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"REDUCING THE IMPACT OF TIME OVERRUN IN ROAD CONSTRUCTION PROJECTS IN ETHIOPIA"

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ABSTRACT

One of the most common, complex and risky problems in construction projects is Delays. Delays of a construction projects can be defined as the late completion of works as compared to the planned schedule or contract schedule. Projects can be delayed due to number of reasons cause by the employer, contactor, both or neither of them for controllable or uncontrollable reasons. They may occur early or later in the project development, alone, or with other delays.

The objective of this study was to identify the major causes of delays, the effect of delays, and the methods of minimizing delays in road construction projects in Ethiopia (see Annex A). This study was carried out with literature and a questionnaire survey. A total of fifty six factors and eight groups that contribute to the causes of delay, the six major effects of delay, and sixteen methods of minimizing delays were identified based on literature review. The questionnaire survey was distributed to the three main parties of the construction industry; employers (Ethiopian Road Authority), contactors and consultants.

Based on the survey findings the top ten major factors contributing to road construction project delay, insufficient site investigation, change order/variation, incomplete documents (drawing and specification), late site hand over due to unpaid compensation to owners, late delivery of drawings, failure to control the progress against the schedule, and unrealistic completion time set by the client; the six major effects of delay on road construction project, time overrun, cost overrun, dispute, arbitration, litigation and total abandonment; sixteen most effective methods of minimizing road construction project delays, Proper project planning and scheduling; competent project manager; availability of resources; frequent progress meeting; Complete and accurate project feasibility study and site investigation; Commitments to project; awarding bids to the right/experience consultant and contractor; multidisciplinary/competent project team; Commitments to project; accurate initial cost estimates; competent and capable of clients representative; use of appropriate construction methods; performs a pre-construction planning of project task and resources needs; and project management assistances, from the perception of the employer and his agents (consultants) were determined.

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CHAPTER TITLE PAGE

ABBREVIATIONS

BPR Business Process Re-engineering
CD Complétion date
CM Construction Management
CPM Critical Path Method
DBB Design Bid Build
DB Design and Build
ERA Ethiopian Roads Authority
EOT Extension of Time
ETB Ethiopian Birr
FIDIC *Fédération Internationale des ingénieurs-conseils*
GDP Gross domestic product
LAD Liquidated and Ascertained Damages
PERT Project Evaluation and Review Technique
RSDP Road Sector Development Program
PDM Project Delivery System
TO Time Overrun

LIST OF SYMBOLS

I - Relative Importance Index

W_i - Weight assigned to i^{th} response.

X_i - Frequency of the i^{th} response given as percentage of the total responses for each factors.

i - Response category index = 1, 2,3,4,5.

Σ - Sum of

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CHAPTER ONE

I. BACKGROUND OF THE STUDY

1.1 Introduction

Construction industry is the leading industry which consumes the country's highest budget. It is one of the major parts of contracting business and it has a large contribution to a country's economy by creating job opportunity and their business activities. In Ethiopia, the construction industry accounted for 60% of the capital budget in the year 2005/06, the highest recipient being the road sector (RSDPII, 2005). Accordingly, this sector employees about 20% of the work force and covers about 30% capital budget of the government in the developing countries (RSDPII, 2005) in most developing countries construction industry constitutes 6% to 9% of GDP and constitutes more than half of fixed capital formation as infrastructure and utilities capital worked for economic development (Tkkara,1998). In our country this sector with communication shares 5.7% the countries GDP (RSDP II, 2007).

In Ethiopia development of physical infrastructure is critical for economic growth, poverty reduction, employment creation and access to markets. Hence road construction projects are perceived as a means through which development strategies of the government are primarily intended to be achieved agricultural activities, investment projects and industrial development of the nation can only be realized if there are adequate and efficient transportation networks available. In recognition of this crucial role of the road sector, various programs have been implemented to develop it. One of the programs that is initiated by the government and implemented by ERA is the RSDP

The RSDP program has been formulated to overcome the accessibility and transport system problems by improving quality and size of road. RSDP is a 10 years program which focused on the restoration of the road network to an acceptable condition. The total road network of the country at the beginning of the RSDP in 1997 was about 26,556 km with a road density of 0.46km and 24.14km per thousand populations and per thousand of sq. km respectively. Due to the construction of the new gravel and regional roads during the last nine years of RSDP, the total network has increased to 42,249 km in the year 2007 with an average annual growth of 5.2% per annum. The road network in Ethiopia has been increasing on the average by 2.06% between 1951 and 1973, by 6.20 between 1974 and 1991 and by about 8.50% between 1992 and 2006 (ERA golden jubilee bulletin, 2001).

However, the midterm review of RSDP shows that despite the improvement seen in performance and productivity with in the sector, there still remains problems of delay and cost overrun of all the road projects (Behailu, 2006). From reports examined on completed road projects, the delay encountered ranges from 20%-30% of the original contract time causing claims for additional costs and extension of time, prolongation costs, consultant fees and overhead costs for the client (ERA) and losses of opportunity costs, losses of revenues/benefits attributed solely to the delay, cost of extension of various bonds (performance bonds and bank guarantees), operational and maintenance costs of facilities to the contractor and finally to the public it creates losses of business opportunities.

From major causes of claims observed on a study shows 79% is claim on the delay and disruption (Journal of Ethiopian Civil Engineers Association, 2003). With this regard, it is essential to investigate and reduce the impact of time overrun and give attention to adopt appropriate remedy.

Hence, this big sector requires good construction planning. Construction planning is a fundamental and challenging activity in the management and execution of construction projects. Chris (1998) showed that construction planning involves the choice of technology, the definition of work task, the estimation of the required resource and duration for individual task and the definition of any interrelationship among the different work tasks.

1.2 Statement of the Problem

Road construction projects have not been completed and available to the road users (customers) within the stipulated contract periods for controllable and uncontrollable reasons for which the employer or the contractor or both are responsible.

1.3 Aim and Objective of the Study

This research therefore, aimed to exhaustively assess the major causes of time overruns in the road construction in Ethiopia, particularly time overruns due to the employers and /or its agent action and recommend practical solution towards reducing the causes and effects of these time overruns. To achieve this, aim the following objectives have been identified.

- Define the problems related to time overrun in administering contracts
- Assess the basis of time overruns on construction projects
- Identify the impacts/effects of time overruns
- Come up with proposals and methods that could reduce the impact of time overruns.

1.4 Scope of the Study

Time overruns can arise from different events that are arising from controllable and/or uncontrollable reasons for which either the employer or the contractor or both are responsible. The research topic could be wide enough to deal with all the causes of time overruns in the road construction projects in Ethiopia. However, for time and financial limitation the scope of this study is limited to reducing the impact of time overruns in the road construction industry that emanate from the employers and /or their agents action while administering contracts.

1.5 Limitation of the Study

The study will be more concerned with technical matters than the legal aspects of time overruns and information and data are expected from projects executed under ERA and did not include projects that are being executed by other agencies.

1.6 Structure of the Research

The research consists of six chapters and appendices. The chapters are summarized as;

Chapter 1 Introduction and Background

This chapter deals with the back ground of the road construction and time overrun, statement of the problem, aims and objective and scope and limitation of the of the research.

Chapter 2 Major Problems and Challenges

In this chapter, major problems and challenges of road construction projects with respect to time overruns would be identified together with their corresponding causes and effects.

Chapter 3 Literature Review

Differences and similarities as well as arguments of different writers regarding time overruns, their likely causes, their impacts and recommended solutions would be dealt under this chapter.

Chapter 4 Research Methodology

Desk discussion on previous literatures and studies(secondary information) from library, literature review, internet and magazines

- Forming questionnaire and data collection
- Analyzing the questionnaires and discussing in group
- Discussing the analysis results with advisor
- Reviewing the result back with group
- Final dissertation writing

Chapter 5 Analysis and Discussion of Results

This chapter deals with analyzing and discussion of results from questionnaire survey on causes, impacts and methods of minimizing construction time overruns.

Chapter 6 Conclusions and Recommendation

This chapter re-visits the research aims, objectives and the identified problems; and the result of this thesis would be recommended for further study in this topic.

References:-

CHAPTER TWO

II. MAJOR PROBLEMS AND CHALLENGES OF TIME OVERRUN

2.1. Introduction

Construction industry is the leading industry which consumes the country's highest budget. Among the major sector of the construction industry, infrastructure projects take huge portion of the capital budget allotment, the highest recipient being the road sector. Even though great emphasis was given to this sector, it is plagued with series of problems and challenges for controllable and uncontrollable reasons for which either the employer or the contractor or both parties are responsible.

2.2. Causes of Time Overrun

In general, time overruns are among the most common phenomena in construction industry from simple to complex projects (Tah et al, 1993). Therefore it is essential to define the causes of time overrun in order to minimize and avoid their impact. Ahmed et al (2005) under their study in construction time overrun in Florida have identified two kinds of causes of time overruns of construction projects. These are external and internal causes. Internal causes of delays are delays resulted from the action of either of the three parties (i.e. the Client, Engineer and Contractor) to the contract while external causes of delay are delays resulted form the action of the other sources such as weather, ground condition, earth quake, change in legislation, etc……

According to the Business Process Re-engineering (BPR) study of ERA for the design and contract implementation sub core process, the major causes of time overrun repeatedly occur in the road sector which leads to an additional extension of time (EOT) and costs are:

2.3. Sufficiency of Design Document

Design documents should be sufficiently prepared and translated into the tender documents appropriately. Problems in preparing these documents have also been a reason for extension of time and cost overrun. According to ERAs Contract Procurement and Project Design Preparation BPR study group (As-Is Report, 2007). Some of the common causes for insufficient design document are:

- Incomplete design and inefficient survey of the project
- Late submission of design documents to the contractor
- The prepared design did not address the customers' needs and stakeholders interest
- The prepared design have not been environmentally friendly

2.3.1. Tender Document Preparation

Tender document are the basis for the successful implementation of the contact and should be prepared in a good quality. However, in most of our road projects, it can be seen that tender documents become among the main causes for a time overrun according to ERAs Contract Procurement and Project Design Preparation BPR study group (As-Is report, 2007). Some of the common causes for immature tender documents are:

- Shortage of skilled man power to prepare the documents
- Selection of poor performing design consultants
- Unavailability of quality control plan and quality assurance system in the ERA and among the service providers.

2.3.2. Possession of Site and Removal/Relocation of Obstructions

Granting possession of the site to the contractor is one of the essential elements for the timely completion of the project; but late possession of the site and removal of obstructions according to the contractors' schedule has been the common reason for time overrun. These problems are occurred due to poor right of way department organizing and responsibility, late site hand over due to unpaid compensation to owners, poor communication with local authorities etc.

2.3.3. Contract Management and Contract Administration

Contract Management and administration requires skilled personnel from all parties. However, due to limitation of local skilled professionals and semi-professionals in the country, consultants, contactors and employers have been forced to employ less qualified staff on project management and administration; as a result of these projects have been delayed due to late identification of problematic areas in the contract, poor recording etc. According to Revey (citied in Jergeas 1994) some section of the contract documents that should be found in most construction documents which requires clauses during contract management and administration that causes construction time overruns include late submission and approval of shop drawings, differing soil/site conditions, delayed payment terms, delayed change orders/extra work, poor day work rates, notification provisions, authorities and responsibilities of parties etc.

2.3.4. Project Delivery Method

The commonly used approach to contracting for road construction projects is the traditional method/design-bid-build, which is one of the project delivery methods which causes construction time overrun because of; its poor adversarial relationships among the contracting parties, does not allow incorporating for changes, poor problem solving mechanism due to the poor communication among the design an construction professionals and this results in time and cost overruns of projects. A need for recognizing the innovative of contracting methods should address the limitations of the traditional approach and leads to timely completion of projects. The major incentives for the use of innovative contracting methods are reducing construction time and cost overruns which specifically results from delay in quality of design and tender documents.

2.4. Effects of Time Overrun

The term time overrun in construction context generally has a negative implication for the key stakeholders (client, consultant, and contractor) in particular and the industry in general. To the client; it implies claims, cost overruns (increasing prolongation cost, disruption cost and overhead costs) in return on investment. To the contractor; it implies loss of profit/return cost of extension of bonds (performance bond and bank guarantee) increasing operational and maintenance costs of facilities, and loss of opportunity cost. To the sector as a whole time overrun could bring about project abandonment and drop in construction activities, bad reputation and liability to secure project finance or securing it at higher cost due to added risk from the major effects of time overrun observed in road projects (i.e. claims ,distrust ,litigation ,cost overrun ,cash flow problems, adverse relationship among stakeholders) (Journal of Ethiopian Civil Engineers Assocation,2003) which results in loss of business opportunities/revenue for the countries economy as a whole. Hence the concern of the corner of this research is to minimize the impact of time overruns in road projects in Ethiopia caused by the client (ERA) and/or his agents (service providers) while managing & administering the contracts and schedules. According to BPR study group of ERA shown in the tables below (table 2.1 to 2.3), the major impacts/effects of time overrun

repeatedly occur due to delay in design documents, delay to procurement of works contract and poor and incomplete design quality in the road sector are:

Table 0-1 Cost overruns per Km, due to delay in Procurement of Works Contract

Financer	Average procurement duration delay (Yrs)	Estimated project cost increment due to Delay in procurement (cost per Km, ETB)AC	Estimated project cost increment due to Delay in procurement (cost per Km, ETB) DBST	Estimated project cost increment due to Delay in procurement (cost per Km, ETB) Gravel	Average
GOE	0.153845	37,723.34	27,725.47	46,502.60	37,317.14
IDA	0.33846	82,991.35	60,996.02	102,305.72	82,097.70
				Average	**59,707.42**

Table 0-2 Cost overruns per Km, due to delay in Deign

Financer	Average design duration delay (Yrs)	Estimated project cost increment due to Delay in design (cost per Km, ETB)AC	Estimated project cost increment due to Delay in design (cost per Km, ETB)DBST	Estimated project cost increment due to Delay in design (cost per Km, ETB)Gravel	Average
	0.31346	76,861.31	56,490.64	94,749.05	76,033.66

Source: BPR study group of ERA (2007) GOE: Government of Ethiopia IDA: International development agency (the World Bank)

Table 0-3 Representative data showing time and cost overrun

No	Contract Name	Original Contract amount	Variation issued	Percentage issued	Original contract duration	Extension of time granted	Percentage elapsed time	Estimated escalation due to EOT
1	Modjo-Awash Arba	227,449,546.16	41,867,596.21	18.41%	1096	1005	91.7%	8.24
2	Awash Arba-Gewane	192,002,709.84	1,097,497.23	.57%	1080	106	9.81%	
3	Gewane-Mille	248,989,340.33	478,876.69	.19%	902	314	34.81%	
4	Woldiya-Alamata	150,329,634.00	25,811,429.44	17.17%	1096	881	80.38%	6.29

5	Betemariam-Wukro	203,410,054.65	16,105,427.00	7.92%	1096	941	85.86%	
6	Debere Markos – Merawi	327,070,830.00	96,907,231.48	29.63%	1096	850	77.55%	
7	Merawi-Gondnder	395,575,959.57	49,842,168.29	12.60%	1096	232	21.17%	
8	Awash-Hernia	256,542,439.10	8,251,296.66	3.22%	1096	695	63.41%	
9	Hirna-Kulubi	188,084,957.20	46,913,157.66	24.94%	913	1175	128.70%	
10	Kulubi-Harar	162,178,583.00	15,924,544.32	9.82%	913	1084	118.73%	
11	Addis Ababa-Ambo	172,533,963.00	70,639,441.00	40.94%	913	513	56.19%	
12	Mekenajo-Nejo	138,601,822.00	26,725,799.63	19.28%	730	248	33.97%	
13	Nejo-Mendi	147,769,823.00	19,578,552.73	13.25%	730	225	30.82%	
14	Dera –Magna	269,002,448.85	116,653,518.7	43.37%	1278		0.00%	
15	Addis Ababa-Awasa	310,979,873.00	75,217,827.39	24.19%	1096	391	35.68%	
	Average	390,521,983.70	612,014,664.43	18.05%				14.53
		226,034,798.91	40,800,957.63	18.05%	1008.73	618.57	61.32%	

Source BPR study group of ERA, 2007

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CHAPTER THREE

III. LITERATURE REVIEW

3.1. Definition of Delay

It is the principal dimension measured by schedules Mc Graw-Hill (1998). According to the writer delay to the private owner mean, a loss of revenues through the resulting lack of production facilities and rentable space, as well as through continuing dependence on present facilities. To the public owner, it can mean that a building or facility is not available for use at the planned time. Finally, to the contractor, delay means higher overhead costs that result from the longer construction period, higher prices for materials resulting from inflation, and escalation costs that are due to labor cost increases. Further, working capital and bonding capacity are so tied up that other projects cannot be under taken.

3.2.Classification of Delay

To analyze the reducing method for impacts of delays it is essential to differentiate types of delays in construction contract.

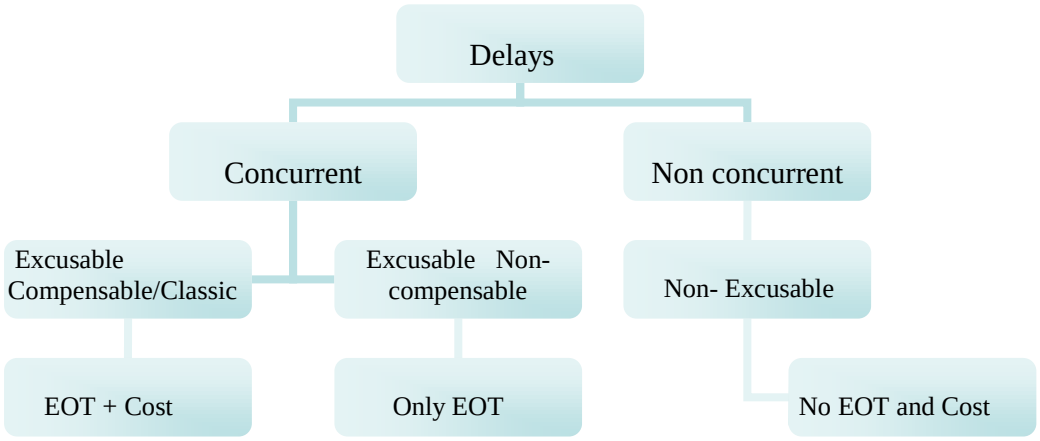

Figure 0-1 Classifications of Delays

3.2.1 Concurrent, Classic and Serial Delays

McGraw-Hill (1998) classified construction delays encountered in construction contracts in to three basic essential categories as:

i. Classic Delay:

These types of delay occur when a period of idealness and/or uselessness is imposed on the contracted work. Harry (1995) classified these types of delays as excusable compensable delays. And they are called also owner caused delays. The contractor is entitled not only an extension of time but also monetary compensation caused by the delay.

The owner is responsible for both the time and cost effects of the delay (Molner 2007). Moreover, the outer states that 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 inactions caused other delays.

ii. Concurrent Delays:

These types of delays occur when work stoppages happen at the same time to separate, parallel activities. Generally, if two parties claim concurrent delays, the court will not try to unravel the factors involved and disallow the claims by both parties. Chang (2007), also, defines a concurrent delay as a delay when the contractor and the owner have both caused independent critical path delays during the same approximate time period.

Harry (1995) states in his writing that, the concurrent delay is considered as an additional delay only to the extent it prologs the delay to the contract completion time beyond the date that the one it is concurrent with had already delayed that date.

iii. Serial Delays:

This is linkage of delays (or some times of different cases of a delay). Thus the effects of one delay might be amplified by a later delay. For instance, if an owner's representative delays review of shop drawings and the delay causes the project to drift into a strike or a period of sever weather, resulting in further delays, a court might find the owner liable for the total serial delay.

3.1.2.Excusable Compensable Delays

Usually these types of delays are known as owner caused delays. If a delay is compensable, then the contractor is entitled to and EOT plus an adjustment for an increase in cost (Molner, 2007).

3.1.3.Excusable Non- Compensable Delays

These are caused by factors that are not foreseeable, beyond the contractor's reasonable control and not attributable to the contractor's fault or negligence, it is excusable (neither party is at fault under the terms of the contact and has agreed to share the risks and consequences). Therefore, if such types of delays are encountered, the contractor will only be entitled for an additional time to complete the work.

3.1.4.Non- Excusable Delays

Non excusable delays are delays, which the contractor either causes or assumes for the risk. According to Ahmed et al (2005) these delays might be the result of inadequate scheduling, mismanagement, construction mistakes, equipment break down problem, staffing problem etc. such types of delays are inherently the contractors responsibility in which he is subjected to contractually imposed LADs.

3.2.Risk Management

There is different definition set by different institutions and writers. According to the Project management Institute, PMI (PMBOK, 2000), a definition of risk should consider both negative and positive effects of project objective. Project risk is defined as "combination of probability of an event occurring and consequences for project objectives", according to the international standard IEC 62198, 2000.

There is no common definition also on the scope of risk analysis and management process. The risk management in it simplest approach, (Simu, 2000), consists of risk analysis followed by the risk response. Risk analysis refers to the inclusion of identification and assessment, see Figure 3.2.

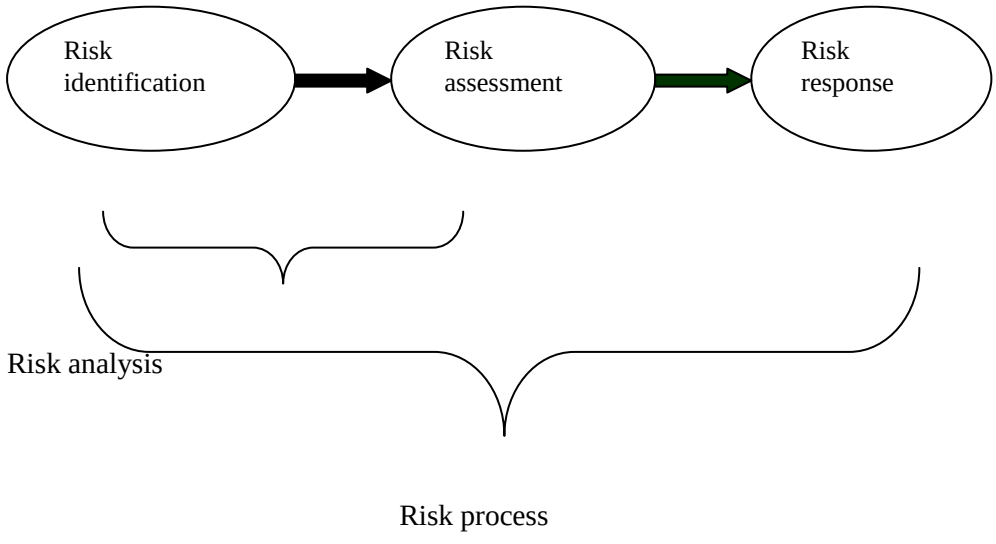

Figure 0-2 the simplest approach of Risk Management System

Risk Identification: has the least systems and tools related to it. The most important and time-consuming step in the above process. The failure to identify correctly in risk management system will result in incorrect assessment and response.

Risk Assessment: there are different tools developed at different times to assess risks. Scoring techniques (Gray, 2005) are developed in way of checklists that include the judgment of both probability and consequences of risk breakdown. Using models or simulation to assess risk is another way to proceed.

Risk Response: is taken to control the risk analyzed in the first two steps. Response is often graded in four levels, namely risk retention, risk reduction, risk transfer, and risk avoidance (Flanagan & Norman, 1993).

3.3.Risk Allocation Caused by Delay

The assignment of responsibility for delay after the fact is often difficult, and the courts have often remarked that delay should be anticipated in any construction projects. Generally, there are four categories of responsibility according to McGraw-Hill (1998). These are:

a. Owner (or owner's agent) responsibility: contractor will be granted for time extension and additional cost.
b. Contractor or subcontractor responsibility: contractors will not be granted for time extension and additional cost.
c. Neither contractual party's responsibility (neutral events): contractor will receive additional time to complete the project but no additional cost will be granted for these caused by neutral events.
d. Both contractual parties responsibility: if both parties contribute to the delay or case concurrent delay, the usual finding that the delays offset one another. An exception would be instances in which the damages can be clearly and distinctly separated.

3.4.Extension of Time

Extension of time(EOT) is the additional time granted to the contractor to relieve it from liability for liquidated and ascertained damages(LADs) and to prove an extended contractual time period or date by which the works are to be, or should have been completed.

3.4.1.Basis of Extension of Time

Failure to complete the construction works according to its prescribed schedule became the reason for the existence of extension of time clause in the contract. Extension of time (EOT) provision and their applications cause more dispute than almost any other aspect of building and civil engineering contracts (James R Knowles). Many disputes could be avoided if employers and their agents (Engineer, Consultant) give due consideration to the reasons for having an EOT provision, and if contracts recognize the need for giving sufficient notice and particulars to enable extensions of time to be granted promptly.

An EOT provision is inserted in a construction contract for the benefit of both the employer and the contractor, its insertion is primarily for the advantage of the employer. If there was no EOT provision, once the employer had caused delay to completion of the works, it would no longer be able to reply on the liquidated damages provision in the contract. In such circumstances, the contractor's obligation would be to complete within a reasonable time in all of the circumstances. (J. R. Knowles, 2005).

Further, even if there is an EOT provision, if the engineer, or the consultant, or employer fails to grant an EOT, with in the period contemplated by the contract, the employer may lose its rights to grant an EOT, and the result would be the same as if there had been no EOT provision, i.e. time would be set at large and the employer could no longer rely on the liquidated and ascertained damages provision on the contract.

3.4.2.Contractual Provisions for EOT

It is essential that the employer protects its interests by ensuring that the EOT clause to be inserted in the contract provides for extensions to be granted in the event of delay caused by the employer, or its agents, or in the event of any delay outside the control of the employer for which the employer is responsible. The extension of time clause permitted extensions of time due to cessation of work by any workmen, inclement weather, or by any omission work, labour or material, or by any other causes beyond the contractor's control. The contract provided that the engineer should order in writing to increase or decrease the quantities of any item/s or to omit any item/s or to insert any additional item/s. There was also other provision for:

- Delayed issue of variation orders
- Orders not given timely
- Suspension of work

The most effective solution is to specify all the causes of delay for which there is power to extend time for completion and to properly select a contractor who is capable of taking any necessary measures to manage these risks.

i. Time for Granting Extension of Time for Completion

Apart from preserving the employer's rights to liquidated damages and allowing the contractor more time for completion, it is essential, for the proper management and planning of procurement and construction, that extensions of time are granted as soon as it is possible to finalize the period of extension, it is good practice to make an interim extension of time for completion, so that the contractor can have a date for planning its works

and placing subcontracts. Some standard forms of contract expressly provide for interim extensions of time, or they can contain provisions for any extension of time which has been granted to be revised at any later date.

The requirement to grant an EOT within the periods contemplated by the contract does not mean that the engineer's opinion is right. The engineer need only consider the delay and grant, or refuse to grant an EOT with in the reasonable period. Provided that there was a genuine attempt to deal with the matter, and the contactor was notified of the extension, or reasons for refusing an extension, with in the period, then the contractual provisions will be satisfied and the employer's rights to rely on the LAD provisions will be preserved. A refusal or insufficient extension which is not based on a genuine attempt to assess the delay (but merely to preserve the liquidated damages provisions) may not be effective. Protracted exchanges of correspondence with no conclusion may not preserve the employer's rights to LADs if it should be subsequently held that no EOT ought to have been granted at the appropriate time.

Delay to completion: a delay to completion is delay that causes the works to continue beyond the contractual completion date. A delay to completion necessarily results in an extended construction period. It is caused by the extension of the period of work of one or more activities on the critical path.

Delay to progress: a delay to progress is one in which the work on site does not follow the current as-planned programme. In other words, a delay to progress occurs if any activity shown on the programme fails to start or fails to finish on the date indicated on the programme. A delay to progress doesn't necessarily affect the project completion date or result in an extended completion date, although it may entitle the contractor to compensation for any direct loss flowing there from. A delay to progress may affect an activity which is in float.

A delay to progress is not the same as a delay to completion, but most of the time the words are connected and, in using them in the same clauses of the contract and lead to confusion. Majority of contractors restrict their notices of delay only to these factors, which in their opinion, have affected or are likely to have an effect on completion. On the other hand, it is some times argued by contractors in the presentation of claims that if a planned activity fails to start or fails to finish on the date shown on their master program (often not even updated) they are entitled to an EOT. This argument is pursued irrespective of weather the phenomenon is a delay to progress only.

Generally, it is only delay to completion that ranks for an EOT and thus excusable and compensable.

It is not unusual for contractors to submit, programmes showing completion of the works earlier than the contractual date for completion. This is not inconsistent with the provision of most standard forms of contract which stipulate that the contractor shall complete the works on or before the date for completion.

Contracts which require contractors to submit programmes using a network are on the increase. When preparing some network contractors usually include float time. When the effect of delaying events is impacted in to the network the effect of these delaying events is calculated automatically.

This gives the contractor some flexibility as to time when he may either start or finish those activities which contain float. It can be extremely useful to take up delays and not affect the completion date. Engineers often argue that where there is float time, no extension (or reduced extension) is necessary if this avoids or reduces the delaying effect they have caused up on the completion date.

ii. Extension of Time for completion under FIDIC 1999 General Conditions of Contract

Extension of time for completion under FIDIC 1999 clause 8.4:

"The contractor shall be entitled subject to sub-clause 20.1 (contractor's claim) to an extension of time for completion if and to the extent that completion for the purposes of sub-clause 10.1(taking over of the works and sections) are or will be delayed by any of the following causes:

a. A variation (unless an adjustment to the time for completion has been agreed under sub-clause 13.3(variation procedure) or other substantial change in the quantity of an item of work included in the contract,
b. A cause of delay giving an entitlement to extension of time under sub-clause of these conditions,
c. Exceptionally adverse climate condition,
d. Unforeseeable shortages in the availability of personnel or goods caused by epidemic or governmental actions, or
e. Any delay, impediment or prevention caused by or attributable to the employer, the employer's personnel, or the employer's other contractors on the site.

If the contractor considers himself to be entitled to an extension of time for completion, the contractor shall give notice to the engineer in accordance with the clause 20.1(contractor's claim). When determining each extension of time under sub-clause 20.1, the engineer shall review previous determinations and any increase, but not decrease, the total extension of time.''

iii. Completion date (CD)

Completion date is the date by which the contractor is contractually obliged to complete the construction contract and hand the works to the employer for use. According to FIDIC 1999, completion date is defined as Time for Completion under sub clause 8.2 as:

"*The contractor shall complete the whole of works, and each section (if any), with in the time for completion for the works or sections (as the case may be), including*

a. achieving the passing of the test on completion, and

b. completing all work which is stated in the contract as being required for the works or selection to be considered to be completed for the purpose of taking over and under sub-clause 10 (taking over of the works and sections).''

iv. Liquidated and Ascertained Damages (LADs)

A fixed sum usually per week or per day, written into the contract as representing the genuine estimate of loss incurred by the owner as a result of the delay of the works by the contractor within the contractual completion period. LADs in some forms of contract are referred to us a delay damages.

v. Change /Variation order

McGraw-Hill (1998) a change order is a formal change to the construction contract that usually includes a change in work scope. Also, with a change in scope, there can be a change in the time to perform the work.

In almost all contracts the owner may, at any time during the progress of the work, authorize additions, omissions, or deviations from the work described in the specifications as here in set forth; and the contract shall

not be vitiated or the surety released there by. Additions, deductions, and deviations may be authorized as follows at the owner's opinion.

- On the basis of unit prices specified
- On a lump sum basis
- On a time and material basis

Further, the contractor must accept this additional work as it is with in the context of the contact. Although the terms additional work and extra work are used synonymously, there is an important legal distinction. Extra work involves the requirement for performance of work entirely independent of the contract. McGraw-Hill states as in public construction contracts and the law describes extra work as; the performance of work and the furnishing of the required labour and material outside and entirely independent of and not necessarily to complete the contract or something done or furnished in excess of the requirements of the contract, not contemplated by the parties, and not controlled by the contract. Additional work; is the work that can be imposed with in the contract documents. It is a change or alteration to the plans or specifications for a number of reasons implicit in the original agreement. These reasons could include, but are not limited to, omissions in the design documents, recognition of better methods or materials to achieve the required effect, resolutions of problems recognized, resolution of unforeseen conditions not anticipated, and similar adjustments with in the intent of the original contract.

Within the context of additional work or change orders, the owner may impose changes to update the equipment, to recognize different functional requirements, and to otherwise improve upon the design. Changes of this nature could potentially be identified as extra work rather than additional work. As work above and beyond the contract, the contractor may choose to refuse extra work or change orders. Generally speaking, the contactor may accept additional work and change orders unless it does not change the scope and progress of the work.

Identifying the origins/causes of typical change orders may emanate from the architect/engineer, field engineer at the job site (unforeseen conditions), and/or the contractor. The basis (i.e. authority and process) for making changes to the contract is usually in the general conditions portion of a Contract. The main causes of change orders are

- Unforeseen conditions
- Scope change (additional or enhancement) by owner
- Value engineering
- Force majeure and
- Acceleration

Project Delivery Methods (PDM)

According to Frederic E. Gould and Nancy E. Joyce the term delivery method refers to the owner's approach to organizing the project team that will manage the entire design and construction process describing how participant are organized to interact, transforming the owner's interest and objective into a finished facility.

i. Traditional or Design Bid Build/DBB Method

For many years, DBB has been the most common method of project delivery for public projects in Ethiopia specially ERA. This method is one of the main reasons for construction time overruns because of; its autonomous work system which provides little opportunity for interaction and team building among the participants; allows late implementation of changes occurred during the construction process; have poor participation of the construction professionals until the design is complete; difficult to reduce the time required to do both design and construction because the process is sequential and linear; have not any system to overlap activities and thus reduce the over all time. Provides little opportunity for integration and team building among the participants and can lead to major break-downs in relationships. Unforeseen condition on a job can also be a source of conflict and may lead to changes in the contract.

ii. Design and Build/DB Method

This method sometimes known as fast track because it tries to solve the problems of construction time overruns through; creating good communication among the contracting parties and professionals, allows easier incorporation of changes due to unforeseen conditions, allows overlapping of the design and construction works, keeps owner staffing to a minimum and puts the full responsibility for good communication, problem solving and project delivery on the design/build team. One major reason for choosing the DB method is to benefit from the good communication that can occur between the design and construction teams developed a smooth flow between design and construction phases of the project. This collaboration allows the project to be easily fast-tracked, cutting down on over all schedules for the project. Good communication between the designer and the construction professionals allows construction input early in the design phase.

iii. Construction Management/CM Method

This method also tries to reduce the construction time overruns through; creating good communication among the contracting parties which encourages collaboration, construction people to influence the design of the project before it is bid, allows fast implementation of changes during the construction course because of the designer, contractor and construction manager are in close communication which these minimizes construction delays.

Proper Recording

Proper record keeping is one of the key elements in resolving construction claims and disputes. The extent of record keeping required for a particular construction job will depend on the type of contract. However, some record keeping will be required in any case because it is:

a. Required by law
b. Required by the terms of contract
c. Needed to control the ongoing work
d. Needed as data for estimating future work
e. Needed for preserving the contractor's rights under the contract

A good set of records that might be kept on a construction project could well include the actual progress of the work; problems encountered, correspondences, minutes of meetings, periodically up dated schedules, productivity records, change orders, shop drawing submittals, inspection reports, clarification memos etc. The daily progress reports are the basis for recording all the events that happen during the life of the project. Site personnel need to be well oriented on how this report should be prepared and what information should the report contain.

Even though proper recording is time consuming it is worth keeping. The importance of record keeping is only understood when problems arise.

3.5.Construction Time Planning

Construction planning is the main activity in any construction management and execution. As Griff (2002), defined it, it is a process of determining, analyzing, devising, and organizing all the resources necessary to undertake a project. The objective of construction planning and scheduling from the principal contractor's stand point, is to obtain and maintain the necessary volume and speed of output, and ensure quality, i.e. to give the client the time value of money, with the best use of resource and time, while giving the greatest economy for principal contractor. This process, construction planning, according to Chris (1998) involves the choice of technology, the definition of work tasks, the estimation of the required resource and duration for individual tasks, and the identification of any inter relationship among the different work tasks. And a good construction plan is the basis for developing the budget and the schedule for work.

The executive process in planning is monitoring. Implementing and monitoring processes with scheduling benefits in reduced construction time, reduced overruns and the minimization of dispute (Callahan et al. 1992, as quoted by Julian 2004). And this benefit accrues to the contractor, owner, suppliers and workers in the form of improvements in productivity, quality and resource utilization (Mattila et al.1998-asquoted by Julian 2004).

The objective of construction planning is , (according to Chitkrar, 2004), to identify discrete activities or tasks that can be planned, estimated, scheduled, executed, and controlled to ensure successful completion of construction projects. In addition the following questions like ,what is to be done , what are the activities, how it is to be done, when it is to be done, where it is to be done, what is needed to do it, who is to do it and who to ensure that is done must be addressed in effective construction planning.

3.6. Phases of Construction Planning

Construction planning at various stages is essential for implementation of project activities and they may be done in the following three stages. Griff (2002)

A. Pre-tender: the planning of the project such that the principal contractor's tender price is based on a realistic construction programme

B. Pre-contract: extension of pre-tender planning to provide the contractor with a contract, or master programme for the site works

C. Contract, short term, sub division of contract, or master programme to facilitate short term planning, which may be undertaken by the contractor before, although more often during, the site work.

A. Pre- Tender Planning

Prepared by the construction planner in consultation with construction management, is used often by the estimator in preparing the tender price for the contract. This program should determine:

a. the overall construction periods
b. the approximate labor requirement
c. the appropriate materials and plant and equipment requirements

To formulate the programme, specific project documentation and information will need to be assembled and analyzed. These documents include the following:

- Condition of contract –likely to include clauses which affect the duration of the project.
- Bill(s) of quantity include elements of works to which time must be apportioned in calculating the unit rate used in the tender.
- Specification and drawings provide the details of the work from which the construction methods, sequence of operations and operational durations will be determined, together with material requirements.
- Project correspondence may raise specific matters which could affect the programme.
- Site visit report-may highlight conditions on the site or within its environs which could affect the programme.

B. Pre- Contract Programming Phase

The principal objective of this is to provide a contract, or mater, programming for the site works. To formulate this programme, all the information that was assembled for the development of pre tender programming will be required, but in greater detail and involving deeper analysis. It includes programs like:

- Methods statement-a summary list of major operations, outlining the construction methods to be used and the principal labor materials and plant resources needed, presented in logical sequence of construction.
- Out line, or draft target, programme
- Contract, or master, programme
- Buildup of operational duration for contract programme
- Calculating duration of labor inputs to the programme
- Calculating duration for plant inputs to the programme
- Programme calculations where unknown quantities are involved
- Preparation of a contract, or master, programme

C. Contract Programming Phase

Using the contract, or master, programme complied during pre-contract planning; contact planning develops sub programmes which are used to guide stages of the project as the work proceeds. Therefore, the contact planning and programming stages focus on interim and ongoing planning mechanism used to monitor and control the construction works. Planning of this type is often referred to as short term planning.

3.6. Construction Scheduling

Sidney (2002) defines scheduling as a tool that provides participants in the project with an ordinary, time related sequence of events to follow in order to effect timely completion of the project. Project scheduling is intended to match the resource of equipment, materials and labor with project work tasks over time in addition to assigning dates to project (Griff, 2000) good scheduling can eliminate program related problems due to production bottlenecks, facilitate the timely procurement of necessary materials, and otherwise ensure the completion of preceding times.

3.7.Scheduling Techniques

Basically, there are three types of scheduling techniques which are used to plan, schedule and control construction projects. These are:

a. Bar Chart
b. Network scheduling
i. Critical path method (CPM)
ii. Project evaluation and review technique (PERT)
c. Matrix scheduling

A. Bar chart

The bar chart is graphically the simplest of the scheduling methods. Most project people understand it, and it can be produced more quickly than any of the other methods. In its most elementary form it may break down a project into three bars reflecting design, bid and award, and construction. According to Jackson, M.J. (1995) when a project is under way, bar charts are useful for monitoring its progress. You can immediately see what should have been achieved at a point in time, and can therefore take remedial action to bring the project back on course.

In summary, E. Gould (2000), bar charts are excellent of time related project information. They are quick and easy to develop and understood by most people. Their major limitation is that interdependencies among activities cannot be shown. Thus, complicated management decisions should be made using other scheduling methods.

B. Network scheduling

I. Critical Path Method (CPM)

It is the predominant way of developing construction schedules. CPM is a logic network that defines the planned sequence of activities. This CPM format is used to develop an as- built schedule. Delaying events are depicted as activities are linked to specific work activities. The critical path(s) are identified twice, firstly in the as-planned schedule and secondly at the end of the project. The difference between the as-planned completion date and the adjusted as-built completion date is the amount of time for which the claimant would request compensation (Aibinu, 2001).

II. Project Evaluation and Review Technique (PERT)

PERT addresses uncertainty in the duration by using tree time estimates. Optimistic, most likely, and pessimistic these estimates then are used to calculate the expected time for an activity Benjamin (1976).

C. Matrix Scheduling

Matrix schedules are typically used for repetitive work, as on a high-rise office building. A quick review of this schedule gives the management team an overall view of the project, including the interdependency among listed actives. Sub-contractors or project people responsible for a specific task need only look at their particular responsibilities and see what proceeds and succeeds their work.

A matrix schedule is good tool for controlling field activities because it can be posted at the field office and updated as the work proceeds. A matrix schedule generally does not consider all project activities but is best used as a coordination schedule to communicate with field or office personal. It may be used for presentation purposes since it presents information in a way that can be easily understood by non technical people. It also presents information in manner that allows for self-correction.

3.8. Causes of Time Overrun

There are many reasons that contribute to causes of time overruns in road projects. Those ranges from; factors inherent in the technology and its management to those resulting from the physical, social, and financial environment.

Shigeru MORICHI in his study on the introduction of time management concept for public work projects in Japan identified six major reasons for time overrun or delay in public work projects with their causes as:

(1) Technological factors include Lack of management skills and Constraints of construction technology to shorten project term

(2) Unexpected factors include unexpected geological conditions, Discovery of underground artifacts of cultural importance and Natural disasters

(3) Budgetary factors include inadequate budgetary resource for optimal project financing and Lack of financial provision for unexpected factors

(4) Administrative procedures include Complexities of negotiation with and consensus building among related public institutions and Lack of standardize procedure regarding time-span for individual's decisions in the process of project planning and implementation

(5) Other legal and regulatory factors: which includes disincentive against shortening the project term, Subsidized public bodies (such as local government) have to pay back the saved cost as a result of completing project before schedule term and Private contractors have to pay penalty for the delay but also have to return the saved cost if term is shortened.

(6) Factors related to stakeholders: Land acquisition, Consensus building among concerned citizens and activism to oppose project implementation

Mezher and Tawil (1998) conducted a survey of causes of time overruns in construction industry in Lebanon from the point of view of owners, contractors and consultants. It was found that owners had more concerns with

regard to financial issues; contractors regarded contractual relationship the most important, while consultants consider project management issues to be the most important causes of time overruns.

Chan and Kumaraswamy (1996) surveyed the causes of construction time overruns in Hong Kong as seen by clients, contractor and consultants, and examined the factors affecting productivity. The results of their research indicate that the five principal and common causes of time overruns are: poor site management and supervision; unforeseen ground condition; low speed of decision making involving all projects team; client initiated variations; and necessary variation of works. These causes were categorized in eight groups:

- Project related factors include project characteristics, necessary variations, communication among the various parties, speed of decision making involving all project teams, and ground conditions.
- Client related factors include those concerned with client characteristics, project financing, their variation and requirements, and interim payments to contractors.
- Design team related factors include design team experience, project design complexity, and mistakes and delays in producing design documents.
- Contractor related factors include contractor experience in panning and controlling the projects, site management and supervisions, degree of subcontracting, and their cash flow.
- Materials related factors include shortages, materials changes, procurement programming, and proportion of off site prefabrication.
- Labor related factors include labor shortages, low skill levels, weak motivation, and low productivity.
- Plant/equipment related factors include shortages, low efficiency, breakdowns, and wrong selection. and
- External factors include waiting time for approval of drawings and test sample of materials and environmental concerns and restrictions.

Abd Majid and McCaffer (1998) studied the factors of non-excusable delays that influence contactor's performance. They classified the main causes of non-excusable delays according to the source of occurrence, and then identified the factors contributing to those causes. It is assumed that the client has more control over the compensable delays and can take action to prevent them. The contractor is expected to have control over the non-excusable delays and presumably, do more to prevent them. They classified the factor of causes of non-excusable delays on to twelve groups. Material related delays, labor related delays, equipment related delays, financial related delays, improper planning, lack of control, subcontractor delays, poor coordination, inadequate supervision, improper construction methods, technical personnel shortages, and poor communication.

Sambasivan et al. (2007) identified ten most main causes of delay and six effects of delay in Malaysian construction industry. The ten most main causes were: contractor's improper planning, contractor's poor site management, inadequate contractors experience, inadequate client's finance and payments for completed work, problems with sub-contractors, shortage of material, labour supply equipment availability and failure, lack of communication between parties, and mistakes during the construction stage. Six main effects of delay were: time and cost overruns, disputes, arbitration, litigation and total abandonment.

Frimpong, et al. (2003) revealed the main causes of delays in construction of Groundwater projects in Ghana included: monthly payment difficulties from agencies, poor contractor management; material procurement, poor technical Performances and escalation of material prices. Koushki, et al. (2005) identified the main causes of delays in the construction of private residential projects in Kuwait included: changing orders; owner's financial

constraints; owner's lack of experience in the construction business; contractor-related problem; and material related Problem.

Wiguna and Scott (2005) studied the risks affecting construction delay and cost overruns in building projects in Surabaya and Denpasar, Indonesia. The most critical risk affecting cost overrun and delay perceived by the building contractors were: high inflation/increased material price; design change by owner; defective design; weather conditions; delayed payments on contract; and defective construction work. Long, et al. (2004), studied the problems in large construction projects in developing countries, a case study from Vietnam. They revealed that the problems could be grouped under five major factors; incompetent designers/contractors; poor estimation and change management; social and technological issues; site related issues, and improper techniques and tools.

3.9.Effects of Time Overrun

The term time overrun in construction context generally has a negative implication for the key stakeholders (client, consultant, and contractor) in particular and the industry in general to the client implies claims, cost overruns (increasing prolongation cost, disruption cost, consultant fees and overhead costs) in return on investment. To the contractor, it implies loss of profit/return cost of extension of bonds (performance bond and bank guarantee) increasing operational and maintenance costs of facilities, creating negative mouth that could put in danger his/her clauses of winning/setting further jobs and to the professional also. To the sector as a whole time overrun could bring about loss of business opportunities, project abandonment and drop in construction activities, bad reputation and liability to secure project finance or securing it at higher cost due to added risk from the major effects of time overrun observed in road projects these are claims, distrust, litigation, cost overrun, cash flow problems, poor adverse relationship among stakeholders (Journal of Ethiopian Association of Civil Engineers, 2003). Hence the concern of the corner of this research is to minimize the impact of time overruns in road projects in Ethiopia caused by the client (ERA) while managing & administering the contracts and schedules.

3.10.Experiences on Reducing the Impact of Time Overrun

The success of construction projects is very important for all project participants as well as the community and the nation to sustain national development. However, various factors affect whether or not a project is completed successfully.

Several researchers conducted studies, recommended and identified the method of minimizing time overrun in construction project. Nguyen, et al.(2004) studied the project success factors in large construction projects in Vietnam. A questionnaire survey was used to collect data from construction practitioners. The following are factors that can be applied as a method of minimizing of construction delays as follows: competent project manager; multidisciplinary/competent project team; availability of resources; commitment to projects; frequent progress meeting; accurate initial cost estimates; accurate initial time estimates; awarding bids to the right/experience consultant and contractor; proper emphasis on past experience; community involvement; systematic control mechanism; comprehensive contract documentation; effective strategic planning; clear information and communication channels; up to date technology utilization; and absence of bureaucracy.

Aibinu and Jagboro (2002) identified two methods to minimize or if possible eliminate time overrun were: acceleration of site activities, and contingency allowance. Koushki, et al. (2005) revealed that the minimization of time delays and cost overruns would require: ensure adequate and available source of finance until project

completion; allocation of sufficient time and money at the design phase; select of a competent consultant and a reliable contractor to carry out the work; perform a preconstruction planning of project tasks and resource needs; hire an independent supervising engineer to monitor the progress of the work; and ensure timely delivery of materials.

Odeh and Battaineh (2002) recommended to improve the situation of construction project; enforcing liquidated damage clauses and offering incentives for early completion; developing human resources in the construction industry through proper training and classifying of crafts man; adopting a new approach to contract award procedure by giving less weight to price and more weight to the capabilities and past performance of contractors; and adopting new approach to contracting such as design-build and construction management (CM) type of contracts.

Sayles and Chandler (1971) recommended that the developments of critical success factors over time are: project managers' competency, scheduling control system and responsibilities, monitoring and feedback, and continuous involvement in the project.

J.Jiang G.kelin and J.Balloun (1996) suggested that clearly defined goal and project mission top management support, a competent project manager, a competent project team, sufficient resources, client/customer involvement and consultation, good communication, responsiveness to clients, proper monitoring and feedback are the factors to be considered in the successful development of the project.

According to Aibinu and Jagboro (2002) the following are methods for minimizing delays:

1. Competent project manager
2. Ensure adequate and available source of finance
3. Multidisciplinary/competent project team
4. Availability of resources
5. Commitment to projects
6. Adopting a new approach to contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors.
7. Adopting new approaches to contracting such as Design-Build (D/B) and Construction Manager (CM) type of contract
8. Complete and accurate project feasibility study and site investigation;
9. Acceleration of site clearance
10. Comprehensive contract documentation
11. Frequent progress meeting
12. Project management assistance
13. Use up to date technology utilization
14. Use of experienced subcontractors and suppliers
15. Complete and proper design at the right time
16. Competent personnel of consultant/designer
17. Competent and capable of client's representative
18. Site management and supervision
19. Use of proper and modern construction equipment

20. Proper project planning and scheduling
21. Accurate initial cost estimates
22. Use of appropriate construction methods
23. Community involvement
24. Proper emphasis on past experience
25. Frequent coordination between the parties involved
26. Absence of bureaucracy
27. Clear information and communication channels
28. Accurate initial time estimates
29. Proper material procurement
30. Developing human resources in the construction industry through proper training
31. Allocation of sufficient time and money at the design phase
32. Awarding bids to the right/experience consultant and contractor
33. Perform a pre-construction planning of project tasks and resources needs
34. Systematic control mechanism; and
35. Effective strategic planning.

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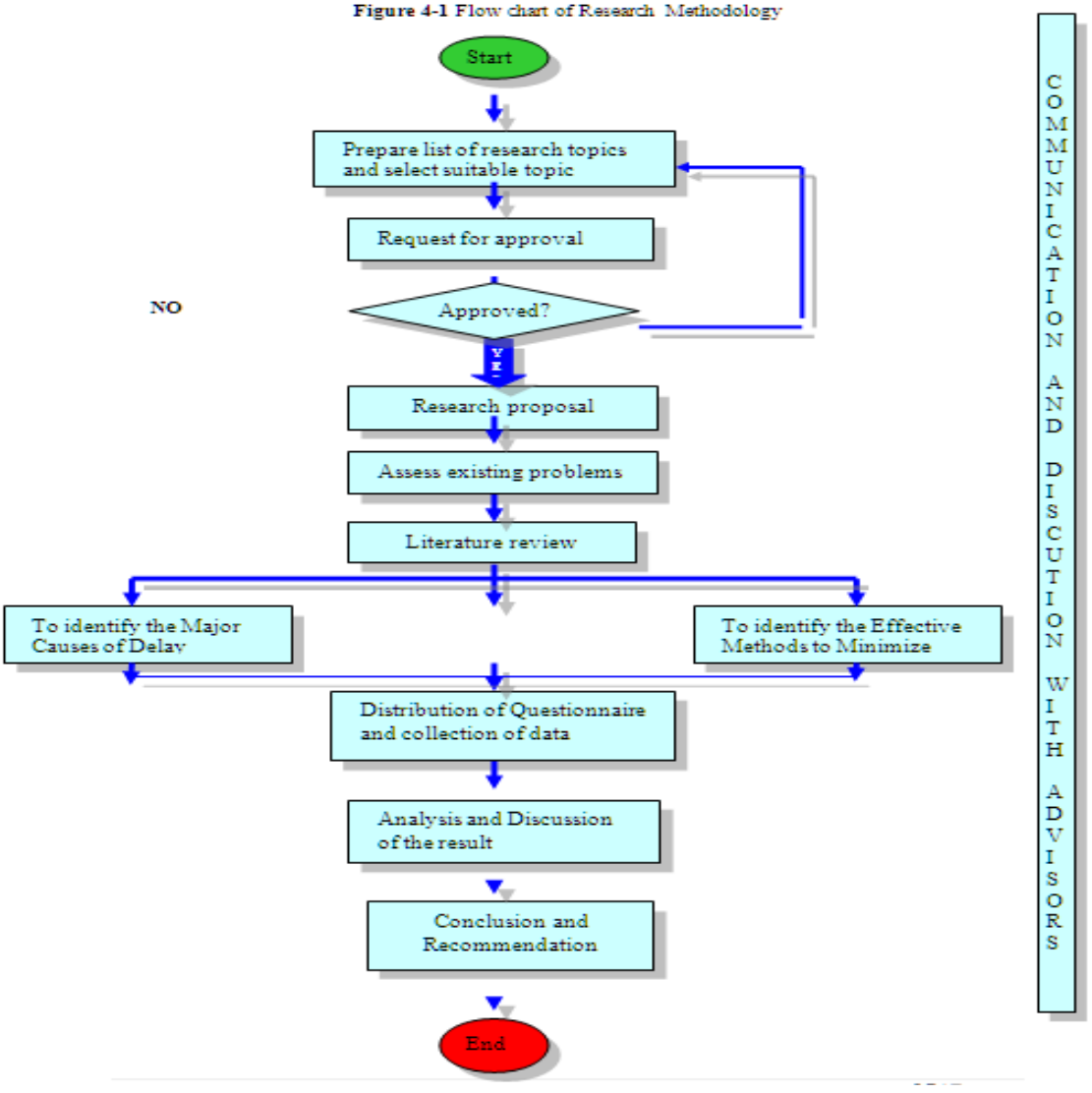
CHAPTER FOUR

IV. RESEARCH METHODOLOGY

4.1 INTRODUCTION

The research methodology will explain how the objective of this study can be achieved. This study was carried out based on the literature review and questionnaire survey with three phases. Phase one was detailed group discussion on desk concentrating on literature review and development of the research instrument. The second phase involved data collection through the questionnaire from the respondents that are involved in construction projects. At the last phase collected data results were analyzed up on which the conclusion and recommendation were made. All the three phases involved discussions with project advisor. The methodology of this study was started from selection of topic then to identification of problem statement, literature review, data collection, analysis of results, discussion of results and forwarding the final conclusion sand recommendations. Figure 4.1 shows a flow chart of the research methodology in order to achieve the objective of the study.

Figure 4-1 Flow chart of Research Methodology



4.2. Questionnaire Design

The questionnaire was designed based on factors that were identified as the causes of delay, effects of delay and methods to minimize the effects. A questionnaire survey was developed to asses the perception of client, contractor, and consultant of the relative importance of causes, effects and methods to minimize construction delay. The questionnaire was developed from literature review that was done through books, magazines and journals, the internet and other sources. And it has four sections: section A; section B; section C; and section D.

Section A: Company and Respondent Profile

This section is to obtain the information about the respondents. The questionnaire includes the following:

- The company in which the respondent represents(serve)
- The experience of the respondent in road construction project
- The experience of the respondent's organization in road construction projects
- Type of organization they are working (i.e. employer, contractor, consultant or others)

Section B: Causes of Delay

This section is to obtain information on factors that contribute to the causes of delay on road construction project in perspective of client, contractor and consultant. There are eight categories with a fifty-six (56) factors that contribute to causes of delay which are structured in table form in the questionnaire. The questionnaire based on Line skirt's scale of five ordinal measure from one (1) to five (5) according to level of contributing. Each scale represents the following rating;

- Five (5) = Very Highly Contribution
- Four (4) = Highly Contribution
- Three (3) = Medium contribution
- Two (2) = Low Contribution
- One (1) =Very Low contribution

Section C: Effects/Impacts of Delay:

This section is focused on information to identifying frequent effects of delay. The respondents were asked to rank individual effects of delay on road projects based on the frequency of occurrence according to their own judgment and work experience on road projects. There are six effects of delay identified based on literature review then constructed to structured table format. The questionnaire based on Line skirt's scale of five ordinal measure from one (1) to five (5) according to level of contributing. Each scale represents the following rating;

- Always
- Mostly
- Sometimes
- Seldom and
- Never

Section D: Effective Methods of Minimizing Delays

This section to minimize the effects of delay based on methods that were identified from different literature reviews. There were sixteen (16) methods identified. The questionnaire based on Line skirt's scale of five ordinal measure from one (1) to five (5) according to level of contributing. Each scale represents the following rating:

- Five (5) = Very Highly Effective
- Four (4) = Highly Effective
- Three (3) = Medium Effective
- Two (2) = Low Effective
- One (1) =Very Low Effective

4.3.Research Sample

The necessary information was collected from stratified categories. All respondents are working in the road project. The three key informants involved in this study were: Client (ERA), Contractors, and Consultants.

4.4.Methods of Analysis

The procedure used in analyzing of data was aimed at establishing the relative importance of various factors that contribute to causes, effects and methods of minimizing road construction projects in the perspective of the Employer.

4.4.1.Relative Importance Index (I)

Odeh and Battaineh (2002), to determine the Ranking of different factors from view point of Contractors, Consultants, and Employers, the relative Importance Index was computed as:

$$I = \sum [(W_i * X_i) / X_i]$$

Where;

i = response category index = 1, 2, 3, 4, and 5 for:

(Section B: Very high~, High~, Medium, Low~, and Not~ contributing.)

(Section C: Always~, Mostly~, Sometimes~, Seldom~, and Never~ Frequent)

(Section D: Very high~, high~, Medium~, Low~, and Very ~Effective)

Respectively

W_i = the weight assigned to *i*th response = 1, 2, 3, 3, 4, 5 respectively.

X_i = frequency of the *i*th response given as percentage of the total response for each factors.

4.5.Summary

In order to achieve the objective of the study, the research methodology has been established. This study was carried out based on literature review and questionnaire survey.

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CHAPTER FIVE

V.ANALYSIS AND DISSCUSION OF RESULTS

5.1.INTRODUCTION

This chapter deals with analysis of information obtained from questionnaire survey and includes identification of the critical causes, effects, and methods for minimizing the effects of delay. The collected data were analyzed using the method discussed earlier in chapter four.

5.1.1.General background information about the respondents

The research is conducted through questioner survey and literature review. The questioners are distributed to randomly selected contractors and consultants that are involved in road sector and to the client (ERA).From the total returned questioner the parties take the following portion.

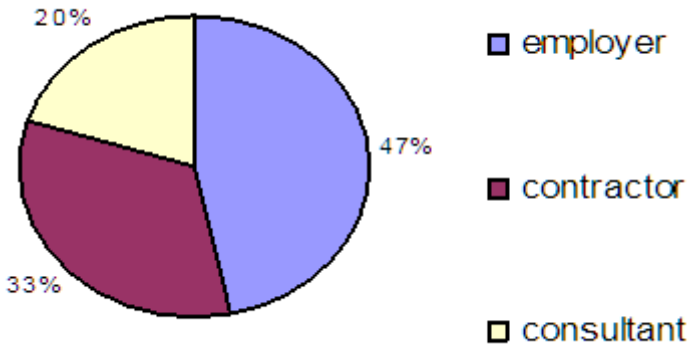

Figure 0-1 Respondent's profile

The respondents work experience in the road sector is also considered in our research to know the background of the respondent in order to ignore the respondents' opinion if the work experience is less than five years.

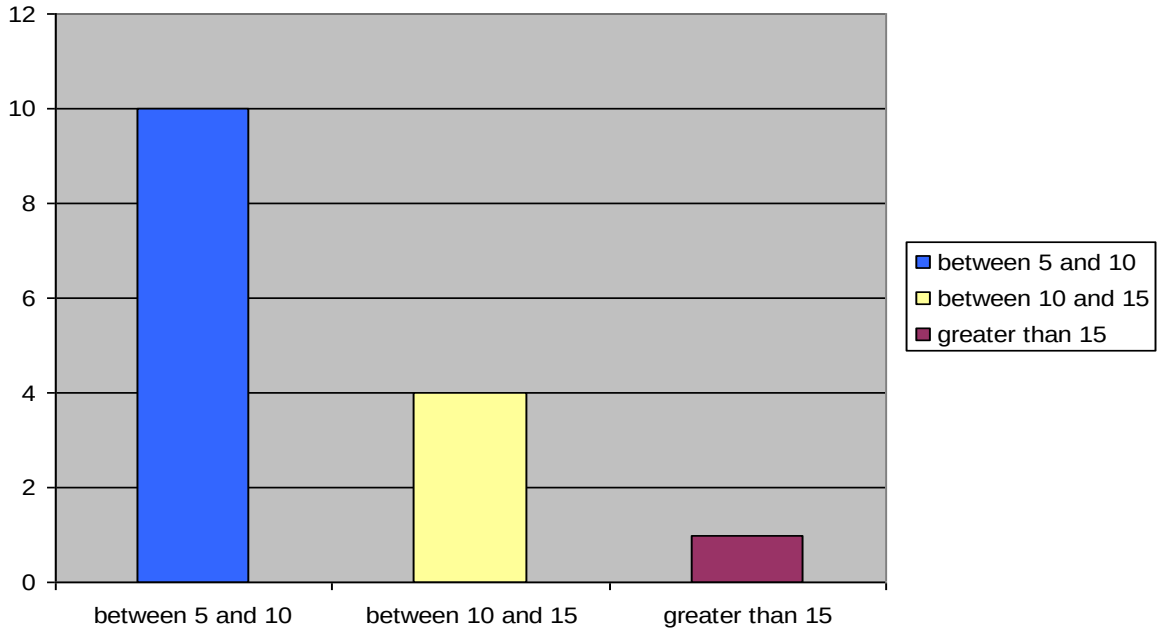

Figure 0-2 Figure work experience of the respondents

5.2.QUESTIONNAIRES RESPONSE RATE

In order to identify the most important factors that cause of delays, common effects of delays and methods of minimizing delays in Road Projects, a total of twenty eight (28) questionnaires were distributed to client(ERA), contractors and consultants . Out of this twelve (12) were distributed to client, and ten (10) to contractors and five (5) to consultants in Road Project, all selected randomly. Out of this twenty eight (28) distributed fifteen (15) were collected from respondents. Table 5.1 shows the response rate of questionnaire.

Table 0-1 sample size, distribution and response rate

Respondent	Questionnaires Distributed(No)	Questionnaires Returned (No)	Return Rate (%)
Client (ERA)	12	7	58.33
Contractor	10	5	50
consultant	5	3	60
Total	**28**	**15**	**53.57**

Factors and Groups that Cause Construction Delay

A total of fifty six (56) major factors that contribute to delay of projects are identified from literature review and forwarded for questionnaire survey. These are further divided into eight groups. In this section, causes of delay are analyzed taking their degree of contribution.

The factors are analyzed in each groups based on their relative importance index from view points of Employers, Contractors, and consultants. Their index are ranked to choose the top contributing factors and are placed in their respective category, Employer, contractor, and Consultant, which are further added and divided to their total number, total average value, to point out the top contributing factors agreed by the three parties.

5.3. Factors of Design Related delays:

There are six factors that contributed to design related delays that are identified from literature review and ranked from the perspective of the three respondents Employer (ERA), his agents (consultants) and contractors.

Table 0-2 Ranking of Factors of Design Related Delays

No	Factors	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Change order or variation	4	3	3.67	2	4.2	1	3.96	3
2	Discrepancy among several documents forming the contract	3.33	4	2	5	3.8	2	3.04	5
3	Incomplete documents								
	3.1 Drawing	3.17	5	2.40	4	3.4	3	2.99	6
	3. 2 Specification	3.17	5	2.67	3	3.4	3	3.08	4
4	Different consultant for the different designs	1.67	7	1.33	6	3	4	2.00	8
5	Insufficient site investigation								
	5.1 Sub-surface soil condition change	4.2	2	4	1	3.8	2	4.00	2
	5. 2 Different site condition	4.29	1	4	1	3.8	2	4.03	1
6	Late delivery of drawing	2.33	6	2	5	3.4	3	2.58	7

From table 5.2 it can be observed that in design related factors contributing to time overrun insufficient site investigation is considered to be the most cause in perception of all the parties, i.e. site differing has the greatest score from all the three parties, sub-soil condition change is the second to take its part, and change order or variation is ranked to third by Employer and his agents (Consultant). Design related delays have shown a good level of agreement by the respondents.

5.3. Factors of Construction Related

There are ten factors which are contributing to construction related delays that are identified from literature review. Their average indexes as perceived by different respondents are calculated as shown in the table 5.3.

Table 0-3 Ranking of Factors of Construction Related Delays

No.	Factors	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Access problem to the road site	2.167	8	1.67	7	3.6	4	2.48	8
2	Late mobilization	4	2	3.67	2	2.8	8	3.49	4
3	Late site hand over due to unpaid compensation to owners	3.67	5	3.33	3	4.6	1	3.87	2
4	Inspection								
	4.1 Un availability of supervisors	2.167	8	1.67	7	2.8	8	2.21	11
	4. 2 Improper or conservative inspection method	2.167	8	1.67	7	3	7	2.28	10
5	Late material supply by contractor due to:								
	5.1 Cash shortage	3.5	6	3	4	3	7	3.17	6
	5. 2 Unavailability of materials	3.6	4	3	4	4	2	3.53	3
	5.3 Poor planning	4.2	1	3	4	3.2	6	3.47	5
6	Lack of labour around the project	1.83	9	2	6	2.6	9	2.14	12
7	Lack of labour during harvest time	1.83	9	1.67		2.4	10	1.97	13
8	Poor sub contractors performance	1.67	10	2.33	5	3.4	5	2.47	9
9	Late delivery of machineries by contractors	3.83	3	4	1	3.8	3	3.88	1
10	Construction reworks	2.5	7	3	4	3.4	5	2.97	7

From table5.3 we can observe that late delivery of machinery by contractors is the cause of delay in road construction projects from the perception of the contractor within construction related delays. Late site handover due to unpaid compensation to owners is the most cause of delay from the perception of the three parties, but it is ranked to be the fifth and third by Employer and his agent respectively. And late mobilization is agreed to be

the second position to contribute for delay of road projects both by the Employer and his agent which is ranked to be in the eighth by respondents from contractor side. One can observe the disparity among the ratings. We assume it to be there exist poor communication among the employer with his agent and contractors or there is denial or disagreement between them which may further need another study. Late supply of materials due to unavailability of materials is another most common factor contributing to the delay of road construction projects. General ranking of this sub-group, construction related, shows higher disagreement between the parties.

2.5. Factors of Financial/Economic Related

There are seven factors which are contributing to financial/economic related delays that are identified from literature review.

Table 0-4 Ranking of Factors of Financial/Economic Related delays

No.	Factors	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Monthly payment difficulties	2.5	2	2.67	1	3	4	2.72	2
2	Delay payment to suppliers/sub contractors	2	4	2.67	1	3.4	2	2.69	3
3	Unreasonable constraint to the client	2	4	2.33	2	1.6	6	1.98	6
4	Client's financial difficulties	1.33	5	2.33	2	3.2	3	2.29	5
5	Contractor's financial difficulties	3.5	1	2.67	1	3.6	1	3.26	1
6	High interest rate	1.167	6	1.67	4	2.4	5	1.74	7
7	Inadequate fund allocation	2.33	3	2	3	3.6	1	2.64	4

From table 5.4 it can be observed that the average index of six causes out of seven is below three. This implies that only one factor has a probability above 50% to cause delay out of all, i.e. contractor's financial difficulty. Financial difficulty of contractors has ranked the highest from all the three parties.

5.4.Factors of Administration/Management Related

There are eight factors which are contributing to administration/management related delays that are identified from literature review.

Table 0-5 Ranking of Factors of Administrative/Management Related Delays

No.	Factors	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Inadequate planning and scheduling by the contractor	3.67	1	4.67	1	4.25	2	4.20	1
2	Staffing problems	3.5	2	4.67	1	3	6	3.72	2
3	Suspension by the employer	1.33	7	1.67	5	3.2	5	2.07	7
4	Suspension by the contractor	1.5	6	1.33	6	2.6	7	1.81	8
5	Failure to update schedules by the contractor	3	5	4	3	3.4	4	3.47	4
6	Failure to control the progress against the schedule by the consultant	3.33	3	2.67	4	3.4	4	3.13	6
7	Lack of co-ordination on site	3.167	4	4.33	2	3.6	3	3.70	3
8	Unrealistic completion time set by the client	3	5	2.67	4	4.4	1	3.36	5

From Table 5.5 it can be observed that inadequate planning and scheduling by the contractor is the first contributing factor to cause delay of road construction project agreed by the three parties. Planning include human resources, staff, failure to do this causes problem. This is observed from the ranking problem of staffing is ranked to be the first by contractors and consultant and second by the employer. From ranking we can observe also Unrealistic completion time set by the client is ranked first by the contractor but it is agreed to be the fifth and fourth by Employer and his agent respectively. This is another ambiguity between the stakeholders, this needs further study.

5.5.Factors of Force Majeure Related

There are four factors which are contributing to force majuere related delays that are identified from literature review.

Table 0-6 Ranking of Factors of Force Majuere Related Delays

No.	Factors	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Adverse weather condition	3.33	1	3.5	1	3.6	2	3.48	1
2	War	1.578	2	2	2	3.8	1	2.46	2
3	Fire	1.33	3	1	3	2.6	3	1.64	3
4	Death or serious accident of workers	1.33	3	1	3	1.4	4	1.24	4

From table 5.6 it can be observed that adverse weather condition ranked only greater than three or (50% chance of occurrence) to be considered as a key delay factor.

5.6.Factors of Labour Related

There are seven factors which are contributing to labour related delays that are identified from literature review.

Table 0-7 Ranking of Factors of Labour Related Delays

No.	Factors	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Low motivation/moral	2.67	2	3.5	2	3.2	2	3.12	2
2	Strike	1.5	6	2	4	2.8	4	2.10	6
3	Absenteeism	1.67	5	2	4	2.4	6	2.02	7
4	Labour supply	2	4	2	4	2.6	5	2.20	5
5	Labour productivity	2.83	1	2	4	3.4	1	2.74	3
6	Shortage of skilled labour	2.5	3	4.5	1	3.2	2	3.40	1
7	Slow mobilization of labour	2.67	2	2.5	3	3	3	2.72	4

From table 5.7 it can be observed that shortage of skilled labour is the factor with highest rank from the average rank of the three parties' response. From view point of the Contractors' labour productivity is the one leading. From Employer and his agent view point low motivation/moral is the first.

5.7.Factors of Equipment Related

There are seven factors which are contributing to equipment related delays that are identified from literature review.

Table 0-8 Ranking of Factors of Equipment Related Delays

No.	Factors	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Inadequate modern equipment	3.167	4	4.5	1	3.4	4	3.69	2
2	Equipment allocation problem	3.167	4	4	3	3.4	4	3.52	4
3	Slow mobilization of equipment	3.67	1	4.33	2	3.4	4	3.80	1
4	Improper equipment	2.8	5	2.5	7	3	5	2.77	7
5	Shortage of equipment parts	3.17	3	3	5	4	1	3.39	5
6	Frequent equipment break down	3.5	2	2.75	6	3.6	3	3.28	6
7	Insufficient number of equipments	3.67	1	3.33	4	3.8	2	3.60	3

From table 5.8 it can be observed that slow mobilization of equipment, inadequate modern equipment and insufficient numbers of equipments are among the main factors from the perception of the three parties.

5.8.Factors of Material Related

There are seven factors which are contributing to material related delays that are identified from literature review.

Table 0-9 Ranking of Factors of Material Related Delays

No.	Factors	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Shortage of construction	3	1	4.33	1.00	4	2	3.78	1

	materials								
2	Poor quality of construction materials	1.67	5	2	6	3.6	4	2.42	7
3	Poor procurement of construction materials	2.5	3	3	4	3.2	5	2.90	5
4	Imported of construction materials	2.5	3	3	4	3.8	3	3.10	4
5	Escalation of materials prices	2	4	3.33	3.00	4.8	1	3.38	3
6	Late delivery of materials	2.67	2	3.67	2.00	4	2	3.45	2
7	Unreliable suppliers	2.5	3	2.33	5.00	3.2	5	2.68	6

From table 5.9 it can be observed that shortage of construction materials, late delivery of materials, and escalation of materials price and imported of construction materials are the major factors of delay in road construction projects from the perception of the three parties

5.9.Ranking of Major Groups that Causes Time Overrun

The survey is based on fifty six (56) factors that were grouped into eight groups of causes of delays. They are ranked based on relative importance index and the viewpoint of employer (ERA) and his agents (consultants).

Table 0-10 Ranking of Major Delay Groups

No.	Major Groups	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Design related	4.36	1	3.68	1	4.80	1	4.28	1
2	Construction related	3.71	2	3.4	2	4.26	2	3.79	2
3	Finance/Economic related	2.12	7	2.33	7	2.97	7	2.47	7
4	Administrative/Management related	2.81	4	3.25	3	3.48	5	3.18	4
5	Force majuere related	1.90	8	1.88	8	2.85	8	2.21	8
6	Labour related	2.26	6	2.64	6	2.94	6	2.62	6
7	Equipment related	3.31	3	3.18	4	3.51	4	3.43	3
8	Material related	2.41	5	3.1	5	3.8	3	3.1	5

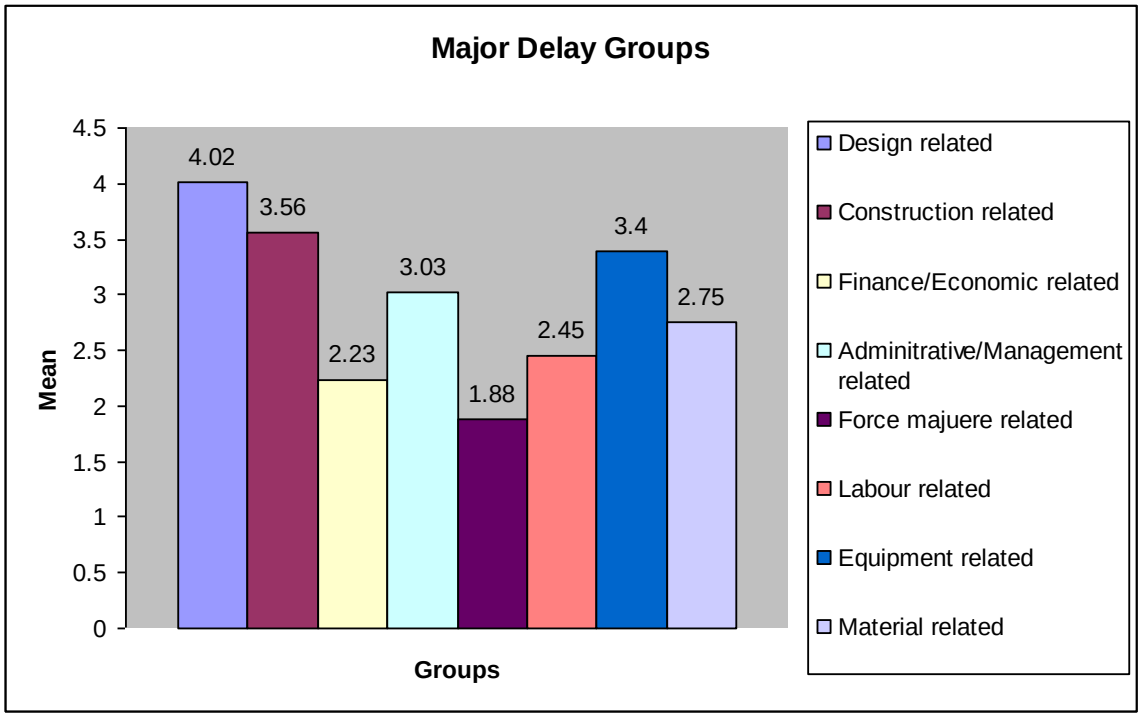

Figure 0-3 Major Delay Groups

From table 5.10 and figure 5.1 it can be observed that design related, construction related, equipment related and administrative related are the major groups that causes delays in road construction.

5.10Ranking of Factors that causes delays

Table 5.9 presents the top eleven ranked factors that contributed to causes of delay based on their relative importance index and from the perspective of employer (ERA) and his agents (consultants).

Table 0-11 Ranking of the Most Common Factors that Causes Delays

No.	Major factors	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Insufficient site investigation								
	1.diffrent site condition	4.2	2	4	4	3.8	5	4.14	1
	2.sub-surface soil condition change	4.29	1	4	4	3.8	5	4.10	2
2	Staffing problem	3.5	5	4.67	1	3	9	4.08	3
3	Change order/variation	4	3	3.67	5	4.2	3	3.83	4
4	Lack of co-ordination on site	3.17	7	4.33	2	3.6	6	3.75	5
5	Shortage of construction materials	3	8	4.33	2	4	4	3.67	6
6	Late material supply by contractor due to Poor planning	4.2	2	3	7	3.2	8	3.60	7
7	Late site hand over due to unpaid compensation to owners	3.67	4	3.67	5	4.6	1	3.50	8

8	Adverse weather condition	3.33	6	3.5	6	3.6	6	3.47	9
9	Late delivery of drawing	2.3	9	4	4	3.4	7	3.2	
10	Failure to control the progress against the schedule by the consultant	3.33	6	4	4	3.4	7	3.00	10

From the top ten factors that contribute to construction delays, three are design related, two are construction related, four are administrative/Management related, and one is material related. From this 33.33% of causes of construction delays are design related.

According to the type of delay, out of top eleven five are excusable and compensable, these are change order/variation, failure to control the progress against the schedule by the consultant, late site hand over due to unpaid compensation to owners, late delivery of drawing, unrealistic completion time set by the client: three are excusable-non compensable, these are adverse weather condition, shortage of construction materials, insufficient site investigation: and three are non excusable and non compensable types of delays. From this it can be concluded that 72.72 % are caused by Employer (ERA) and his agent or other external factors which the employer is responsible for.

5.11.Common Effects of Time Overrun

Table 0-12 Ranking the Common Effects/Impacts of Time Overrun

No.	Effects/Impacts TOs	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Delay	4	1	4.33	1	3.8	2	4.04	1
2	Cost Overrun	3.8	2	3.67	2	4.4	1	3.96	2
3	Dispute	3.5	3	2	3	3.4	3	2.97	3
4	Arbitration	2.2	4	2	3	2.2	5	2.13	4
5	Litigation	1.8	5	2	3	2.4	4	2.08	5
6	Total abandonment	1.17	6	1.33	4	1.6	6	1.37	6

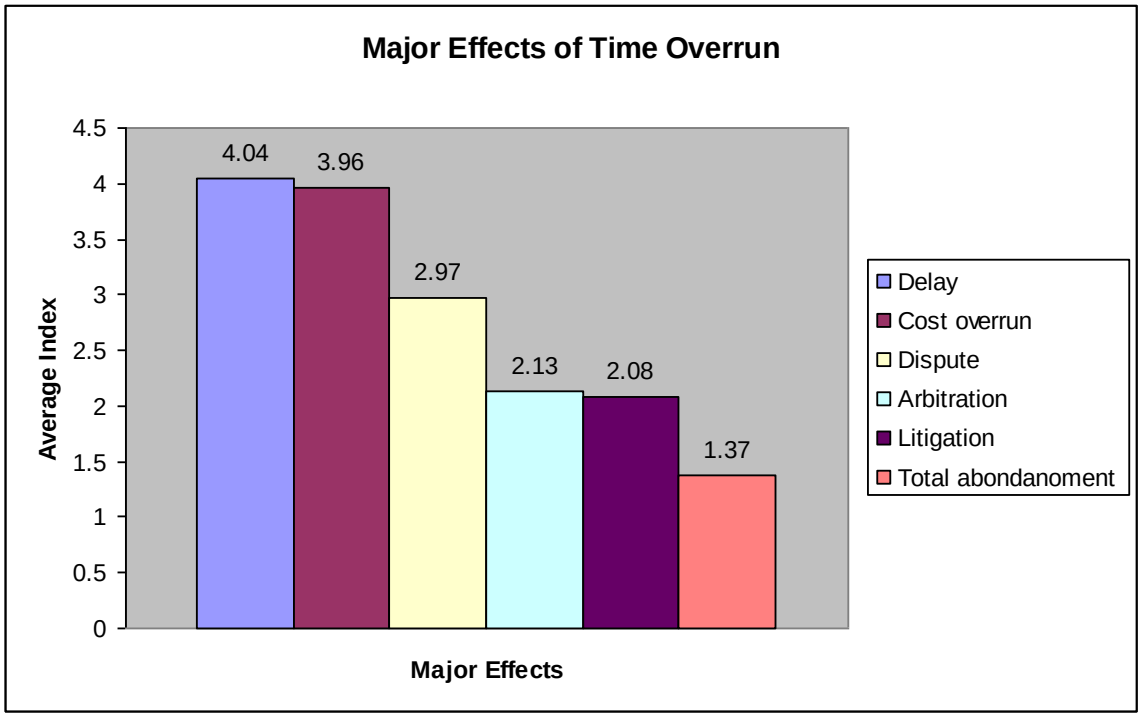

Figure 0-4 Major effects of Time Overrun

In order to identify the common effects of delays six main effects are identified from Literature Review and are ranked based on their average index from respondents perspective.

Table 5.12 shows that delay and cost overrun are the common effects of construction project delay in the perspective of the three parties. In perspective of employers' respondent and his agent (Consultant) again the most common effects in Road construction projects are delay and cost overrun.

From table 5.12, the contributing factors of causes of delay in road construction projects at least five having high influences are related to time overrun, i.e. insufficient site investigation, change order/or variation, shortage of construction materials, late site hand over due to unpaid compensation and adverse weather condition, and at least three high influences are related to cost overrun in road construction projects, i.e. late site hand over due to unpaid compensation, shortage of construction material/price escalation of materials and insufficient site investigation.

Dispute takes the third place in effects of time overrun of construction projects by the three parties that are involved in responding. From the common Top ten common causes contributing to road construction project delays all may cause dispute but adverse weather condition, failure to control the schedule against the schedule by the consultant and are the common to cause. One of the key factors to minimize dispute are adequate and proper site investigation, ensuring complete designs and documents. The Effective Methods of Minimizing Construction Time Delay

In Table 5.13 the top sixteen methods to minimize the effects of Delay are ranked based on the respondents' perspective and they are ranked based on the relative importance index and from the employers (ERA) and his agents' point of view. The result of the table shows that insuring proper Project Planning and Scheduling, availability of resource, competent Project Manager, and complete and accurate project Feasibility Study with good site investigation have made top four effective methods for all three parties. That is resource, planning and

scheduling, effort and good leader ship should always be available through out the project life. Insuring availability of resource, like financial and human, in adequate and required quality up to the end of project progress is the key to start any project. This is achieved through proper planning and scheduling. Efforts, in terms of involving of stakeholders in preparation and documentation of projects, are needed to insure the existence of agreements and collective genuine of professionals in concerned organization as well as for proper project organization. Leadership is the least and last option for existence of good organization. Then leadership with different competencies: ability to lead change, functional competence such as technical and human resource management skill, and personal skills such as high personal motivation achievement and persistence is required to, which the project manager is also required to achieve in addition to technical and managerial skill, search tangible and non tangible in to days time based economy with quote "Time is Money"

Table 0-13 Ranking of Effective Methods of Minimizing Time Overruns

No.	Effective Methods	Employer		Consultant		Contractor		Average	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Competent project manager	4	1	4.67	1.00	3.8	5	4.16	3
2	Multi disciplinary/competent project team	3.83	2	4.33	2.00	4	4	4.05	6
3	Availability of resources	4	1	4.67	1.00	4	4	4.22	2
4	Commitments to project	3.83	2	4	3	4.5	1	4.11	5
5	Adapting a new approach to contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors	3.25	6	4.33	2.00	4.4	2	3.99	7
6	Adopting new approach to contracting such as DB,CM type of contract	3.33	5	4	3	3.75	6	3.69	10
7	Complete and accurate project feasibility study and site investigation	4	1	4.67	1.00	3.75	6	4.14	4
8	Frequent progress meeting	3.67	3	4	3	4.2	3	3.96	8
9	Site management and supervision	3.67	3	3.5	5	3.8	5	3.66	11
10	Proper project planning and scheduling	4	1	4.67	1.00	4.2	3	4.29	1
11	Competent and proper design at the right time	4	1	3.67	4.00	3.4	7	3.69	10

12	Competent and capable of client's representatives	3.5	4	3.67	4.00	3.4	7	3.52	13
13	Accurate initial cost estimates	3	8	4.33	2.00	4.2	3	3.84	9
14	Use of experienced subcontractors and suppliers	3.167	7	3	6	3	9	3.06	15
15	Proper material procurement	3.5	4	3	6	2.8	10	3.10	14
16	Allocation of sufficient time and money at the design phase	3.67	3	4	3	3.25	8	3.64	12

2.6. Summary

The major groups of delay were identified. The main factors from three contracting parties were identified. Out of fifty six the top ten most important factors that contribute for construction time overrun were identified and the top five from employer and his agent (consultant) side are, insufficient site investigation, change order/variation, late site hand over due to unpaid compensation to owners, unrealistic completion time set by the owner, and Failure to control the progress against the schedule by the consultant. The most common effects from perspective of the three parties are identified to be delay, cost overrun, dispute, arbitration, litigation and total abandonment. Out of these the most common effects to the Employer and his agent (consultant) are delay, cost overrun and disputes. To minimize the effects of construction delay top ten methods were identified out of total of sixteen methods. From this, the top ten to minimize the effects of construction delay in the employer and his agent (consultant) sides are recruiting competent personnel or contract administrators, fast decision of site possession or removal of obstructions, fast decision making when problems happen, preparing quality design, complete and accurate project feasibility study and site investigation, multi disciplinary/competent project team, Adapting a new approach to contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors, frequent progress meeting and record keeping, accurate initial cost estimates, preparing competent and proper design at the right time and site management and supervision.

CHAPTER SIX

VI. CONCLUSIONS AND RECOMMENDATION

6.1. Introduction

This chapter presents the findings that are to be concluded from the Literature Review and questionnaire survey with some forwarded recommendations to the Employer (ERA) for its implementation of the road construction projects in Ethiopia.

6.2. Conclusion:

There are three objectives of this study which have been achieved. The first to identify the major employer related causes of delays, the effects of delays, and the method of minimizing delays. Construction delays can be minimized after the causes and their effects are clearly identified and known. The aim of this research is to identify these causes and effects and to come up with an effective method of minimization. Based on the analysis on the previous chapter the following conclusion is drawn.

6.2.1. Major causes of Delay

A total of fifty six (56) causes of delays are identified. The five most important factors that contributed to the causes of delays from the perspective of employers (ERA) and his agents include: insufficient site investigation, change /variation order, incomplete documents (drawing and specification), late site hand over, late issue of drawings, failure to control the progress against the schedule, improper recording, and unrealistic completion time set by the client.

According to their sub group Design related is critical followed by Construction related, Equipment related, Administrative/Management related, Finance/Economic related, Material related, Labour related, and Force Majeure related delays.

6.2.2. Common Effects of Delay

There are six factors that effect delays in construction project which includes: time overrun, cost overrun, dispute, arbitration, litigation, and total abandonment. The results of analysis shown time overrun and cost overrun were the two most common effects of delays in construction project from the perception of the employer and his agents (consultants).

6.2.3. Methods of Minimizing Construction Delays

The third objective of this study was to identify the effective methods of minimizing delays in road construction project has been successfully achieved. A total of sixteen methods of minimizing delays were identified. The most effective methods of minimizing delays includes: recruiting competent personnel or contract administrators, fast decision of site possession or removal of obstructions, fast decision making when problems happen, preparing quality design, complete and accurate project feasibility study and site investigation, availability of resources, frequent progress meeting, Complete and accurate project feasibility study and site investigation, Commitments to project, awarding bids to the right/experience consultant and contractor; multidisciplinary/competent project team; Commitments to project; accurate initial cost estimates, use of appropriate construction methods, performs a preconstruction planning of project task and resources needs; and project management assistance.

6.3. Recommendation:

From this study, some recommendations are given as follows:

(1) Delays in construction projects can be reduced through the joint efforts of participants in the construction industry. Clients, designers/consultants, contractors, suppliers, finance sources, educational institutions, manufacturers, and the government should cooperate to provide the infrastructure necessary for efficient management. A means of achieving this is to formulate and execute a participatory program for the development of the construction industry through a dedicated national agency.

(2) All parties involved in project agreed that delay occurs mostly during the construction phase. Therefore, in resolving those problems, suggestion to increase construction productivity, followed by enhancing the expertise and skill of human resources, and conduct site meetings more frequently. A strategic view of solving delay problems should be considered as an importance of management aspects, the effects of knowledge and information flow between the organization levels, and importance of top management contribution in solving the problems.

(3) From the analysis above it is considered that design related problem is the first cause for time overrun, and in DBB project delivery system design of the project is the task of employer and his agent. In the literature review it is mentioned that DBB is related to time overrun because of: difficulty to reduce the time required to do both design and construction because the process is sequential and linear; lack of system to overlap activities and thus reduce the over all time; its little opportunity for integration and team building among the participants and can lead to major break-downs in relationships. So it is recommendable for ERA to use the new innovative systems of project delivery methods like DB because: of its transfer of design related risk from employer to contractors, its ability to over lap design activities and reduction of over all time; to benefit from the good communication that can occur between the design and construction teams developed a smooth flow between design and construction phases of the project. This collaboration allows the project to be easily fast-tracked, cutting down on over all schedules for the project. Good communication between the designer and the construction professionals allows construction input early in the design phase.

(4) Problems and ambiguities in tender document preparation are also a means for road construction time overruns. So a need to procure a qualified design consultant (i.e. recruiting and assigning of qualified clients representatives), reviewing of the qualified personnel's and introducing of quality assurance systems is due required to minimize road construction time overruns.

(5) Timely removal of obstructions and late issue of site hand over are also the main causes of road construction delays resulting from the poor communication between the Federal and Local Road Authorities and poor organization of right of way departments and responsibilities. Therefore, a need to communicate with the local authorities and strengthen the right of way departments is important.

(6) One of the big problems observed for ERA while managing and administering construction projects is proper record keeping which is one of the basic requirements for solving construction claims and disputes, so a need to have proper recording and keeping is due important.

(7) Selection of best performing contractors and consultants through performance evaluation system and awarding bids to the right/experienced consultant and contractor is also an important way of minimizing road construction delays.

(8) A need to install a fast decision making procedures for problems during the construction contract implementation process are among the effective method in reducing road construction time overruns.

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