



**Addis Ababa University**  
**School of Commerce**  
**Department of business and Economics**

**ASSESSMENT ON THE EFFECTIVENESS OF MUGHER  
CEMENT ENTERPRISE COAL CONVERSION PROJECT**

Thesis Submitted to Addis Ababa University School of Commerce,  
Distance Education Graduate Studies Program

In Partial Fulfillment of the requirement for the Degree of Masters of  
Arts in Project Management

By  
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Advisor: Dr. Wubshet Bekalu

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**By Henok Eshetu W/Senbet**

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## DECLARATION

I declare that this thesis entitled “**ASSESSMENT ON THE EFFECTIVENESS OF MUGHER CEMENT ENTERPRISE COAL CONVERSION PROJECT**” 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

*Many projects experience schedule and cost overrun and thereby exceed initial contract amount period and cost. It becomes difficult to complete projects in the allocated cost and time. Taking into account the scarce financial resources of the country, cost overrun is one of the major problems and need investigation. This study examines previous literature on construction projects cost and schedule overruns, with the specific aim of identifying the causes and effects of cost schedule overruns in Mugher Cement Enterprise Coal conversion project. This is because of the overriding importance of time for both the owner (in terms of performance) and the contractor (in terms of money), it is the source of frequent disputes and claims leading to lawsuits. The primary concern of these arguments is answering the question of the extent of each contracting party's responsibility for the delayed projects and extra cost incurred. Consequently much has been done to avoid disputes related to delays. The thesis was initiated to investigate these issues by considering the case of Mugher Cement Enterprise Coal conversion project, towards developing a frame work for improving cost overrun and delay analysis. The methodology adopted in undertaking this research was the mixed approach involving a detailed review of the relevant literature, report produced followed by survey through structured interview to investigate the variables identified in depth. The study has revealed that the Mugher Cement Enterprise Coal conversion project is exposed to delay caused by delayed site handover, lack of coordination between main and sub-contractors, delayed in delivery of equipment as scheduled, delay in initial payment, labour strike, civil unrest (uncontrolled problem). In addition it was found out in the literature that methodologies for analyzing delays are different in various ways leading to difficulties and disputes associated with delay analysis. Therefore, best practice recommendations for avoiding the causes of delays identified and a model for assisting the analyst in selecting an appropriate delay analysis methodology for any claim situation were provided.*

## List of tables

<b>Table 4.1</b> Project office staff.....	42
<b>Table 4.2:</b> Respondents organizational profile.....	43
<b>Table 4.3:</b> Respondents designation.....	44
<b>Table 4.4:</b> Experience of respondents in the project.....	44
<b>Table 4.5:</b> Common factors for Time and cost overrun (Ismail et al., 2013).....	48
<b>Table 4.6:</b> Rating Mughher coal conversion project.....	52
<b>Table 4.7:</b> Overall rating of Mughher coal conversion project as per respondents.....	53
<b>Table 5.1:</b> Overall Project progress (30-12-2016).....	56

## List of Figures

Fig. 1.1: Contractual agreement between different parties in Mughher Coal ConversionProject.....	05
Fig. 2.1 Project Management Triangle.....	12
Fig 2.2 Delay classification (Source: Trauner et al., 2009).....	17
Fig 4.1 Major causes for the delay in Mughher Cement coal conversion project.....	42
Fig 5.1 Staff deployment based on the main contractor report.....	48

## **List of abbreviations**

CCIIDI :	Ethiopian Chemical Corporation, Chemical and Construction Inputs Industries development Institute
CNBM :	China National Building Materials
EPC :	Engineering Procurement Construction
ESL :	Ethiopian Shipping Lines
HFO :	Heavy Furnace oil
MCE :	Mugher Cement Enterprise
PAC :	Provisional Certificate of Acceptance

## **List of appendix**

Appendix 1 Interview Questions

## 1. Table of Content

	Page
<b>I. Introduction.....</b>	<b>2</b>
1.1 Background of the study.....	2
1.2 Background of Mugher Cement Enterprise coal conversion project.....	3
1.3 Statement of the Problem.....	6
1.4 Research Question.....	8
1.5 Research Objectives.....	9
1.6 Significance of the Study.....	9
1.7 Scope of the Study.....	10
1.8 Limitation of the Study.....	10
1.9 Organization of the Study.....	10
<b>II. Literature Review.....</b>	<b>11</b>
2.1 General.....	11
2.2 Project Efficiency and Effectiveness.....	12
2.3 Definition of project office, time overrun and cost overrun.....	13
2.3.1 Time overruns.....	15
2.3.2 Cost overruns.....	16
2.3.3 Types of delays.....	17
2.3.4 Causes of time overruns.....	20
2.3.4.1 Unreasonable project scope.....	20
2.3.4.2 Inadequate early planning.....	20
2.3.4.3 lack of risk management systems.....	21
2.3.4.4 Lack of resources and Labour productivity.....	21
2.3.4.5 Over ambitious estimates and incorrect task Assessment.....	21
2.3.4.6 Lack of task clarity.....	21
2.3.4.7 Design delays and Approval and Drawings.....	22
2.3.4.8 Owner interference & decision making process.....	22
2.3.4.9 Inadequate contractor & subcontractors' experience.....	22
2.3.5 Effects of Delay.....	22
2.3.6 Causes of cost overrun.....	23
2.3.7 Effects of Cost Overrun.....	26
2.3.8 Implication of Time and Cost Overrun.....	26
2.3.9 Measures to Control project Cost.....	27
2.4 Project Time and Cost Management.....	29
2.4.1 Project time.....	29
2.4.2 Project Cost.....	29
2.4.3 The Definition of Project Time and Cost Management.....	29
2.4.4 Project Time management.....	30

2.4.5 Project Cost Management.....	31
2.5 Forms of Contract Agreement.....	32
2.5.1 Fixed price contracts.....	32
2.5.2 Cost reimbursable contracts.....	33
2.5.3 The case of Mugher cement coal conversion project.....	33
2.6 Summary of literature review.....	34
<b>III. Methodology.....</b>	<b>37</b>
3.1 Introduction.....	37
3.2 Description of the Study Area.....	38
3.3 Research Approach.....	38
3.4 Research Design.....	38
3.5 Population and Sample.....	38
3.6 Data Sources and Types.....	39
3.7 Data collection Instrument.....	39
3.8 Data Collection Procedures.....	39
3.9 Ethical Consideration.....	40
3.10 Validity and Reliability.....	40
3.11 Data Analysis.....	40
<b>IV. Analysis findings and discussion.....</b>	<b>41</b>
4.1 Project office.....	41
4.2 Survey responses.....	43
4.3 Characteristics of the respondents and their organization.....	43
4.4 Results of interview for causes of time and cost overrun.....	44
4.4.1 Factors influencing time and cost overruns at Mugher Cement Coal Conversion project.....	45
4.5 Causes of Schedule delay and cost overrun based on Literature.....	48
4.6 Existence of disputes.....	49
4.7 Existence of external and/or internal factors.....	51
4.8 Research Findings.....	53
4.9 Mitigation methods performed.....	56
<b>V. Conclusions and Recommendations.....</b>	<b>58</b>
5.1 Conclusion.....	59
5.1.1 Consequences of project delay.....	60
5.2 Recommendations.....	61
References	62

# I

## INTRODUCTION

### 1.1 Background of the Study

Project success can be defined as meeting goals and objectives as prescribed in the project plan. A successful project means that the project has accomplished its technical performance, maintained its schedule, and remained within budgetary costs.

Project management tools and techniques play an important role in the effective management of a project. Therefore, a good project management lies in the management tools and techniques used to manage the project. Project management involves managing the resources, workers, machines, money, materials and methods used. Some projects are effectively and efficiently managed while others are mismanaged, incurring much delay and cost overruns.

Delay in project completion and cost overrun are inherent part of most projects' effectiveness despite the much acquired knowledge in project management. Although some may argue that this is negligible. It is important to note that physical and economic scale of projects today is such that it is driven under the platform of profit to the parent organization, and of national interest (for government projects) by the degree of success defined within the Iron triangle of cost, time, and scope.

Majority of Construction and industrial projects in Ethiopia are affected by time and cost overruns and there by exceed their initial scheduled time and contract amount. These overruns vary from few months and cost as higher as double of their initial cost, placing the project viability at risk.

Completion of a construction project with budget is frequently seen as a major criterion of project success by clients, contractors, consultants and related stakeholders. It is here that project management becomes essential tool for the delivery of effective projects. However, the construction industry is faced with challenges to meet budget.

Due to the delay in commissioning of the turnkey project, cost overrun is expected as delay is one of the reason for cost overrun. For the Enterprise the cost overrun, if there is will be indirect due to turnkey project but for the contractor it is mostly a direct cost overrun. Due to the delay, the factory stopped operation for eight months as the factory could not complete the project on time and continue using HFO will not make the enterprise competitive in the market. The factory spends 840 million birr per year for HFO purchase and this will be higher when the factory fully utilizes its capacity.

The time and cost for performance of a project are usually of the essence to the employer and the contractor. This is because late completion of projects can deny employers the benefits that accrue through use of the project and may also expose them to serious financial and economic risks. On the contractor's side, delay in completion entails additional cost accruing from extended home office and site office overheads, labor and equipment standby costs and other intangible costs such as an opportunity cost if the delay is unjustifiable.

Mugher Cement Enterprise commissioned the new coal fired unit after 16 months of the initially planned time. Due to this it will incur more cost, will lose revenue and its market.

Thus, this study will attempt to highlight the effectiveness of the Mugher Cement Enterprise coal conversion project in terms of schedule delay and cost overruns, and will investigate the impact of the factors of the project delay in the enterprise's operation. Hence, it can help similar factories in Ethiopia, contractors and project managers to understand the importance of cost and time in a project, alleviate financial and time related issues in order to make their project successful

## **1.2 Background of the Mugher cement Enterprise coal conversion project**

Mugher Cement factory is a state owned enterprise established with a purpose of producing and supplying cement and carrying out related activities that are important for the attainment of its objective.

Initially it was Established with capital of Birr 334,716,000.00 /three hundred thirty four million seven hundred sixteen thousand birr / of which birr 257,516,000.00/ two hundred fifty seven million five hundred sixteen thousand birr/ is paid up in cash & in kind, is formed in 1999 through amalgamation of two formerly independent factories.

The Factory is located about 90kms North West of the capital city, Addis Ababa, on the elevation of about 2450 mts above sea level. The mother plant of the factory has three production lines with production capacity of 5000 tons of clinker per day. The first, second and third lines started operation in 1984, 1990 and 2011 respectively.

The main expenditure of the enterprise is energy expense. It is about 60% of the production cost. Optimizing the energy use in the factory will enable it to be competent and to remain in the market.

Except Mughher cement enterprise all other similar factories are using coal as their energy source for calcination. This helped them to produce cement at lower production cost than Mughher. Use of coal reduces the production cost by more than 40%.

The contract agreement made between Chemical Industries corporation Mughher cement and the contractor, CNBM International Engineering Co., Ltd, subsidiaries of China National Building Materials & Equipment Import & Export Co., Ltd, with the total cost of USD 38,357,963. There is also an additional fee of USD 837,213 for the supply of 2 years normal plant operation spares. About 70% (USD 26, 551,831) is paid in foreign currency and the rest in local currency. The consultant fee is USD 385,310 for the 13 months stay. All prices stated are firm and not be subject to any escalations.

The price established in the Contract is the total cost of the Contract, and covers the Delivery of the Project Designs, all the Deliveries and the Technical Documentation thereof, and all the Services, under the conditions of the Contract, and includes packing, marking, forwarding, de-livery to site, storage, duties (except those to be borne by the owner) before the delivery becomes the property of the Owner.

The contract is signed here in Ethiopia on 12<sup>th</sup> Jan, 2014. It was expected to be completed within 13 months but after 16 months delay it commissioned in November 2016 and the completion of the conversion project was celebrated on 9<sup>th</sup> January 2017.

All Muger production lines are now coal fired. The replacement was crucial to increase quality, reduce production delay and supply energy on a regular basis. Converting from imported heavy fuel to domestically-supplied coal will also help reduce the cost of production.

### Scope of Work

The Contractor sells, erects and commissions and the Owner takes over after final acceptance a Coal Handling, Storage and Conveying System to convey coal as fuel for the three existing operating lines at Muger, on turnkey basis (Design, Supply, Construction, Erection, Commissioning, training etc.) to be installed at Muger Cement Plant.

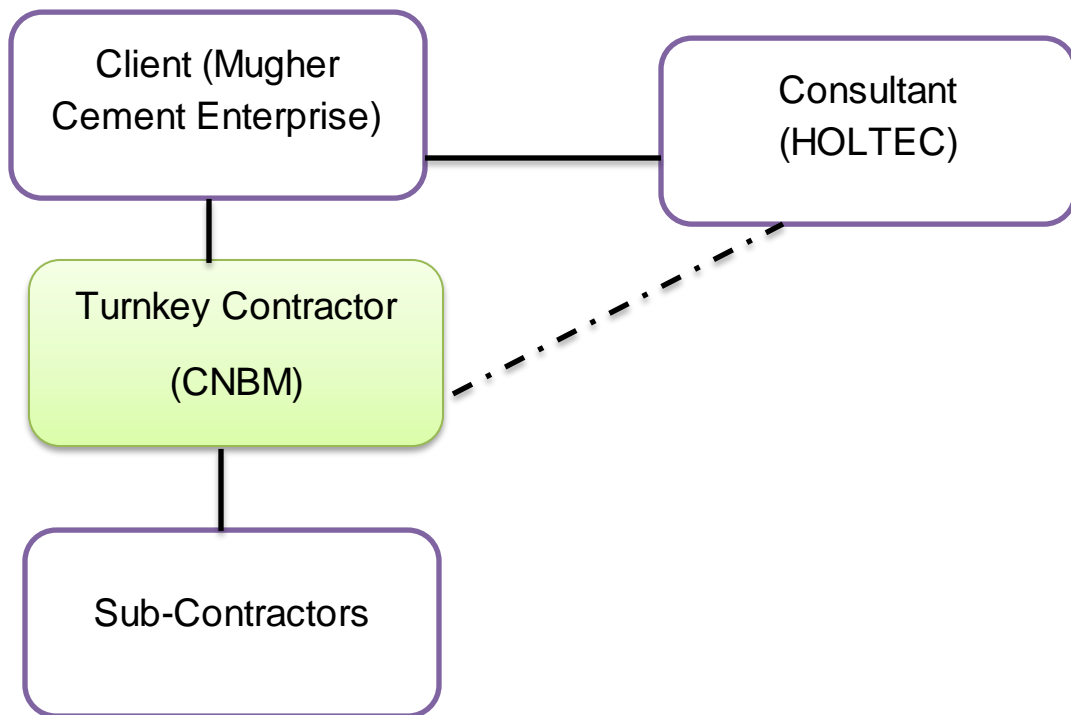


Fig. 1.1: Contractual agreement between different parties in Muger Coal Conversion project

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Muger Cement Enterprise commissioned the new coal fired unit after 16 months of the initially planned time. Due to this it will incur more cost, will lose revenue and its market.

Thus, this study will attempt to highlight the effectiveness of the Muger Cement Enterprise coal conversion project in terms of schedule delay and cost overruns and performance / quality. And will investigate their impact in the enterprise's operation. Hence, it can help similar factories in Ethiopia, contractors and project managers to understand the importance of cost and time in a project, alleviate financial and time related issues in order to make their project successful

### **1.3 Statement of the Problem**

The production process of cement clinker is energy-intensive and requires a large amount of fuel. Electrical and fuel (oil or coal) energy are the two energy types used in cement factory. Fuel energy takes the major share. About 60% of fuel is used in pre - calciner for calcination and the remaining 40% is consumed in rotary kiln for ending the

calcination process and then for sinterization. In terms of cost, about 60% Mugher Cement Enterprise's production cost is the cost of fuel oil (Feleke Bayu, 2014).

Currently more Cement factories are established and in the process of establishment that increase competition in the market. The cost of cement was skyrocketed before the establishment of these new cement factories.

The new factories are using coal in place of Heavy Furnace oil (HFO) that enables them reduces their production cost by nearly 35%. This makes them competitive in the market and force Mugher Cement Enterprise to think the use of Coal as fuel oil.

Mugher Cement Enterprise initially proposed the conversion of its HFO with coal (with project cost of US\$ 14 million) when it complete the expansion study (from 2000 ton to 3000 ton clinker per day) that initiate the use of coal as fuel to be competitive in the market. But this idea was rejected and made Mugher the only factory that use HFO.

From time to time Mugher becomes less and less stronger in the market and its operation becomes costly as the HFO price increase.

By understanding this, the government allows the previous proposed project to proceed and enable Mugher Cement Enterprise to use coal in place of HFO. The project at this time costs US\$ 39 million, 179% higher than the previous proposal and signed an agreement with a foreign company in January 2014.

The project implementation initially planned to be for 13 months but took 29 months and commissioned November 2016 exposing the enterprise for more cost and eight month operation stoppage.

Project delays and cost overruns can be caused because of different things like poor project planning and management, project complexity, shortage in imported or local materials, design changes, scope change, inappropriate and inadequate procurement, number of sub-contractors participated and external factors.

Completion of a project in time and within the budget is considered as the most important factors of successful projects, which help to decrease problems for all parties and give new chances for the contractor to construct other related projects and for cost minimization and profitability to the promoter. Otherwise total project abandonment, dispute and claims arise, over budget and can lead to court cases, etc

Of all the challenges of construction management, the triple constraints are the most looked out for. Managing cost, schedule (time) and quality are the triple constraints which inter depend on each other (Abebe, 2003). When large projects deviate from their objectives (either in cost, completion time, performance, safety or environmental effects), the damage caused obviously transcends out of the contracting parties and affects the project stakeholders and the public at large. Emphasizing the completion time deviation and total cost factors as they are very common in our country's construction industry whether it is building, road or industrial construction, lack of justified methodologies in quantifying and analyzing delays happens to be the greater challenge.

The impact of time delay and cost overrun seen on market loss, loss of revenue, frustration in the project owner and contractor, etc. Mugher Cement Coal conversion project faced a time delay beyond expected that result in market share shrinkage and revenue loss. A contractor faced cost overrun and frustration that will affect its performance.

In the lights of these problems this research therefore, tried to assess the effectiveness of Mugher cement enterprise coal conversion project in terms of schedule and cost

#### **1.4 Research Question**

The main question that this thesis urges to answer is the identification of the causes of schedule delays and cost overruns, and quantification of their impacts on the project and the Enterprise. To come to such a generalized inquiry the following questions will be raised along side

- What is the level of effectiveness of the coal conversion project in terms of time and cost?
- What are the factors that cause time and cost overrun (if any)?
- What are the effects of time and cost variances on the performance of the coal conversion project?

### **1.5 Research Objectives**

This research tried to investigate the causes of cost overruns and time delays during the project implementation phase and the influence of project's characteristics on cost overruns and time delays.

In addition to this the thesis has the following main objectives:-

1. To investigate the level of effectiveness of the coal conversion project in terms of schedule and cost on the Coal conversion project;
2. To investigate and evaluate the factors that cause time and cost overruns in the coal conversion project;
3. To discuss the effects of schedule and cost variances on the performance of the coal conversion project;
4. To conclude and recommend based on the result obtained.

### **1.6 Significance of the Study**

As the project is recently commissioned there is no research conducted to examine the reasons for schedule delay and cost overrun in this particular project, factors contributing for this and their impact on Mughar Cement Enterprise operation. So, this study will enlighten why the schedule delay and cost overruns happens to the promoters.

The findings of this study will be beneficial to the government so as to consider the issues raised in the study to other government sponsored projects, project managers and contractors in similar projects.

### **1.7 Scope of the Study**

This study is limited to Mugher Cement Enterprise Coal Conversion Project and conducted among, promoters, project managers and contractors in order to identify the cost overrun factors and project delay. To carry out this study, Interview is made on the selected respondents from Owners comprising the government agency (the enterprise), Ministry of Industry Chemical and Construction Inputs industries development Institute, Consultants working in the project, contractors who are involved (main and sub-contractors), project manager and project office workers.

### **1.8 Limitation of the Study**

In the study process, the following limitations might be observed

- Getting and discussing with the consultants was hard as they left the country but gave their views in writing;
- There exists no organized system of delay analysis in the project;
- Some selected interviewee refused to respond as they left the enterprise claiming that not ethical to give comment

### **1.9 Organization of the Study**

This thesis will be organized on five chapters as described below;

- Chapter one is an introductory part containing discussions on background, research problems, aim and objective of the research, significance of the research, scope and limitation of the research and organization or layout of the research.
- Chapter Two presents literature review with general descriptions by different researchers on construction, contract, risk and risk management.
- Chapter Three discusses about research design and methodology
- Chapter Four presents results and discussion of the research findings.
- Chapter Five contains conclusions and recommendations based on what is discussed in the previous chapters.

## **II**

### **Literature Review**

#### **2.1 General**

Project success can be defined as meeting goals and objectives as prescribed in the project plan. A successful project means that the project has accomplished its technical performance, maintained its schedule, and remained within budgetary costs.

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.

Project management tools and techniques play an important role in the effective management of a project. Therefore, a good project management lies in the management tools and techniques used to manage the project. Project management involves managing the resources—workers, machines, money, materials and methods used. Some projects are effectively and efficiently managed while others are mismanaged, incurring much delay and cost overruns.

A construction project such as Mugher Coal conversion project comprises two distinct phases: the preconstruction phase, (the period between the initial conception of the project and signing of the contract; and the construction phase which is the period after award of the contract when the actual construction is going on). Delay and cost overruns occur in both phases however, major causes of project overruns usually take place in the construction phase. Therefore, this paper is limited to this phase.

Cost and time were the two most commonly used variables when implicitly measuring effectiveness of any project. With regard to the Mugher Cement coal conversion Project

under consideration, there is no scope problem except in some cases the sub-contractor found to go out of the scope. Due to the problem the main contractor changed the sub-contractor.

Time and cost overruns occur in most construction projects and the magnitude varies considerably from project to project. So it is essential to discuss about the effectiveness of the project in relation to these variable, the actual causes of time and cost overruns in order to minimize and avoid the delays and increasing cost in any construction project.

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.

## 2.2 Project Efficiency and Effectiveness

The concepts of efficiency and effectiveness are commonly used when evaluating different processes. Since project are often struggling with the balance between time, cost and quality, they are interested in doing this as efficient and effective as possible.

All projects are carried out under certain constraints – traditionally, they are cost, time and scope. These three factors (commonly called 'the triple constraint') are represented as a triangle (see Figure 1). Each constraint forms the vertices, with quality as the central theme:



Fig. 2.1 Project Management Triangle (PMBOK, the guide published by the PMI)

“These constraints form an interdependent set - a change in one constraint can require change in another constraint in order to restore the equilibrium of the project.

### Managing Scope

Scope refers to the quality and quantity of project deliverables specific to a particular project. Scope, unfortunately, has a tendency to increase as a project progresses. This can be due to a number of factors. Often as the project progresses it becomes more clearly defined and realize the actual requirements as opposed to the perceived requirements based on estimation. Sometimes people, both on the customer and vendor sides, can get caught in the trap of "wouldn't it be good if it could do.....". Adding scope means increased cost in terms of project budget and possibly project time, so project managers need be on top of scope issues:

### **2.3 Definition of Project office, time overrun and cost overrun**

#### Project Management office

A project management office is a group or department within a business, agency or enterprise that defines and maintains standards for project management within the organization. The Project Management office strives to standardize and introduce economies of repetition in the execution of projects.

#### Project Delay

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.

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.

### Cost Overrun

Several authors have defined cost overruns differently. For instance, Al-Najjar (2002), has defined cost overruns as the change in contract amount divided by the original contract award amount. However, Zhu and Lin (2004) are of the view that cost overruns are the excess of actual cost over budget. Choudhury (2004) have defined cost overruns to be the difference between the original cost estimate of project and actual construction cost on completion of works of a commercial sector construction project. Cost overrun is described as the excess of actual cost over budget (Zhu and Lin, 2004). The authors further describe cost overrun as the change in contract amount divided by the original contract award amount.

### **Cost overrun = Final Contract Amount – Original Contract Amount**

Cost overrun is a condition which the total of money that has been used was greater than the original cost or estimated cost (Frimpong et al., 2003). In addition, cost

overrun also defined as an excess of actual cost more than the cost estimated in the budget plan (Al-Nijjar, 2008).

### **2.3.1 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.

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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. 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).

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### **2.3.2 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.

Cost is one of the main considerations throughout the project lifecycle and can be regarded as a significant parameter of a project and the driving force of project achievement. Despite its proven significance, it is not rare to observe a project failing to achieve its objectives within the specified, or even the approximate estimated cost. Cost overruns vary significantly in scale from project to project. Cost overrun is common for infrastructure projects (Azhar et al., 2008). Understanding the causes of cost overruns is a critical to the success of infrastructure projects. Past studies have found significant yet common cost overrun for infrastructure projects.

Cost overruns in projects are common around the world. High profile examples include; Denver's airport which had a cost overrun of 200%; the Oresund Bridge that experienced a 68% cost overrun; and the Scottish Parliament Building that was over three years late and experienced more than 900% cost overrun (Love et al., 2011).

Cost overruns have plagued government infrastructure projects for decades. Rising construction costs were not merely the result of technical challenges associated with delivering large, complex projects, but also associated with deep psychological and political economic factors that contribute to the persistence of the cost overrun.

A project is considered on time and on budget only if it is built to the final estimate at the time when the project was approved, which is typically before a construction contract is signed.

### 2.3.3 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.

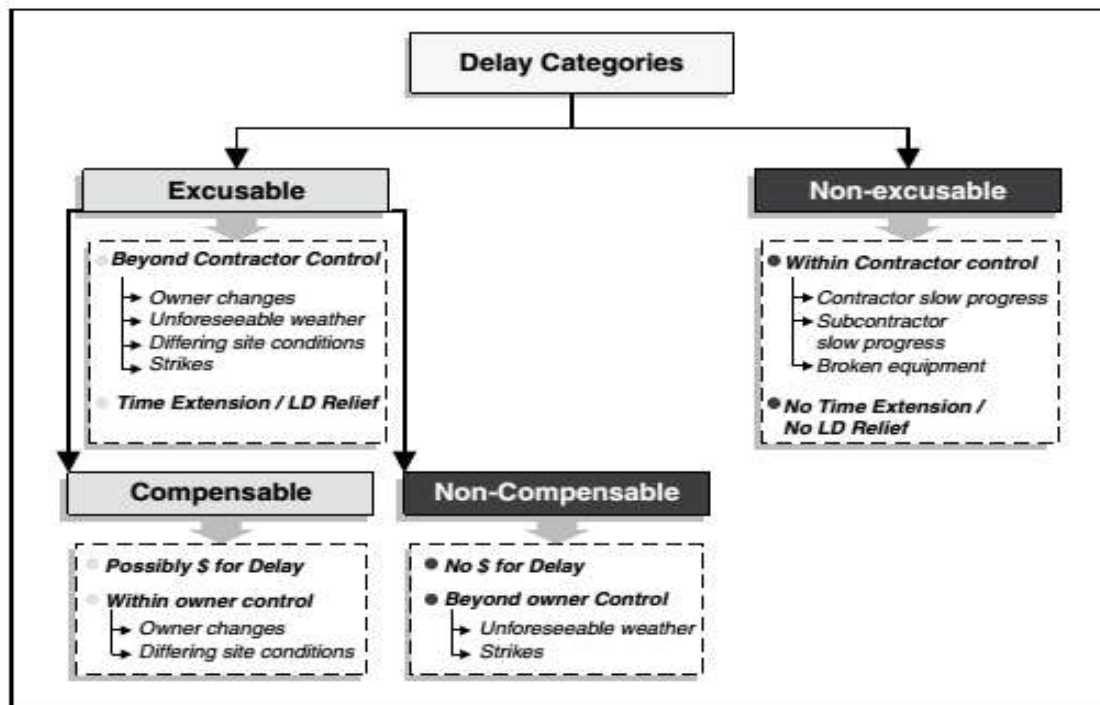


Fig 2.2 Delay classification (Source: Trauner et al., 2009)

### **Excusable or non-excusable (Contractor Caused) delay**

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:

- ✓ General labor strikes
- ✓ Fires
- ✓ Floods
- ✓ Acts of God
- ✓ Owner-directed changes
- ✓ site conditions
- ✓ Unusually severe weather
- ✓ Intervention by outside agencies
- ✓ 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. This is the delay for which the party assumes the risk of delayed performance and its consequences to its own performance and the impact upon others.

These are some examples of non-excusable delays (Al- Gahtani and Mohan 2007):

- ✓ Late performance of sub-contractors
- ✓ Untimely performance by suppliers

- ✓ Faulty workmanship by the contractor or sub-contractors
- ✓ A project-specific labor strike caused by either the contractor's unwillingness to meet with labor representative or by unfair labor practices

### **Concurrent & Non concurrent delay**

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

The delays that occur in a project are either due to the owner such as additions, alterations, modifications and changes to plans and specifications. The delays where the owner may still be responsible are site conditions which are differing and suspension of works. The delays by the contractor which occur in the same period as the owner will be regarded as concurrent delays. "Delays considered will include those caused by changes in the plans or specifications, occurrence of differing site conditions, holds on the work due to owner-initiated suspensions of work, and so-called 'excusable' delays, all when taking place concurrently with contractor-caused delays." (Ponce de Leon, 1987)

### **Compensable (Owner caused) & Non-Compensable Delays**

Here, the owner is responsible for both the time and cost effect of the delay. The contractor may claim the owner interfered with the work, did not deliver owner-purchased equipment or supplies on site as promised, or that the owner's actions or inaction caused other delays. An owner cannot contract out of its obligation to pay for compensable delay, although it may be able to limit its liability for such delays.

“Any clause in a construction contract, which purports to waive, release, or extinguish the rights of a contractor, subcontractor, or supplier to damages or an equitable adjustment arising out of unreasonable delay in performance which delay is caused by the acts of omissions of the contracted or persons acting for the contracted is against public policy and is void and unenforceable.” (Carl , 2005 ).

The issue of change order by the client is the most common factor that is responsible for causing a delay to a project. The issuance of the change order affects the work that has been already done. This requires new work to be done, modification to the existing work and /or the removal and the works and installation of the works as per the change order. The delay has to be demonstrated by an impact analysis on the critical path network to claim for additional time and cost due to the delays caused by the changes.

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.

#### **2.3.4 Causes of time overruns**

The reasons for delays are project specific and vary from project to project. The following are identified the causes for delays.

##### **2.3.4.1 Unreasonable project scope**

Generally projects do not have an agreed scope of works document agreed at the start of the project. Even though the scope is identified in the contract documents, it is always possible for parties to interpret in the ways that are suitable and beneficial for them.

##### **2.3.4.2 Inadequate early planning**

The primary task before the commencement of any project is as the saying goes “Plan the work, Work the plan”. It is of utmost importance for any project to commence with the full planning to ensure the successful execution of works.

#### 2.3.4.3 Lack of risk management systems

The issue of risk management is a complex one as risk management has various levels and it is important to understand and attend to all these levels to allow for an effective risk management system.

#### 2.3.4.4 Lack of resources & Labor productivity

The manpower is the most important factor in the successful completion of any project. In case of projects where there is a lack of manpower then it also affects the productivity of the existing workforce as they would be required to undergo long working hours which would reduce the productivity. "poor construction productivity is commonly caused by a lack of resources at the crew level. Providing proper resources is an important planning issue, requires significant effort, and is necessary to properly manage a construction project." (Pappas et al 2003 ).

#### 2.3.4.5 Over-ambitious estimates and incorrect task assessment

In projects which are in the design and tender stage where there is an urgent requirement of the estimated cost, there usually thumb rules are applied for providing the estimates. Such estimates are usually based on quantity takeoffs from the available drawings and details. An incorrect task description or assessment may result in an incorrect or overambitious estimate which may either derail the project or make the project too costly and uneconomical for the owner.

#### 2.3.4.6 Lack of task clarity

The projects are usually having amounts that are reserved as a provisional sum for some section of the works as the client or the designer is unsure as what would be the actual requirement. These works usually involve specialist inputs and cannot be finalized at the initial stage itself. In some cases the client deliberately reserves the amount to decide at a later stage how the money has to be spent. This gives rise to an uncertain scope of work where there is no clarity regarding the task to be carried out. Even the baseline program of works prepared at the start of the project cannot detail the activities due this lack of task clarity.

#### 2.3.4.7 Design delays & Approval of drawings

The construction projects are envisaged based on the conceptual design and drawings. If these conceptual designs are not converted to actual designs and drawings including the structural feasibility and practicality then it would necessitate changes to the original concept design which would impact the perspective of the project itself. It would also affect the program for the project in terms of timely completion and thus the cost of the project.

#### 2.3.4.8 Owner interference & decision-making process

The successful completion of the project in terms of cost and time has an influence which can be a positive factor as well as a negative factor is the decision making process which is greatly influenced by the owner. Sometimes the owner's influence is also construed as the owner's interference.

#### 2.3.4.9 Inadequate contractor & Subcontractors experience

In case of projects where there are contracts that are awarded solely on the basis of the cost then these projects are likely to suffer delays as proper of evaluation of the subcontractors has not been done. The subcontractors who have quote low or simply missed out on any items will fail to perform thereby delaying the project.

In fact the owner may end up losing more money if the project is delayed and the returns expected from the project get delayed. Also, by deploying the contractors or subcontractors without checking their credentials and performance, the owner is risking the quality of the project and his reputation.

### **2.3.5 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 arbitration and Litigation;
4. Total abandonment; and

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.

### 2.3.6 Causes of cost overrun

Cost overrun occurs when the final cost or expenditure of the project exceeds the original estimation cost, (Avots, 1983). The problem may be found in both developing and developed countries. 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 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. **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.
- g. **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.
- h. **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.
- i. **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.
- j. **Construction Cost Underestimation**:-According to Nega, (2008) some parties have deliberately underestimating of costs for their project in order to get project approval.

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 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.

### **2.3.7 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. 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].

### **2.3.8 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).

### **2.3.9 Measures to Control project 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.

## **2.4 Project Time and Cost Management**

### **2.4.1 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.

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.

### **2.4.2 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 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.

### **2.4.3 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).

#### 2.4.4 Project Time management

PMBOK's (fifth edition, 2013) 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. 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 work periods which will be needed to complete individual activities
- ✓ Activity resource estimating: the process of estimating the number of work periods needed to complete individual activities with estimated resources
- ✓ Schedule development: analyzing activity sequences, activity durations, and resources requirements to create the project schedule.
- ✓ Schedule control: controlling changes to the project schedule.

#### 2.4.5 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).

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.

## **2.5 Forms of Contract Agreement**

The actual form of agreement, which describes the contracting parties, authority, the work in general, the consideration to be paid, penalties or bonuses, and the time for performance is often a very brief document. This document is seldom the issue of concern in a dispute. More commonly the documents that detail the relationship and project requirements are the sources of disagreement. Primarily, these documents for a construction project are the general condition, special conditions, technical specification, and plans.

Contract types require a division or separation among the wide variety of contracts in the industry. In keeping economic exchange concept contracts can be identified as either fixed price or cost reimbursable.

### **2.5.1 Fixed price contracts**

Fixed price contracts establish a fixed sum of money for the execution of a defined quantity of work. Fixed price contracts fall in to two major categories: Lumped sum and unit price.

Lump Sum contract is where a party undertakes to complete the whole of the work for a stated and fixed amount of money payable by the other. What is important is that at the time of contracting, both parties must have agreed upon a lump sum price to be payable for a defined scope/quantity of work to be undertaken. This contract requires the contractor to assume all risks assigned by the contractor for their stated price.

Adjustments to costs and extensions of time require a modification to the original agreement.

Unit price contracts permit more flexibility by establishing costs relative to a measurable work unit. Here the contractor is paid a set amount for every 'unit' of work performed. If the contractor performs well under this contract, he can benefit from cost saving; however, if the project does not proceed as originally planned, the contractor cannot recover cost overruns except for certain limited situations.

### 2.5.2 Cost reimbursable contracts

Reimbursable contracts allow for contract adjustments relative to project scope as determined by the cost and do not, generally, address a final fixed price. In this contract type the owner reimburses all cost in performing a project and pays contractor a pre-determined fee or a percentage fee of the cost incurred.

The types of cost reimbursement contracts are: cost plus fixed fee contracts, cost plus percentage fee contracts and cost plus fluctuating fee contracts

Fixed price contracts allocate more risk to the contractor and thus require more effort, money, and time on design documentation before construction is initiated.

Cost reimbursable contracts require greater risk sharing between the owner and contractor and require more owners personal for contract administration during the construction phase to enforce cost and schedule. They are more easily used for fast tracking of design and construction. Reimbursable contracts are also very flexible for changing design or scope of work and establish the basis for a less adversarial relationship between the owner and contractor.

Often both forms of contracts exist on a project simultaneously. Prime contractors will often have cost reimbursable contracts with the owner and fixed price contracts with their subcontractors. In the Ethiopian construction industry fixed price contract is widely practiced.

### 2.5.3 The case of Mughher cement coal conversion project

The owner, Mughher cement Enterprise agreed with the main contractor with Package deal or fixed price turnkey contracts with no variation. This is where the owner settles on a complete package, usually based on a standard specification drawn up by a commercial firm. Such arrangements sometimes result in a specially drafted contract.

This type of contract establishes a price that is not subject to adjustment based on the contractor's costs. Firm Fixed Price (FFP) contracts place all risk and responsibility for

cost on the contractor, maximizing the contractor's incentive to control costs. FFP contracts also reduce the administrative burden on the owner by eliminating its responsibility to monitor contractor costs.

## **2.6 Summary of literature review**

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 interview question survey in order to collect data from the targeted respondent.

Assessing project management (or mismanagement) has become an important part of our professional challenge in business and industry today. The unexpected cost overruns and implementation delays of computer systems projects during the early 1970s and the disastrous cost overruns and schedule delays of the heavy construction projects in the late 1970s have given new meaning to the word performance for project management.

How we measure the performance of a project? All projects are expected to have specific objectives; that is, an end result, which costs so much and should be completed within a certain time-frame. Therefore, projects which achieve cost, schedule and quality objectives are successful. Those that do not are failures.

Even though it seems success or failure is a simple measure of performance it is not very practical for most projects may be for small simple projects.

Criteria such as meeting project time, budget, technical specification and mission to be performed are the top priorities of project objectives. This corroborates the findings that project success is measured against the overall objectives of the project (i.e. time, cost, quality, and project mission).

Different researchers outlined that success in a construction project is corresponding to the efficiency and effectiveness measures. Pinto and Slevin (1988: 1989) identify project success in terms of efficiency and effectiveness measures. Efficiency measures

refer to strong management and internal organisational structures (adherence to schedule and budget, and basic performance expectations). In other words, efficiency measures deal with 'time, budget and specifications'. Effectiveness measures refer to the achievement of project objectives, user satisfaction and the use of the project.

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. Poor communication between construction parties, poor resource management, delay in commencement, delay in procurement, poor procurement practice, involvement of many sub-contractors, insufficient inspectors, changing orders, owners' financial constraints, and owners' lack of experience are the main causes for time 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 construction projects whether it is building, industry, road or other

constructions. 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 building or road projects.

These days there are many industrial projects in Ethiopia both by the government and private there should be a research on factors affecting cost and time overrun on industrial projects. At different places industrial parks are under construction both by foreign and local contractors that are affected by time and cost overruns.

With regard to the price agreed it can be either fixed price or cost plus. Fixed price means that a price has been set for goods or services, and in most circumstances no bargaining is permitted over that price. The price is held constant regardless of the cost of production. Cost plus pricing, often used in government contracts, refers to a contract where the price is based upon the actual cost of production and any agreed upon rates of profit or fees.

Both have their own advantage and disadvantages for both parties. Fixed price is advantageous for the buyer which allows setting in advance an exact budget. The buyer is aware of the total cost before the project even begins. But it tends to be less flexible for managing changes or requests. Excessive focus on maintaining a fixed price may come at the expense of quality, creativity and timeliness. The value of the work often becomes less important than the price. A fixed price model may cost the buyer more than anticipated, if the job is completed early or if materials cost less than estimated.

With regard to cost reimbursable method gives the project flexibility to redirect a contractor whenever the scope of work cannot be precisely known and defined at the start and needs to be altered, or when high risks may exist in the effort. Frankly put, if the client doesn't know what they want, this type of contract allows the project to move forward without the risk to the contractor.

The decision to choose which type of contract needs understanding of the type of project, the risks to be faced and benefits to gain from each type.

### III

## Methodology

### 3.1 Introduction

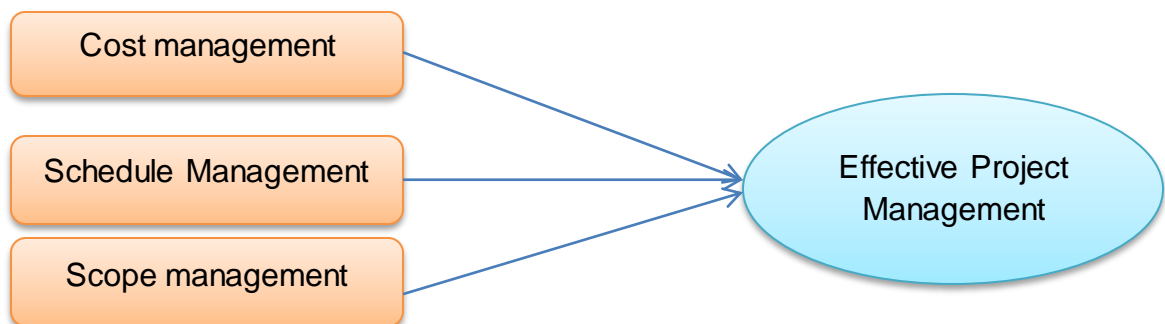
To accomplish the objective of the thesis, the researcher used the following methodologies. Complete literature reviews were conducted regarding the concept of project management, effectiveness and efficiency; about schedule delay and cost overruns on project and the factors contributing for effectiveness and efficiency.

Following literature survey /reviews/, in order to assess the reasons for schedule delay and cost overrun, data collection carried out; both primary and secondary data are collected using a well-structured interview, project report document analysis, and review of previous research works.

The researcher designed the interview questions for assessing the planning processes, the input factors that affects schedule and cost, their impact, the impact of the different actors in the project (internal and external).

#### Conceptual framework

In this study the effectiveness of the Mugher Cement Enterprise coal conversion project is seen on its cost management, schedule management and scope management. Cost and time will be measured by looking the variance seen between what is set and what actually is. The effectiveness of the project will be looked based on the actual time consumed, the total cost at the end of the project and whether the project meet its target or not.



### **3.2 Description of the Study Area**

The study focused only on Muger Cement Enterprise coal conversion project carried out from 2014 and October 2016. It focuses on the schedule and cost performance and their impact on both the project and the enterprise.

### **3.3 Research Approach**

The research approach that was followed for the purposes of this research was qualitative research method with structured interview. The interview will be made on selected groups from Client, project office, consultants and contractors and other government office.

### **3.4 Research Design**

This research is descriptive research as it tries to describe the effectiveness of the coal conversation project of Muger cement Enterprise on schedule and cost performance parameters of the.

Generally two surveys will be conducted in this research; the first got opinion from identified representatives from stakeholders, and consultants as their relative importance through interview. The second will be looking critically at the reports made internally and externally. Reports made by the contractors, consultants and other government bodies.

### **3.5 Population and Sample**

For this research sample members are selected on the basis of their special relationship with the project under investigation, sufficient and relevant work experience in the field, knowledge, and expertise regarding a research subject

The target population of the study consisted of peoples from Muger Cement Enterprise (MCE), Ethiopian Chemical Corporation, Chemical and Construction Inputs Industries development Institute (CCIIDI), project managers, consultants,

contractors and implementers during the period. Ten people are approached for interviewed from the respective offices.

Mughar coal conversion project was recently commissioned (November, 2016) no study was made how the performance was made and hard to get studies made. Thus all representative form the stake holders will be interviewed.

### **3.6 Data Sources and Types**

The two most used data types are primary and secondary data. The primary data is the original information collected by the researcher for a specific purpose and secondary data is information collected by others. This study made use of both the primary and secondary data.

Primary data is collected with the help of interviews. Secondary data is collected from the Enterprise documents project performance periodical and closure reports.

### **3.7 Data Collection Instrument**

In order to collect the relevant information for this study, structured interview is preferred as the interviewees are few and at management level. The interview questions were first formulated, tested with the project manager and commented by my thesis advisor and by delegated General Director of Chemical Industries Corporation. This is to focus on relevant issues and not address confidential information and free them from personal issues.

### **3.8 Data Collection Procedures**

The choice of the population to be sampled will be greatly influenced by the available data and the size of the population. For the purposes of this research, in depth interviews is made. I preferred personal interview to have personal and direct contact between me and interviewees and to eliminate non-response rates

Some certain questions are prepared, so as for the researcher to guide the interview towards the satisfaction of research objectives, but additional questions will be made encountered during the interviews.

### **3.9 Ethical Consideration**

The research provided interviews. It is very important the design and execution provides ethical considerations. The research will respect the following ethical principles: No harm is done to participants; sufficient informed consent will be provided; Privacy will be respected; Integrity is fundamental. The research will provide declaration of information. Records will be kept confidential and anonymity will be guaranteed during and after this paper is compiled. The research complies with the Netherlands Code of Conduct for Scientific Practice.

### **3.10 Validity and Reliability**

Every possible precaution taken during interviews to explain the objective and background to the survey, and questions will be structured in such a way that there is not prejudice and bias among the respondents. In this research study both face validity and content validity tests are carried out. A recording device, was planned to be used to insure reliability during interviews but not used.

### **3.11 Data Analysis**

The collected data through the means of interview and using document analysis will be analyzed & interpreted in relation to the theoretical propositions. A total of 10 peoples are interviewed. The results of the statistical analysis will be presented in chapter five.

The fact that the number of respondents is few will not allow the use of extensive descriptive statistics. Instead, tabular presentation followed by discussions and reports will be used. The analysis will be conducted in perspective with the research objectives and follows the topics of causes of construction delays, delay exposition of the Mughar Coal conversion Project and delay claim administration.

## **IV**

### **Findings Analysis and Discussion**

The surveys employed an interview in collecting data on schedule delay and cost overrun on the Mughher Cement Enterprise coal conversion project from key persons like employees, contracting and consulting organizations of the project and supporting institute. The questions contained in the interview were based on review of the literature reported on chapter two and preliminary discussion with the Mughher Cement Coal Conversion project office.

This chapter presents the results and analysis of the responses to individual questions in the lights of comments made on the effectiveness of coal conversion project in relation to schedule delay cost overrun analysis and is produced by grouping the questions under the following headings.

#### Heading Group

- Project Office
- Survey responses
- Characteristics of the respondents and organization
- Causes of construction delays
- Results of interview for causes of time and cost overrun
- Existence of disputes
- Existence of external and/or internal factors

#### **4.1 Project office**

Based on document review and detail discussion with the Delegated General Director of Chemical Industries Corporation it is understood that the Mughher Cement Enterprise coal conversion project office was well established and staffed with the required manpower. The following table showed list of positions and number of staff.

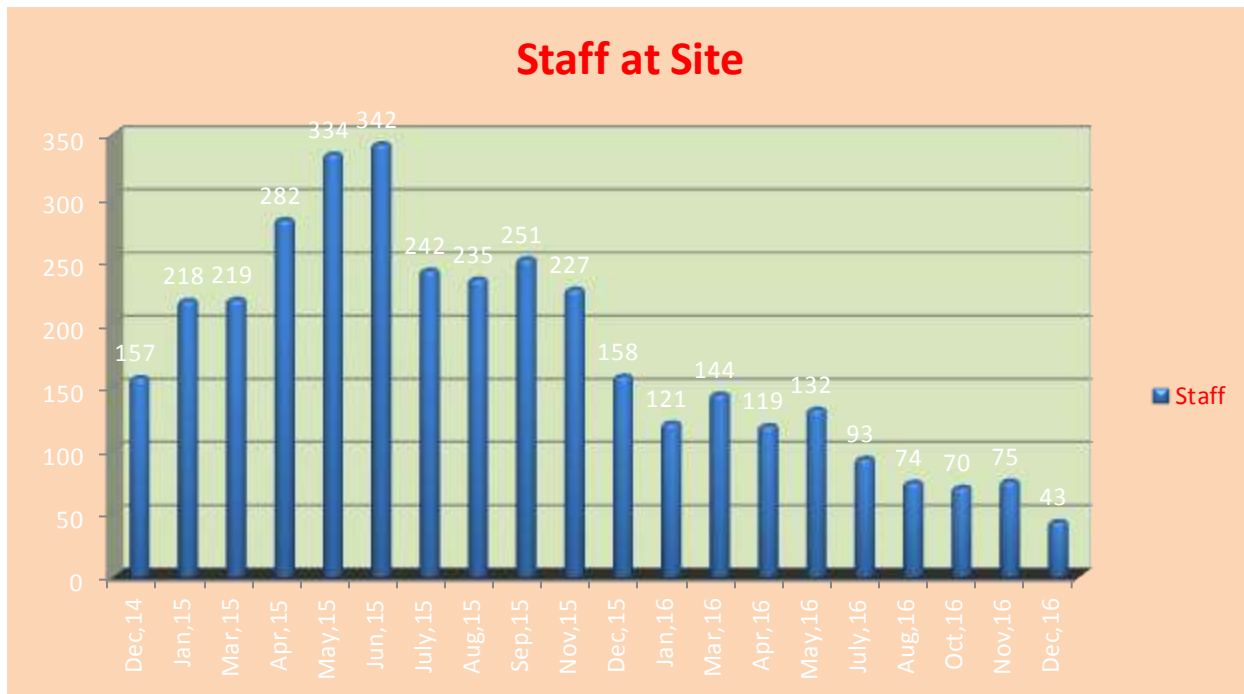
## Assessment on the effectiveness of Muger Cement Enterprise Coal Conversion Project

It is pure project based structure with full responsibility to all tasks under the project. It is staffed with full time bases. It has two offices, one in Addis Ababa and the other at site. The site Manager and the Civil, Electrical Engineers and Process Engineers are based at the site.

**Table 4.1** Project office staff

S/N	Position	Number of staff
1	Project Manager	1
2	Site Manager	1
3	Civil Engineers	3
4	Electrical Engineers	2
5	Process Engineers	2
6	Liaison Officer	1
7	Finance	1
8	Project Secretary	1
9	Drivers	2
	<b>Total</b>	<b>14</b>

Based on the final report made by the contractor the number of manpower deployment by the contractor and sub-contractor is shown below at different stage of the project.



**Fig 5.1** Staff deployment based on the main contractor report

## 4.2 Survey responses

Out of the planned 10 interviews seven interviews were conducted and the filled questions returned. The reason for the non-returned questions, some are outside the country, some claim too busy for the interview but the consultant respond in writing about the overall project performance. This results a response rate of 70%. Out of these 7 participants, 2 of them were again selected for further interview based on the filled interview questionnaire. Informal interview also conducted with some who have direct contact with the project like the enterprise finance department and Mughher Cement factory workers.

## 4.3 Characteristics of the respondents and their organization

Table 4.2 and table 4.3 show the distribution, profile of the respondents' organization in terms of type, size and designation. Here, it is important to note that the consultant group was not willing to accept any interview question rather respond in general about the project.

**Table 4.2:** Respondents organizational profile

S/N	type of organization	Number of respondents	percent
1	Mughher Cement Enterprise	Four	57.1
2	chemical and construction input industry development institute	One	14.3
3	Contractors	one	14.3
4	Consulting firm	one	14.3

**Table 4.3:** Respondents designation

S/N	Designation	Number of respondents	percent
1	Project Manager	one	14.3
2	Contract Engineer	one	14.3
3	Head/Director	two	28.57
4	Civil site Engineer	two	28.57
5	Consulting firm	one	14.3

The Consulting firm representative was outside the country and agreed to respond by mail without sending him the interview questions to be addressed.

With regard to the size of the respondents, as the survey indicates a narrow range of spectrum, it was due to the specificallity of the research topic the newlines of the considered construction project and the number of personnel participated that can provide reliable information.

The designation of the respondents shows a relatively wider Varsity of professionals which are relevant to the case under analysis. The respondents have been acting as senior project managers, contract manager, consultants and enterprise manager.

**Table 4.4:** Experience of respondents in the project

S/N	Function	experience Current position	Project experience
1	Head, Corporate Research & Development Sector	2	Yes
2	Project site manager	2	Worked on four projects
3	Cement and related product industry development director	3	no
4	Project Manager	6	yes
5	Civil site Engineer	3	yes
6	Mechanical Engineer (consultant)	6	yes

As can be seen the years of experience in the field of project on all of the relevant functions is more than 3 years. This suggests that most of the respondents were

participating in the project since the start of the Mugher Coal conversion project and thus were ideally suited to comment on the issues dealt within the survey.

#### **4.4 Results of interview for causes of time and cost overrun**

The causes of time and cost overrun from the 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 Mugher Cement Enterprise Coal Conversion Project 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 schedule delay and cost overrun, it is important first to identify their causes for Mugher Cement Enterprise Coal Conversion Project, and then identify their rate of occurrence.

##### **4.4.1 Factors influencing time and cost overruns at Mugher Cement Coal Conversion project**

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

###### **a. Contractors view**

The contractor claims that there were both time overrun and cost overrun in the project.

With regard to the time delay, the contractors view for the delay is that the initial proposed time was not sufficient, Unrealistic imposed contract duration. The contractor demand more time (15 months) but not accepted from the client side. The delay occurred besides this is the problem due to on time delivery of equipment procured abroad.

The second cause is related to materials and equipment supply delay, as per the contractor view limiting of use Ethiopia shipping line (ESL) by the owner as the only sea transport company hindered the fast execution of the project. And the other issues for the cause are the rainy seasons, and worker strike

The 2016 civil unrest in the country also has major contribution to the delay of the project.

The other delay was related to the advance payment to be made to the contractor from the client as per the contract agreement, and late delivery of the site for work these affect the contractor from paying of equipment manufacturers for those items with high lead time, not deploying of its team on time.

As for the cost overrun there is no cost overrun from the client side, the project completed with the initial contract amount (fixed price with no variation). This is not because of the efficient cost controlling rather the client could not accept the additional cost requested due to the delay occurred beyond the contractor's control.

But from the contractor side there is cost overrun due to schedule delay that cause cost overrun. The main issues related with this are mainly manpower management fee, increased equipment rental fee, material and equipment delivery cost, cost to cover the consultants fee for the delay period . These made the contractor to incur more cost than agreed.

#### **b. Consultants view**

Consultants also rate financial problem delay in initial payment, Unrealistic imposition of contract duration by the client, less attention and poor main contractor performance and poor support from main contractor's head office contribute for the delay. And the consultant also agreed with the civil unrest hindered the progress of the project.

The consultant stressed mainly on the subcontractor's ability of performing the task. Low financial capability and not paying its workers timely created delay. Due to late

payment from the subcontractor labour strike happened. The consultant also mentioned the existence of civil unrest around the area but not as such significant.

As the contract is fixed price turnkey project all the additional costs rests on the contractor, even the consultants' additional stay fee is covered by the contractor.

### **c. Clients view**

Client has also its own view for the delay, the client firm agreed with what raised by the contractor and consultant with the civil unrest and delay in initial payment.

The other issues that contribute for the major delay of the project are the problem with the contractor which is Contractor could not deploy its team timely and Contractor sub-contractors dispute on cash flow, misunderstanding and labour strike.

The main contractor of the project had itself subcontracted another company which by its standard failed to deliver its obligations in due time because of inadequate man power, resource shortage (equipment and machinery), port clearance delays, occasional strikes by its employees due to delay in paying out their wages.

The client also reached the conclusion that the time estimate to finish the project seems over ambitious and fixing of the project cost at initial stage discourage the contractor.

The client view the project as a poor cost performance project even if no payment is made over the initially agreed fixed cost, the company had lost its market share until it completes the project; second it stopped the whole cement production for eight months as it is not economical to continue working with HFO system.

The following figure showed the main causes for the delay occurred on the project. Even if client and contractor have different estimates based on third parties' data the percentage is calculated.

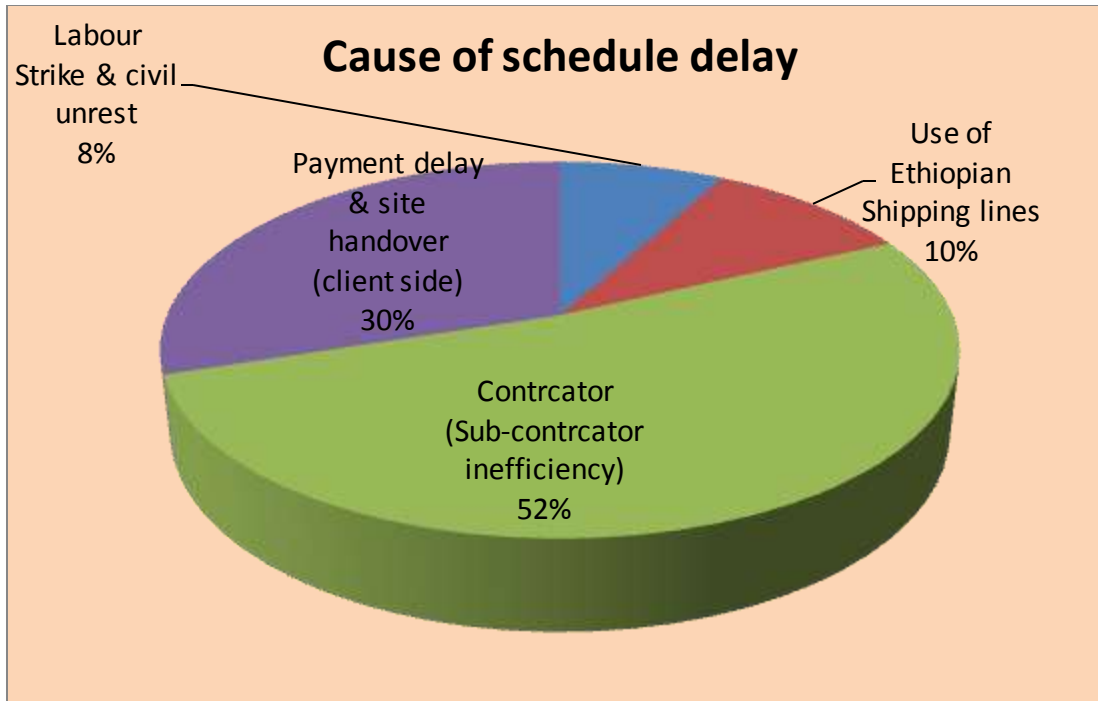


Fig 4.2 Major causes for the delay in Mughher Cement coal conversion project

#### 4.5 Causes of Schedule delay and cost overrun based on Literature

Schedule and cost overruns can occur for a wide variety of reasons on various types of projects which has led to the debate on how to minimise these construction projects cost and schedule overruns. Projects or construction works that are not delivered on time to the client and that are not within the set budget are referred to as projects that have undergone schedule and cost overruns. According to Ismail, 2013 the following are the reasons for schedule and cost overrun

**Table 4.5:** Common factors for Time and cost overrun (Ismail et al., 2013)

No	Factors
1	Poor site management and supervision
2	Incompetent subcontractors
3	Schedule delay
4	Inadequate planning and scheduling
5	Lack of experience
6	Inaccurate time and cost estimates
7	Mistakes during construction

8	Inadequate monitoring and control
9	Frequent design changes
10	Mistakes and errors in design
11	Incomplete design at the time of tender
12	Poor design and delays in Design
13	Delay Preparation and approval of drawings
14	Cash flow and financial difficulties faced by contractors
15	Poor financial control on site
16	Financial difficulties of owner
17	Delay in progress payment by owner
18	Delay payment to supplier /subcontractor
19	Contractual claims, such as, extension of time with cost claims
20	Lack of coordination between parties
21	Slow information flow between parties
22	Lack of communication between parties
23	Labour productivity
24	Shortage of site workers
25	Shortage of technical personnel (skilled labour)
26	High cost of labour
27	Labour absenteeism
28	Fluctuation of prices of materials
29	Shortages of materials
30	Late delivery of materials and equipment
31	Equipment availability and failure
32	Poor project management
33	Change in the scope of the project
34	Delays in decisions making
35	Inaccurate quantity take-off

It can be seen that the causes that actually occurred in Mughar Coal Conversion project are similar to those stated in different literatures. The highlighted ones are those internal causes occurred on the coal conversion project under study.

#### **4.6 Existence of disputes**

Disputes were raised at different times in the Mughar Cement Enterprise coal conversion project. The reasons for these disputes were:

a. client side

Most of the disputes aroused were related to the sub-contractor inefficiency, not meeting client requirement during implementation like civil work quality problem, not meeting specification of agreed inputs at the time of procurement, incomplete civil work, colour mismatch, etc.

The other disputable issue was the temporary installation site laboratory for testing concrete works as a civil work requirement. But the contractor don't want to install the laboratory rather transport and test in Addis Ababa and report.

The major dispute was related with the sub-contractor, and the disputes continue until the contractor finally accepts firing of the sub- contractor and complete the work by itself.

When disputes arouse, first discussed on project level project manager, contractor and consultant and resolved. When they are beyond them the dispute brought to the top management in the presence of main contractor's senior official and resolved. About six times disputes aroused and solved without referring to the court.

b. Contractor side

The contractor also believed that there was dispute and argued that most of the disputes happens on design issues because different understanding of process and contract, other disputes cause due to site construct quality and payments confirmation issues.

Normal disputes were solved by three party (client, contractor and consultant) negotiated on weekly project management meeting, if can't the disputes will negotiated and decided on top management meeting (owner & consultant & main contractor's senior attended)

c. Consultant side

The consultant also assured that there was dispute specially to cancel the contract agreement between the main and the subcontractor based on the request made by the client.

The other dispute was civil works made outside the client requirement specified on the contract agreement like color matching, material usage, etc. The client claimed that the contractor is using lower quality materials to gain cost benefit.

But all dispute resolved through discussion in the presence of the consultant. Both parties agreed to solve dispute with the consultant and that was successful.

#### **4.7 Existence of external and/or internal factors**

The factors identified by Walker and Hughes as constituting environment of projects are political, legal, institutional, cultural, sociological, technological resources, economic, financial, and physical (infrastructure). Both studies directed attention to some factors within the environment that pose greater challenges to projects, management and organizational structure than others and suggested that these factors should form the focus for the management of the projects environment.

On Mughar Cement Enterprise coal conversion project there were both internal and external factors that contribute for the delay of the project.

For the internal factors, both the client and the contractor agreed the existence of labour strikes with different views for the number of times the strike existed. The client said the strike happened two times disrupting work progress for a total of 28 days (by Chinese labour force) due to delay in paying out their wages but there was no physical damage on the project.

Assessment on the effectiveness of Mugher Cement Enterprise Coal Conversion Project

From the contractor side it happened for three times for a total of 42 days but no damage on project just stop work at site. The contractor also mentioned that the labour strike was from the sub-contractor side.

Late payment, late delivery of site and geotechnical condition of the area are also internal factors contributed for the delay and cost overrun from the contractor side and additional payment to the consultant by the client.

For external factors the civil unrest (political problem) that happen in the year 2016 which was all over the country, government regulation to use ESL as the only carrier for government related imports. This is beyond the control of both the client and the contractor.

The success of the Mugher Coal conversion project was tried to see with the selected factors from the client, contractor and consultant side rating. The following table show this.

**Table 4.6:** Rating Mugher coal conversion project

Critical Success Factors	success factors Presence in Mugher coal conversion project			
	Client to management	Contractor	Consultant	Project Manager
Adequacy of funding	Yes/no	No	Yes/No	No
Adequacy of plans and specifications	Yes	Yes	Yes	Yes
Budget updates	Yes/no	No	No	No
Constructability	Yes	Yes	Yes	Yes
Owner's involvement and frequent feedback	Yes	yes	Yes	Yes
Owner's commitment to established schedules and budget	Yes/no	no	No	Yes
Project Manager commitment and involvement	Yes	Yes	Yes	Yes
Project Manager competency/experience	yes	Yes	Yes	Yes

The yes/no answers from the client side is that for the adequacy, update of the budget and Owner's commitment to established schedules and budget , getting hard currency on time was sometimes difficult and hard to keep promise.

From the consultant side the funding should have included variation or the client should have been open for contractor's request of budget adjustment. Due to this off quality materials were shipped and used.

The overall rating of the project is tabulated below

**Table 4.7:** Overall rating of Mugher coal conversion project as per respondents

Respondent s	Excellent	Good	Bad
Client		√	
Contractor			√
External Respondent		√	
Consultant		√	

#### 4.8 Research findings

Drawing from the primary data collected and the literature review, the main research findings obtained in respect of the research objectives are as follows

- From archival reports and interviews, schedule delay (which caused cost overrun) in Mugher Cement Enterprise Coal conversion project is mostly caused by sub-contractors inefficiency, labour strike and civil unrest, financial problem, shortage of hard currency, reliance on bank loan for the project, client's problem in delay of initial payment, contractor's problems in assigning staff and delivering equipment on time.
- According to the responses the project is delayed by 16 additional months due to, in addition to the above mentioned reasons, unrealistic schedule estimate, use of ESL as the only sea carrier, poor project management form the sub-

contractor side, less attention given to by the main contractor, lack of continuous support from contractor's head office.

- Due to the delay the company had lost its market share until it completes the project. It caused extra payment to foreign consulting firm as it had to stay till end of project closure. It had put psychological pressure on management and employees alike as time lag happened.
- From the contractor side there is a cost overrun (not disclosed by the contractor how much is) due to the delay occurred.
- Another problem contributed for the delay was inadequate man power allocation, resource shortage (equipment and machinery), delay in equipment shipping due to the use of only one vessel shipper being limited by the owner(government policy) .
- The delay occurred due to civil unrest, use of ESL as the only vessel carrier and weather & geotechnical condition of the area are excusable delays without compensation as they are caused by third parties or incidents beyond the control of both the owner and the contractor. And no compensation was claimed.
- Delays like late payment, late transfer of site to the contractor by the client was excusable with compensation. This is where the contractor incurs additional indirect costs for both extended field office and home office. Such delay normally leads to a schedule extension and exposes the owner to financial damages claimed by the contractor.
- The delays occurred due to the inefficiency of the sub-contractor chosen by the main contractor (responsible for more than 50% of the delay) is non-excusable delays.

- Both parties agreed that port clearance delays, occasional strikes by contractor employees, civil unrest happen all over the country delayed the project.
- Less attention given by the main contractor, poor support from contractor's head office, less equipment and manpower from the contractor side general contractor's scorn on the project contribute for the delay.
- According to the responses and document review again there was no cost overrun due to client refusal. The contract is fixed price contract. Furthermore the client succeeded in getting liquidated damage 5% (USD 1.5 million) of the agreed contract price based on the agreement signed.
- The Contractor is obligated by the contract agreement to perform the customs clearance and forwarding activities at Djibouti port of receipt for the imported portion of the Deliveries on behalf of and in the name of the Owner. But disallowing the use of sea carriers other than the Ethiopian Shipping lines should not happen as it is becoming an issue for the delay.
- The consultant's final comment on the project was rigorous control procedure and requirement (as it is government project and policy) was too much to run such project. But appreciate the client's involvement and support.
- Any dispute between the Owner and the Contractor, which is not resolved through a mutual and amicable settlement, shall be resolved by arbitration in accordance with, and pursuant to, the procedures stated in the contract. But all disputes resolved with mutual agreement harmoniously, that is the good side of the project even if the contractor did it to get good will from the contract so that it can have other projects in Ethiopia.
- The Contract of Mughher Cement Plant HFO to Coal Conversion Project has been signed between CNBM International Engineering Co., Ltd, subsidiaries of China National Building Materials & Equipment Import & Export Co., Ltd and Chemical Industries Corporation in Ethiopia on 12<sup>th</sup> Jan, 2014. Mr. This means that the

project was expected to be completed in February 2015. The following table produced by the main contractor showed the overall status of the project on December 30, 2016.

**Table 5.1:** Overall Project progress (30-12-2016)

<b>Overall Project progress(2016-12-30)</b>			
S.N	Item Description	Wt in %	Actual Current
01	Engineering & Design	5.0%	100.0%
02	Civil Construction	30.0%	99.0%
03	Procurement and Manufacturing of Plant & Machineries	10.0%	99.0%
04	FOB Delivery, Shipping & Transportation to Site	20.0%	99.0%
05	Site Fabrication	10.0%	100.0%
06	Mechanical Erection	10.0%	100.0%
07	Electrical and Instrumentation Installation	10.0%	100.0%
08	No Load Trials	2.0%	100.0%
09	Commissioning	2.0%	100.0%
10	Training of Owner Personal	1.0%	100.0%
Total		100.0%	
TOTAL PROGRESS		99.70%	

#### **4.9 Mitigation methods performed**

Keeping construction projects within estimated costs and schedules requires sound strategies, good practices, and careful judgment. There are, however, steps that can be taken to minimize their causes and effects of time and cost overrun, the major one is using efficient project management tools and practices.

The client from its side states that there was no project software used but Gant Chart and MS Office excel were in use. Frequent evaluations were made from time to time on the progress project by the owner, main contractor and consultant. At one point the owner insisted to fire the sub-contractor and urged the main contractor to finish by itself.

The other proposal was to carry out the project phase by phase instead of parallel. Client proposed to finish phase by phase, i.e., complete coal firing system for part of the plant whose output is better and later on move for the remaining part of the plant with smaller capacity. This was successful and the Enterprise benefited. Otherwise the indirect cost (loss of revenue) as a result of extended use of HFO is high.

The client believed that there could have more things to be done for the success of the project if the contract was not an EPC contract which is "Engineering, Procurement, and Construction". An **(EPC)** is a particular form of contracting arrangement used in some industries where the **EPC Contractor** is made responsible for all the activities from design, procurement, construction, to commissioning and handover of the project to the End-User or Owner.

The contractor, CNBM, states that it has a project analysis committee with difference senior experts to estimate the reasonable project time and cost. The contractor also compare the cost and schedule performance with similar projects successful completed by CNBM. The contractor also uses P3/Microsoft Project to control schedule and project cost.

## V

### **Conclusions and Recommendations**

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 Muger Cement Enterprise coal conversion project. The second objective was to identify factors influencing time and cost overruns in the project and 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 coal conversion project. Interview 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.

Literature reviewed showed that the major causes of cost overruns include: cost of materials, incorrect planning, wrong method of estimation, contract management, and fluctuation of prices of materials. Other causes identified through literature include, environmental factors, construction factors, frequent design changes, Cost estimating factors and financing factors.

Furthermore, literature showed that the major causes of schedule overruns include: design error, poor site condition, delay in payment, financial incapability of client, financial incapability of contractor and non-availability of subcontractor and supplier. Other causes of schedule overruns included: financial or cash flow difficulties, financial difficulties faced by contractors and public agencies, frequent change order and design, failure to pay for completed works, shortages of resources, considerable additional work, escalations of material prices, increases in the scope of work. For more causes see table 4.5.

It is well documented that claims related to project delays and cost overruns are a major source of disputes in the construction industry. Consequently, there has been much

desire to reduce or completely avoid this problem and this has created considerable research interest among researchers and practitioners.

Despite such attempts, delays and their analysis continues to pose great challenge to project parties. It is this reason that stimulates to investigate the case of Mugher Cement Enterprise Coal conversion project effectiveness concerning time and cost overrun. This was achieved through the use of interview surveys distributed to the client, contractor, consultant and other related government institutions.

The purpose was to use the result from this investigation and that from review of the literature to determine the causes and effects of schedule delays on Mugher Cement Enterprise Coal conversion project and develop a framework for improving delay analysis. The major findings and conclusions from the previous chapters and recommendations for further researchers are reported below.

## **5.1 Conclusion**

- From the secondary data and interview question it is clear that there is schedule delay for about 16 months. The initial planned time was 13 months (some said 14) but the project is completed after 29 months.
- With regard to Cost overrun, the client claim that there is no additional fee incurred with the main contract and completed with the initially agreed cost (fixed price agreement). But Mugher cement Enterprise paid an additional fee of USD101,745 for the consultant as first amendment for the consultants stay beyond the agreed period (13 months).
- With regard to the main contractor there is cost overrun as the schedule delay occurs for its foreign and local workers. For foreign workers salary and accommodation cost and for local workers salary. The additional period fee of the consultants which is USD 376,324 also covered by the contractor. This payment is for the second and the third period extension fees.

### **5.1.1 Consequences of project delay**

Delay is one of the biggest problems often experienced on construction project sites. Delays can instigate negative effects such as increased costs, loss of productivity and revenue, many lawsuits between owners and contractors and contract termination.

For Mughher cement coal conversion project all parties agreed that the consequence for the Mughher Cement Enterprise is high. The main aim of the project is to convert HFO to coal that is expected to reduce production cost by 35%. That means per ton of clinker production 612 birr production cost reduction is possible.

Due to the delay occurred (16 months more), Mughher cement Enterprise, based on its annual HFO consumption rate, lose 392 million birr.

The consequence is too much for the Mughher Cement Enterprise even if it claim as it complete the project within the budget with this much delay. No claim raised by the Enterprise even if the delay is due to the contractor's problem and incurred that much revenue loss.

From the Contractor side the consequence is very high, Additional payment to its staff, covering additional fee to the consultant for extended period and 5% liquidated damage payment to the client.

A project is said to be effective when it delivers the intended product within the preset schedule and budget. The project may be effective in delivering the intended result but not efficient if it exceeds the schedule and the budget.

Mughher Cement Enterprise Coal conversion project is said to be completed within the set budget except payment of first amendment fee for the consultants, but with schedule slippage. As it is fixed price contract no additional money is paid to the contractor.

Due to the overall performance mostly due to delay on the project Mughar cement Enterprise withhold a 5% Contract Price as a liquidated damage which is 1.5 million American Dollar.

The project is said to be effective in getting the intended result but the quality of the product will be known in the future. But not said to be efficient as 16 months of additional period are required to complete the project which resulted in a loss of Birr 392 million by the use of HFO instead of coal.

## **5.2 Recommendations**

Based on the findings of the research, the following recommendations were proposed

- The client should have been tolerant and consider the contractor's additional project duration instead of sticking its own proposal. Contractors have better understanding of the project from their past experience. Project deadlines are not goals by themselves rather means to get the end result within the budget.
- Project delays are quite common and are expected. Certain types of delays are highly predictable (i.e. late delivery from outside sources), and should have been factored into the schedule before project work begins.
- Fixed price contract with no variation should have not been applied it mainly benefit the client and not the contractor that has an impact on the quality of the project output. It is raised many times from the client side that the contractor mischiefs in the use of low quality imported inputs.

Being exhausted, the contractors left some civil works incomplete at the final stage of the project accepting any penalties the client demand or propose.

- The employer should allow the contractor to use any carrier to import equipment. Allowing searching and use sea carrier fasten the importation and avoid delay due to transportation.
- Both parties should be compensated for the delay reasons they are responsible. Except claiming of USD 1.5 million by the client no other compensation was made. This discouraged the contractor.
- The contractor should not scorn on the project even if not satisfied with the things and assign proper staff and qualified subcontractor. The contractor is still working in the country in one of the private cement factory as management contractor. The image it develops in this project will affect its future existence in the country.

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Appendix 1

Interview Questions

MASTERS OF SCIENCE IN PROJECT MANAGEMENT

IDENTIFYING THE CAUSES OF TIME AND COST OVERRUN FOR MUGHER COAL CONVERSION PROJECT:

Dear Sir/Madam,

Your kind co-operation is sought for the completion of this interview, which is a survey being conducted to collect data for an academic exercise towards the award of master degree from Addis Ababa University School of Commerce.

Your willingness to complete the questionnaire will be much appreciated. All information will be treated as strictly confidential.

**I. INFORMATION ABOUT THE INTERVIEWEE**

1. What is the name of your organization? \_\_\_\_\_
2. What is your title of current position? \_\_\_\_\_
3. What is the number of years you have been working at you current position? \_\_\_\_\_
4. Due have any experience in project management? \_\_\_\_\_  
\_\_\_\_\_
5. Were you part of Mughher coal conversion project? If so in which type of organization were you working with: client, contractor or consultant? \_\_\_\_\_

**II. GENERAL QUESTIONS ABOUT PROJECT PERFORMANCE**

1. For how long was the contract of the project initially planned? \_\_\_\_\_  
\_\_\_\_\_
2. How was the level of time and cost estimate accuracy for the project? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. Did the *Mughar Coal conversion* project have a time overrun and cost overrun?\_

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4. If yes what are the main causes?

4.1 with regard to schedule overrun\_\_\_\_\_

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4.2 with regard to cost overrun\_\_\_\_\_

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5. Do you think that the time overrun had an impact on the cost performance of the project? How? Why?

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6. What are the consequences or impacts of cost and schedule overrun for the project?\_\_\_\_\_

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7. How many subcontractors involved in the project and which party subcontracted them Mughar or Main contractor?\_\_\_\_\_

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8. Can you please mention the actions that were taken to reduce the impact of both schedule and cost overruns?\_\_\_\_\_

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9. Do you think that Mughar Coal conversion project is said to be a good or poor cost performance project?

Why? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

10. What are the critical success factors that you think were present in this project that would have helped to avoid schedule and cost overruns in this project? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

11. Were there disputes raised between the project owner and contractors/sub-contractors?

Yes  No

If Yes, what were the causes for the disputes? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

If disputes happen how they are solved? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

12. Were there labour strike or other strikes?

If yes, for how long? And were there damage on the project? \_\_\_\_\_

Assessment on the effectiveness of Mugher Cement Enterprise Coal Conversion Project

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13. Were there Sufficient top management support in all levels of the project?\_\_\_\_\_

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14. Please mark with the following points by **Yes** or **No**

<b>Critical Success Factors</b>	Presence in Mugher coal conversion project
Adequacy of funding	
Adequacy of plans and specifications	
Budget updates	
Constructability	
Economic risks	
Owner's involvement and frequent feedback	
Owner's commitment to established schedules and budget	
Project Manager commitment and involvement	
Project Manager competency/experience	
Realistic obligations/clear objectives	
Risk identification and management	

15. Your overall remark on Mugher Coal conversion Projects?

Bad                       Good                       Excellen

**THANK YOU FOR YOUR COOPERATION**