contractor during construction stage	3.121	7	3.571	4	3.5	6	3.286	6
Technical incompetence, poor organizational structure, and failures of the enterprise	3.12	7	3.142	9	3.6	5	3.177	8
Project materials monopoly by some suppliers	3.035	9	3.142	9	3.2	9	3.082	10
Additional work at owner's request	2.914	10	3.429	6	3.2	9	3.087	9
Lack of experience of technical consultants,	2.914	10	2.857	11	3.1	11	2.918	11
Some tendering maneuvers by contractors, such as front- loading of rates	2.69	12	2.857	11	2.7	12	2.737	12
Unpredictable weather conditions	2.552	13	2.571	13	2.6	13	2.562	13

"Inadequate review for drawings and contract documents" was ranked as the second major factor of cost overruns by contractors with a mean score of 3.897. The third cause of cost overruns was "Fluctuations in the cost of materials" with a mean score of 3.845. Fluctuation in prices has a significant impact on cost increase. Often the contractor estimates prices of the tender according to the present prices at local markets. It's known that the tendering phase and awarding is an early phase of the project, even the awarding process takes long time, so there is a chance of

price fluctuation. In case of high prices, the contractor would face the problem of cost overruns at the execution phase.

The contractors ranked unpredictable weather conditions as the least factor that cause cost overruns with a mean score of 2.552. Addis Ababa has good climatic conditions, so it isn't exposed to any hurricanes or great leaps in temperature or snow fall, therefore the weather condition does not have a significant impact on execution of construction project and to make any damages of these projects.

4.3.3.2 Consultants view

The first important factor that cause delay according to consultants was "Design changes" with a mean score of 4.143. "Inadequate review for drawings and contract documents" and "Fluctuations in the cost of materials" were the second factors of cost overruns ranked by consultant with a mean score of 3.714. Consultants consider "Lack of cost planning/monitoring during pre contract stages" and "Delays in issuing information to the contractor during construction stage" ranked by consultants as the fourth factors to cause cost overruns with a mean score of 3.571. Any information should be given to contractor on time. Delay in giving information will incur additional costs to contractor.

Table 4.7 shows that consultants ranked "unpredictable weather conditions" as the least factor that cause cost overruns with a mean score of 2.571. As discussed earlier Addis Ababa has good climatic conditions, so it isn't exposed to any hurricanes or great leaps in temperature or snow fall, therefore the weather condition does not have a significant impact on execution of construction project and to make any damages of these projects.

4.3.3.3 Clients' view

"Design changes" and "Fluctuations in the cost of materials" were the first factors to cause cost overruns with a mean score of 4.1. Design changes are considered as one of major factor for increasing the cost of project. As any modification 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 means the

increase of project duration and to loose of materials. Thus the cost overruns will be present at this case.

"Inadequate review for drawings and contract documents" and "Lack of cost planning/monitoring during pre contract stages" were ranked as the third factors of cost overruns with a mean score of 3.7. The fifth factor ranked by clients was "Indecision by the supervising team in dealing with the contractor's queries resulting in delays" and "Contractual claims, such as, extension of time with cost claims "with a mean score of 3.5. Table 4.7 shows that clients ranked the "Unpredictable weather conditions" as the last factor with a mean score of 2.6.

4.3.4 Tests for Agreements on Causes of Time and Cost Overrun Among Stakeholders in the Construction Industry

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 Addis Ababa. Hence in this section respondents' response will be tested for correlation using Spearman rank correlation coefficients, to see if there is difference in ranking between two groups of respondents; these are Clients versus Contractors; Contractors versus Consultants; and Clients versus Consultants, on the variables of cost overrun and their rate of occurrence.

The purpose of a hypothesis test is to avoid being deceived by chance occurrences. The tests also helped to evaluate whether consensus of opinions exist among respondents.

The Null Hypothesis (H_0) is: -There is no agreement in the ranking of causes of time and cost overrun between two groups of respondents

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

The spearman correlation coefficient (ρ) is calculated using Equation 3.3 and tabulated as shown below in Table 4.8,

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, H_0 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, H_0 is accepted, i.e. there is no evidence of a statistically significant agreement between the two groups.

Table 4.8: Summary of correlation test on the ranking of causes of time overrun

Respondents	$\text{Rho } (\rho_{\text{cal}}) = 1 - \frac{6 \times (\sum d_i^2)}{N \times (N^2 - 1)}$	Critical value of ρ (Appendix B)	Significance for $P < 0.05$
Client Vs Contractor	0.438	0.3021	significant reject
Contractor Vs Consultant	0.497	0.3021	significant reject
Client Vs Consultant	0.567	0.3021	significant reject

In this case, with a 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 significant agreement between the respondents is rejected i.e. the null hypothesis is rejected.

From Table 4.8 above, it can be concluded that there is strong correlation between the attitudes of the respondents in all the three groups and hence the null hypothesis should be rejected and the alternative hypothesis shall be accepted. This means that most of the respondents have the same perception about causes of time overrun.

In a similar way correlation test is done for cost overrun as shown below.

Table 4.9: Summary of correlation test on the ranking of causes of cost overrun

Respondents	$\text{Rho } (\rho_{\text{cal}}) = \frac{1 - \frac{6 \times (\sum d_i^2)}{N \times (N^2 - 1)}}$	Critical value of ρ (Appendix B)	Significance for $P < 0.05$
Client Vs Contractor	0.825	0.4825	significant reject
Contractor Vs Consultant	0.615	0.4825	significant reject
Client Vs Consultant	0.607	0.4825	significant reject

In this case, with a 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 significant agreement between the respondents is rejected i.e. the null hypothesis is rejected.

From the above Table 4.9, it can be concluded that there is strong correlation between the attitudes of the respondents in all the three groups and hence the null hypothesis should be rejected and the alternative hypothesis shall be accepted. This means that most of the respondents have the same perception of variables of cost overrun.

4.4 Effects of Cost Overrun

The desk study results shows, almost all projects delayed and incurred additional cost from estimated amount. This shows the severity of the effects of time and cost overrun. The first victim from time and cost overrun is the project end user that is the people of the city. Although the degree of effects of time and cost overrun varies on the stakeholders in the construction industry, all the parties involved are affected by time and cost overrun. Cost overrun does not affect only those parties that are involved directly in the construction of a project, but its effects pass to the construction industry as a whole and consequently to the national economy of the country.

If there is excessive cost overrun then it requires additional budget, this in turn affect the scarce financial resources of the country, which lead to further budget short fall for construction projects. This prevents the planned increase in property and service production from taking place

and this phenomenon in turn affects, in a negative way, the rate of national growth. Cost overrun will also be a source of dispute among stakeholders and it will lead to adversarial relationship among project participants. Client will lose confidence on consultant and on professionals in general. To the industry as a whole, cost overruns could bring about a drop in construction activities, bad reputation, and inability to secure project finance easily from public authorities in the future.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

This chapter includes the conclusions and recommendations that would help in solving the problem of delay and cost overruns at construction in Addis Ababa road projects. The first objective of this study was to identify whether time and cost overrun exist or not and evaluate to what extent the time delay and cost increases in Addis Ababa road construction. The second objective was to identify factors influencing time and cost overruns in road construction in Addis Ababa. Discussing the effect of time and cost overrun in overall road construction in Addis Ababa was the third objective and the last one was to formulate recommendations to avoid or minimize time and cost overrun.

Desk study was used to identify the existence and extent of time and cost overrun on road construction projects in Addis Ababa. Questionnaire survey was also used to identify the causes of time and cost overrun. Client, consultants and contractors were asked to identify the factors affecting time and cost overrun in the Addis Ababa road construction industry. The data gathered from the survey are analyzed using the mean score (MS).

5.1 Conclusions

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

1. The first specific objective was to identify whether time and cost overrun exist or not and evaluate the extent of time and cost overrun in Addis Ababa road construction. Ten out of ten, (100%), road projects investigated in the research suffered time and cost overrun in their execution. For these road construction projects, the actual time overruns ranges from 25% to 264.38% of the contract time and the cost overrun ranges from 4.11% to 135.06% of the contract amount.
2. The second specific objective was to identify factors influencing time and cost overruns in road construction in Addis Ababa. From the results of these thesis 32 causes of time overrun and 13 causes of cost overrun were identified by the respondents. The most

common causes of time overrun are Delay to deliver the site (Right of way problem), financial problems of contractors, Improper planning, and Site management. And the most common causes of cost overrun are Design change, fluctuation in the cost of materials and inadequate review for drawings and contract document.

3. Results indicated that the factor "Delay to deliver the site (Right of way problem)" has been ranked in the first position by contractors and owners while it gets the second rank by consultant. This result indicates the high importance of delivering the site on time to complete the project on time. The right of way problem creates disputes between the parties of project, and then the time of completion will be affected even more. This agreement of opinions between contractors and owners proves the importance of these factors in projects delay.
4. The factor of "Financial problems" has been ranked in the 2nd position by the contractors and owners while the consultants ranked in the 1st position. This result indicates the high importance of cash for the progress of project. Any shortage of cash for the contractor will cause many problems such as slow progress and work decline in productivity. Also the contractors will not be able to purchase the needed equipment for work. More over the problem of cash also expanded to traders and suppliers, which in turn leads to slow the work, then to occurrence of project's delay. Shortage of cash is created either by improper use of advance payment by contractor or delay in payment by client.
5. From the results obtained at this thesis, and compare it with the results and analysis of previous literatures, it's found that there are a real similarity of the important factors that influencing time and cost overruns. But right of way problem is a major problem in Ethiopia and not that much significant in other country. Because literatures that are done out of Ethiopia not included right of way problem as a major factor for time overrun.
6. The third specific objective was to identify the effect of time and cost overrun in overall road construction in Addis Ababa. There are many effects of time overrun to stakeholders in the construction industry. The most common effects of time overrun in the construction industry are; cost overrun, dispute and arbitration.

7. 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/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/her chances of winning further jobs, if at fault.

5.2 Recommendations

The following points are recommended to all parties in order to minimize and control time and cost overruns in construction projects.

1. Contractors are recommended to use advance payment properly to avoid the financial problems. It is advised to conduct breakeven analysis from time to time.
2. Contractors are recommended to have a proper planning and good site management system in the different activities of the project so as to avoid any mistakes that may lead to rework of activities, resulting time and cost overruns. Contractors are advised to setup stores for required construction materials, and especially that are scarce or that are in limited quantity in the markets to avoid time and cost overruns.
3. Planning and scheduling: they are continuing processes during construction and match with the resources and time to develop the work to avoid cost overrun and disputes. Site management and supervision: administrative and technical staff should be assigned as soon as project is awarded to make arrangements to achieve completion within specified time with the required quality, and estimated cost.
4. The client should give attention on the right of way problem. Before the construction starts the client has to fulfill all the necessary requirements for delivering the site. Failure to deliver the site will cause time and cost overrun.

5. The client should determine the required duration of project and impose realistic duration to avoid time and cost overruns. Client recommended to have technical staff who is able to manage the different stages of any project and to follow the performance percentages, and also able to compare the actual performance with the planned one.
6. The client is recommended giving sufficient time for bid documents such as technical specifications, drawings, bill of quantities and designing of the project and revising it in a good way. This is because any discrepancy in bid documents will lead to disputes between projects parts and so delay may occur. Pay progress payment to the contractor on time because it impairs the contractors' ability to finance the work.
7. The client recommended minimizing change orders as possible as they can in order to avoid any time and cost overruns. The communication and coordination between the stake holders also have to be improved to minimize time and cost overruns.
8. Consultants are advised to continuous coordination and direct communication with contractors and clients, which will eliminate design discrepancies and errors as well as omissions in design and also provide an opportunity to review the contract documents thoroughly. This would help in eliminating change orders or variations due to discrepancy in contract documents.
9. Consultants are advised to hire a qualified technical staff to manage the project in a good way, so he would be able to overcome any technical or management problems that happen. It is also advised for consultant to have high qualification to give suitable instruction in a suitable time and to be able to answer any question stated by contractor to avoid time and cost overruns. They have to Review and approve design documents, shop drawings, and the payments of contractor to avoid any delay or cost overruns at the project.
10. Consultants are advised to adopt efficient information distribution systems to guard against communication gaps; respond as quickly as possible to contractor and client questions and requests for clarification to avoid associated delays and confusions which consequentially will lead to time and cost overrun.

11. Government must create a climate of economic stability that is sufficient to inspire investors, especially in the production of construction materials to be produced from local materials and production of enough quantity and quality of construction materials in the local market, this will help to reduce excessive price fluctuations associated with imported construction materials.
12. Government should give capacity building for professionals and firms on the construction sector so as to develop the performance of the professionals. In addition, government has to initiate intellectuals to do researches regarding causes of time and cost overrun.
13. Government should create opportunities for local contractors and consultants to work with international contractors and consultants to share experiences and adopt new technologies.

5.3 SUGGESTIONS FOR FUTURE WORK

- Management of delay and cost overruns during construction
- Implication of cost overruns and time delay on construction
- The impact of cost control techniques on construction projects

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APPENDIX A

QUESTIONNAIRE FOR RESEARCH THESIS

Introduction

This questionnaire is prepared to obtain information from key informants with semi- structured questions. The information is required for the academic research entitled “Factors Affecting Time and Cost Overrun in Road Construction Projects in Addis Ababa”, which is being conducted as partial fulfillment of MSc in construction technology and management. The main objective of the research is to identify the main factors that lead to time and cost overruns, and make recommendations based on the findings.

The questionnaire consists of three sections. Section A general organization information. Section B contains factors of time overruns and Section C contains factors of cost overruns in Road construction projects in Addis Ababa. 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,

AbubekerJemal

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Addis Ababa

SECTION A: GENERAL ORGANIZATION INFORMATION

1. Name of organization: -----

2. State respondent organization/company type.

Client

☐

Contractor

☐

Consultant

☐

3. Respondents designation:

Owner of organization

☐

Project manager Site Engineer

☐
☐

Office Engineer

☐

Resident Engineer

☐

Site Supervisor

☐

Other _____

4. Relevant working experience (Years):

1-4Yrs4-8Yrs8-12Yrs>12Yrs

☐
☐
☐
☐

SECTION B: FACTORS AFFECTING TIME OVERRUNS OF CONSTRUCTION PROJECTS IN ADDIS ABABA

Please indicate the significance of each factor by ticking the appropriate boxes. Add any remarks relating to each factor on the last column e.g. as to the reasons, the critical factors or the solutions.

E.S. = extremely significant (5);

V.S. = very significant (4);

M.S.= moderately significant (3);

S.S. = slightly significant (2);

N.S. = not significant (1)

No	Factor	E.S. (5)	V.S. (4)	M.S. (3)	S.S. (2)	N.S. (1)	Additional comment (If any)
1	Project – related						
a	Discrepancies between contract documents						
b	Suspension of work by owner or contractor						
c	Change order						

No	Factor	E.S. (5)	V.S (4)	M.S. (3)	S.S. (2)	N.S. (1)	Additional comment (If any)
2	Owner						
a	Delay to furnish and deliver the site (Right of way problem)						
b	Poor communication and coordination						
c	Finance and payments of completed work.						
d	Owner interference.						
e	Slow decision-making by owners.						
f	Unrealistic imposed contract duration.						
3	Contractor						
a	Financial problems						
b	Subcontractors						
c	Site management.						
d	Construction methods.						
e	Improper planning.						
f	Mistakes during construction.						
g	Inadequate contractor experience.						
h	Quality of material.						
i	Shortage in material.						
j	Labor supply.						
k	Labor productivity.						
4	Consultant						
a	Absence of consultant's site staff						
b	Lack of experience on the part of the consultant						
c	Contract management.						
d	Preparation and approval of drawings.						
e	Quality assurance/control.						
f	Waiting time for approval of tests and inspections.						

No	Factor	E.S. (5)	V.S (4)	M.S. (3)	S.S. (2)	N.S. (1)	Additional comment (If any)
	External factors						
a	Equipment availability and failure.						
b	Major disputes and negotiations.						
c	Lack of communication between the parties.						
d	Weather condition						
e	Regulatory changes						
f	Unforeseen ground condition						

If you have comments regarding time overrun kindly request to write here

SECTION C: FACTORS INFLUENCING COST OVERRUNS OF CONSTRUCTION PROJECTS IN ADDIS ABABA.

No	Factor	E.S. (5)	V.S. (4)	M.S. (3)	S.S. (2)	N.S. (1)	Additional comment (If any)
1	Lack of cost planning/monitoring during pre and post contract stages						
2	Design changes						
3	Inadequate review for drawings and contract documents.						
4	Indecision by the supervising team in dealing with the contractor's queries resulting in delays.						
5	Unpredictable weather conditions						
6	Delays in issuing information to the contractor during construction stage						
7	Contractual claims, such as, extension of time with cost claims.						
8	Some tendering maneuvers by contractors, such as front- loading of rates						
9	Fluctuations in the cost of materials						
10	Additional work at owner's request						
11	Technical incompetence, poor organizational structure, and failures of the enterprise						
12	Project materials monopoly by some suppliers						
13	Lack of experience of technical consultants,						

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

APPENDIX B

Spearman's Rank Table

Sample size (n)	p = 0.05	p = 0.025	p = 0.01
4	1.0000	-	-
5	0.9000	1.0000	1.0000
6	0.2860	0.8857	0.9429
7	0.7143	0.7857	0.8929
8	0.6429	0.7381	0.8333
9	0.6000	0.7000	0.7833
10	0.5636	0.6485	0.7455
11	0.5364	0.6182	0.7091
12	0.5035	0.5874	0.6783
13	0.4825	0.5604	0.6484
14	0.4637	0.5385	0.6264
15	0.4464	0.5214	0.6036
16	0.4294	0.5029	0.5824
17	0.4142	0.4877	0.5662
18	0.4014	0.4716	0.5501
19	0.3912	0.4596	0.5351
20	0.3805	0.4466	0.5218
21	0.3701	0.4364	0.5091
22	0.3608	0.4252	0.4975
23	0.3528	0.4160	0.4862
24	0.3443	0.4070	0.4757
25	0.3369	0.3977	0.4662
26	0.3306	0.3901	0.4571
27	0.3242	0.3828	0.4487
28	0.3180	0.3755	0.4401
29	0.3118	0.3685	0.4325
30	0.3063	0.3624	0.4251
40	0.2640	0.3128	0.3681
50	0.2353	0.2791	0.3293
60	0.2144	0.2545	0.3005
70	0.1982	0.2354	0.2782
80	0.1852	0.2201	0.2602
90	0.1745	0.2074	0.2453
100	0.1654	0.1967	0.2327