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FACTORS AFFECTING TIME PERFORMANCE OF
LOCAL ROAD CONTRACTORS ON FEDERAL ROAD
CONSTRUCTION PROJECTS

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Key Words

ERA	Ethiopian Roads Authority
TP	Time performance
CTP	Construction Time Performance
RSDP	Road Sector Development Program
DB	Design Build
DBB	Design Bid Build
DBST	Double Bituminous Surface Treatment
RII	Relative Important Index
ASCE	American Society of Civil Engineers

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ABSTRACT

In Ethiopia it is common problem to observe time performance problem in almost all road construction projects either completed in the previous years or currently progressing and the situations are still showing little or no improvements.

The factors that result in poor time performance has been dealt by different professional, researchers largely on the magnitude of their effect of various nation construction projects. The aim of this thesis is to identify and evaluate the main factors affecting the time performance of road construction projects particularly on new and upgrading projects which have been executed or being progressing under Ethiopian Roads Authority by local contractors. In the literature review part of this research factors affecting the time performance have been identified and local factors have been added from local experts' recommendations through an interview. About 22 completed and/or on progress under the ERA, RSDP III and IV were sampled for analysis of their time performance with the identified causing factors. A questionnaire survey was conducted on the identified factors under major groups of planning, management, financial, technical, material equipment and labor for the sampled projects. In addition, a case study has been conducted on selected four projects to identify factors that affect the time performance on the specific cases.

As per the weighted rank of the respondent, financial related problems, improper utilization of advance payment followed by financial constraint for construction material and spare parts have been agreed as very important factors that affect the time performance. Through the course of the case study respondents have suggested that ERA shall assist in financing the project with setting rules and regulation to tackle the improper advance payment utilization. In line with this the researcher has learnt that ERA, the client pre-financed projects under the case study by taking into account the seriousness of the issue. On the other hand, poor management which is manifested as unrealistic resource allocation in the planning period and poor site coordination of available resource during the construction period was ranked as the preceding factor.

Finally, selected respondents have been interviewed for their recommendation to curb the ranked factors and to minimize their effect for the upcoming projects.

1.0 INTRODUCTION

Infrastructure development is primary plan for any developing country, and Ethiopia being one of the developing nations will be anxious to implement the same. Among the major infrastructures, construction of road across different parts of the country is taken as the first requirement to facilitate development in other sector. Accordingly, for the successful and timely completion of the government plan, the time performance of private local contractors in the county has to be effective. The performance of every contractor is usually evaluated with respect to the frame work set in the subject agreement mainly; time of completion, quality of work performed, and amount of cost incurred for the construction. Project time performance is considered as poor when the actual completion is found more than the contract time stipulated in the initial agreement for the specific project. As per ERA's RSDP report, almost all projects have poor time performance even some may take above 100% of the contract time. Hence the purpose of this research is to identify the factors that affect the time performance of the selected local contractors that have been participated in the Federal Highway Project since July 2007: the study entertains new and upgrading projects.

Studies on construction industries of developing countries have found a wide range of problems with performance. George Ofori (1994) reviewed and reported poor project performance from many developing countries. Aniekwu and Okpala (1988) identified factors that contribute to poor results on projects in Nigeria, and Abedi and Haxnmond (1997) and the National Construction Council in Tanzania (1993) gave accounts of the situation in Ghana and Tanzania respectively. Different literature mentioned that multiple dimensional factors result in the poor performance of major road project; some found extended even more than hundred (100) percent of the original contract time.

In Ethiopia, contractual arrangements, bidding practices and the procedures of selecting contractors need improvements. There are so many issues raised related to design or technical matters which happen in the design stage that result in negative effect the timing of the project during construction period. Lack of proper planning before construction either by the client or the contractor and financial problems have put their own impacts on timely completion of the

project. The unavailability of rental equipment, poor management of owned equipment and poor workmanships are serious issues facing local contractors in most projects in Ethiopia. There are many indicative factors for poor time performance of Ethiopian road construction such as poor planning, poor site management, poor design, financial problem of the contractor and resources shortage (ERA, RSDP report, 2011). The issues that contribute to untimely performance of selected federal road construction by local firms that involved in the construction phase were address by this research work.

Hence, as different scholars have attempted to identify the factors that contribute for poor time performance for some other developing countries, this thesis would focus on factors that affect time performance of selected completed and ongoing Federal Projects and possible recommendations would also be forwarded to alleviate the difficulties. The main factors that affect the time performance have been identified in the literature review from the work done by different researchers in the past. Moreover, respondent's interviews have also been considered to add the local prevailing factors. Due to time and financial constraints and to minimize the scope of research, this study focused only on completed as well as ongoing projects that have been implemented through RSDP III and IV. Questionnaire surveys which had been distributed for each of the three parties, client, consultants and contractors has been distributed followed by case study on selected projects to rank and in order to analyze the effect of the indentified factor on the project time performance.

Finally, possible recommendation is forwarded as per the foundation of the analysis in order to curb the ranked factors and minimize the problem of time performance for future road projects.

1.1 Problem statement

The government of the Federal Democratic Republic of Ethiopia, through Ethiopian Roads authority, ERA, had implemented three RSDPs (I, II, III) from 1997 to 2010. And since July 2010 it has started RSDP IV. However, although both the former and latter programs have been believed to be affected by poor time performance of the local contractors participated in the period, as to the best knowledge of the researcher the magnitude of the problem has not yet been investigated. Thus, the main target of this study was to find out factors that affect time performance by taking into account the construction contexts of Ethiopia.

The Ethiopian government has recently adopted a strategy to improve contractor performance that includes closer follow up mechanisms during mobilization; it expects the contractor to complete a certain construction in a given period of time. In order to enhance the capacity of local contractors and to make them complete their work as to the plan, the government provides them with some initiatives such as pre-financing the projects to minimize financial problem of the contractors.

RSDP IV has been prepared as part of the National Growth and Transformation Plan where strong emphasis is placed on improving access to rural areas, improvement and maintenance of the main and rural road networks. The plan provides an opportunity to transform the road sector by significantly increasing rural accessibility and improving the condition and standard of the country's road network.

Hence, this research intended to investigate the factors that contribute to poor time performance of local contractors in the federal road sector mainly on new construction and upgrading projects based on data collected through questionnaires from the employer, the contractor and consultant involved in the specific project. Case study on selected projects was made to check and analyze time performance and to find out factors that affect the project time performance. Questionnaire and interviews were used as the research tool to assess the stated problems on ongoing projects (which have already been completed above 60%) and completed in the recent period.

1.2 General and Specific Objectives

1.2.2 General Objectives

The general objective of this study is to find out the factors affecting time performance of ongoing and completed road projects that have been launched under ERA through RSDP III and IV and constructed by local contractors.

1.2.3 Specific Objectives

The specific objectives of the study are:

- To assess and identify factors affecting time performance of local contractors who participate on either upgrading and/or new construction of federal highway projects
- To investigate the major constraints that challenges of local contractors in their manner of managing the time performance.
- To forward possible recommendations on the bases of the findings so that the time performance of the future projects would logically be effective.

1.3 Research Questions

It is common practice to observe poor time performance of almost all local contractors in the federal projects, and the main issues raised in this paper mainly focused on:

- The problems during the tendering stage that contribute as factors for time performance of the construction stage
- Problem depicted during the construction stages in terms of management, finance, resources, etc.
- The major factors that affect the timely performance and any remedial to be taken for the future projects

Generally, depending on the literature reviewed and the point of view of local respondents, the main factors which could affect the time performance of the projects stated were addressed in relation with major groups as: unrealistic target setting, management, finance, technique, construction material, and equipment and labor factors. And these main categories could be divided into related sub groups.

1.4 Research Outline

This research comprises of six main chapters and Annexes which are described as follows:

- Chapter one described introduction which is composed of objectives of research, problem statement of the problem and research questions and gives an overview of time performance in the construction projects
- Chapter two composed of literature review of various work done on the main factors that affect the time performance of construction projects which have been identified by previous researchers

- Chapter three described in detail methodology followed in this research study in order to achieve the required objectives
- Chapter four contains the analysis, description and discussion of the information gathered through the questionnaire
- Chapter five provides the conclusions and recommendations of the thesis
- Chapter six deals with issue which recommend and proposed for further future researcher
- Finally annex included in the research is also attached with this thesis

2 LITERATURE REVIEW

2.1 Introduction

The construction industry, by nature, has many special problems and requirements. The importance of taking measures to improve the performance of the construction industry has now been recognized in several countries at various levels of socio-economic development.

In order to alleviate these problem different countries organized/established different agencies or organizations to hand the problem of project performances. Considering the nature of the industry's needs in many developing countries and the prevailing problems such as, the resource constraints, formation of an agency does not guarantee the success of construction industry development. Hence a number of countries at different levels of development have recently formulated long-term plans for improving their construction industries.

These include: Australia (Australian Procurement and Construction Council, 1997), Hong Kong, (Singapore Construction 21 Steering Committee) and the UK construction task force (Latham, (1994) and Egan rethinking construction (1998)). The reviews have been given impetus by both internal and external trends which indicate a challenging future for each of these construction industries. The trends include the needs of an increasingly sophisticated economy, client demands, technological and social change, and globalization leading to competitive pressures. The initiative in Singapore, which has a successful construction industry development agency (formed in 1984 originally as the Construction Industry and Development Board, which became the Building and Construction Authority in 1999) is a good example of such efforts. The Authority was appointed, with the following terms of reference: (i) to arrive at a vision and role for the construction industry in the 21st century; (ii) to examine the current status of the construction industry with regard to techniques, manpower, management practices and others and benchmark it against the best standards in the world; (iii) to set concrete targets for the construction industry and its workforce in Singapore by taking into account the gaps between current reality and the intended vision; and (iv) to recommend strategies to meet the targets and move the construction industry and workforce towards the intended vision.

The Authority formulated a vision for Singapore's construction industry for the 21st century: "To Be a World Class Builder in the Knowledge Age". Hence the report outlines the outcomes for the Singapore construction industry: (i) a professional, productive and progressive industry; (ii) a knowledge workforce; (iii) superior capabilities through synergistic partnerships; (iv) integrated process for high buildability; (v) contributor to wealth through cost competitiveness; and (vi) construction expertise as an export industry. Egan (1998) suggested that there are significant inefficiencies in the construction industry which can be resolved by implementing a more systematized and integrated project process in which waste in all its forms is significantly reduced and both quality and efficiency improved. He recommended that process modeling could be used as a method to improve the construction performance. Following the Latham and the Egan reports, the construction industry has developed its own set of Key performance indicator to measure its performance.

2.2 Key performance Indicators

Performance measurement and its indicators had been studied for several years. Karim and Marosszeky (1999) defined performance measurement as an operational management accounting including financial and non-financial performance indicators. They stated that performance measurement is a process of re-thinking and re-evaluation of business processes to achieve significant performance improvements of projects. Reichelt and Lyneis (1999) defined performance measurement as a model which treats projects as the complex dynamic system. The key performance indicators are identified by DETR (2000) as an applicable indication of project and/or company levels.

Project performance can be measured and evaluated using a large number of performance indicators that could be related to various dimensions (groups) such as time, cost, quality, client satisfaction, client changes, business performance, health and safety. These key performance indicators enable for measurement of project and organizational performance throughout the construction industry. These KPIs can then be used for benchmarking purposes, and will be a key component of any organization move towards achieving best practice.

The key performance indicators also allow to trace which processes and capabilities must be competitive and distinctive, and which merely need to be improved or maintained. (Cheung et al.

2004). Time, cost and quality are, however, the three predominant key performance indicator. Key performance indicators are further used to evaluate the performance of construction projects. These indicators can be used as benchmark for evaluation of the firm's performance for any particular project and used as future career in the construction sector.

The performance of a specified project may be measured with the key performance indicators. Hence construction companies will be able to benchmark their performance to enable them to identify strength and weaknesses. The key performance indicators enable a comparison between different projects and enterprises to identify the existence of particular patterns. Navon (2005) defined performance measurement as a comparison between the desired and the actual performances. Ugwu and Haupt (2007) classified the key performance indicators as site-specific and project-specific: The key performance indicators may vary from project type and site conditions as critical required by the project type. Early contractor involvement and early supplier involvement give contractors and suppliers the opportunity to give advice and/or specific idea earlier to improve performance.

Neely (2005) described that performance measurement is the process of quantifying the efficiency and effectiveness of actions. For a performance measurement system to be regarded as useful management process, it should act as a mechanism that enables assessment to be made, provides useful information and detect problems, allowing judgment against certain predetermined criteria to be performed.

In general the purpose of the Key Performance Indicators is to enable measurement of project and organizational performance throughout the construction industry. This information can then be used for benchmarking purposes, and will be a key component of any organization's move towards achieving best practice.

2.3 Benchmarking of project

Construction Best Practice Program (CBPP) defines benchmarking as a systematic process of comparing and measuring the performance of the company or project activities against others, and using lessons learned from the best to make targeted improvements. A key performance indicator is used to measure the performance of the process that is critical to its success.

Companies that engage in benchmarking do for two basic reasons; they either attempting to gauge where they stand against key competitor, or they are looking to learn and incorporate successful ideas from best class companies (Acord, 200). Benchmarking is a process of continuous improvements based on the comparison of an organizations process or products with that of identified as best practice. The best performance achieved in practice is the benchmark (McGeorge and Palmer, 1997). Benchmarking is a process of continuous improvement based on the comparison of a process with these identified as a best. Benchmark is a standard of excellence or achievement used to compare and measure against. M.Will (2008), benchmark is the process of comparing one's performance against a benchmark to assess current performance and generate a plan to drive improvements in order to drive performance towards the benchmark level.

Hence the object of benchmarking is to understand the existing process and activities and then to identify an external point of reference or standard by which that activity can be measured or judged. Benchmarking is a management technique aimed at achieving superiority; hence it must be formal and structured approach that is planned, implemented and monitored. Chan Albert and Chan Daniel (2004) obtained that the accurate construction planning is a key determinant in ensuring the delivery of a project on schedule and within budget. It is remarked that there is an increasing global concern about benchmarking best practice measures of construction time performance (CTP) for use by clients, consultants and contractors in the construction industry. Researchers in construction management and practitioners in the construction industry have begun to realize the importance of developing best practice benchmark measures such as construction time performance.

So in order to evaluate project key performance indicators appropriate benchmark has to be set for each performance with respect to each KPI. Among the KPIs construction time is one which is used as measure project performance based on pre set benchmark.

2.4 Performance Measurements

Mbugua et al., (1999) and Love et al., (2000) have identified a distinction between performance indicators, performance measures and performance measurement. According to Mbugua et al., (1999), performance indicators specify the measurable evidence necessary to prove that a planned effort has achieved the desired result. In other words, when indicators can be measured

with some degree of precision and without ambiguity they are called measures. However, when it is not possible to obtain a precise measurement, it is usual to refer to performance indicators. Performance measures are the numerical or quantitative indicators (Sinclair and Zairi, (1995). On the other hand, performance measurement is a systematic way of evaluating the inputs and outputs in manufacturing operations or construction activity and acts as a tool for continuous improvements (Sinclair and Zairi, 1995; Mbugua et al., 1999). In response to calls for continuous improvements in performance, many performance measurements have emerged in management literature. Some examples include: the financial measures (Kangari et al., 1992; Kay 1993; Brown and Lavenrick 1994; and Kaka et al., 1995), client satisfaction measures (Walker, 1984; Bititci, 1994; Kometa, 1995; Harvey and Ashworth, 1997; and Chinyio et al., 1998), employee measures (Bititci, 1994; Shah and Murphy, 1995; and Abdel-Razek, 1997), project performance measures (Belassi and Tukel, 1996) and industry measures (Latham, 1994; Egan, 1998; Construction Productivity Network, 1998; and Construction Industry Board, 1998); as cited in (Mbugua et al., 1999). Cordero (1990) classifies performance measurement based on the method of measurement and area of measurement. The methods of measurement of performance can be in terms of the technical performance, the commercial performance and the overall performance. The areas of measurement are at the planning and design level, the marketing level and manufacturing level etc., and for the overall performance are at the level of a firm or strategic business unit. Furthermore, he proposes a model of performance measurements in terms of outputs and resources to be measured at different levels. Outputs are measured to determine whether they help to accomplish objectives (effectiveness) and resources are measured to determine whether a minimum amount of resources is used in the production of outputs (efficiency).

2.5 Project success

There is still a disagreement between project management researchers as to what constitute project success and how it is to be measured. De Wit (1988) and Pinto (1988) mentioned that it is still not clear how to measure project success since project stakeholders perceive success or failure factors differently. C.S.Lim and M.Z.Mohamed (1999) believed that project success should be viewed from different perspectives of the individual owner, developer, contractor, user, and the general public and so on.

In *Search of Excellence in Project Management*, Kerzner (1998) discusses definitions of Project success, and provides a list of critical success factors that can affect project performance at different stages of a project life cycle. As he mentioned, the definition of project success has changed over the years. In the 1960s, project success was measured entirely in technical terms: either the product worked or it did not. In the 1980s, the following definition for project success was offered : project success is stated in terms of meeting three objectives: 1) completed on time, 2) completed within budget, and 3) completed at the desired level of quality. The quality of a project was commonly defined as meeting technical specifications. Note that all three of these measures are internal to a project, and do not necessarily indicate the preferences of the end user or the customer. In the late 1980s, after the introduction of TQM, a project was considered to be a success by not only meeting the internal performance measures of time, cost and technical specifications but also making sure that the project is accepted by the customer; and resulted in customers allowing the contractor to use them as a reference.

Atkinson (1999) separates success criteria into delivery and post-delivery stages and provides a “square route” to understanding success criteria: iron triangle, information system, benefit (organizational) and benefit (stakeholder community). The ‘iron triangle’, has cost, time and quality as its criteria (for the delivery stage). The post delivery stages comprise: (i) the information system, with such criteria as maintainability, reliability, validity, information quality use; (ii) benefit (organizational): improved efficiency, improved effectiveness, increased profits, strategic goals, organizational learning and reduced waste; (iii) benefit (stakeholder community): satisfied users, social and environmental impact, personal development, professional learning, contractors profits, capital suppliers, content project team and economic impact to surrounding community. This model takes into consideration the entire project life cycle and even beyond. It thus lends itself for continuous assessment. Chan (2004), modeled project success measurement into ‘micro viewpoint: completion time, completion cost, completion quality, completion performance, completion safety; and macro-view points: completion time, completion satisfaction, completion utility, completion operation. A key feature of this model is that it proposes only lagging indicators and gives no room for continuous assessment and monitoring.

2.6 Factors affecting Time performance

According to Albert (2002); construction time has been perceived to be one of the most essential performance indicators among numerous successful projects. Considerable efforts have been

dedicated to the issue of how to benchmark best practice measures of construction time performance for the use in the construction industry. Previous works have modeled the project constructions duration based solely on the scope factors principally represented by construction cost. However, a recognized appreciation of other significant attributes contributing to the construction time has paved the way for further study in which multi- dimensional prediction models were established.

Andi and Susandi (2003) in the Petra Christian University noted that construction time is one key element of performance indicators of a construction project and define time performance (TP) as comparison between actual time (AT) and planning time (PT) to finish a project. $TP > 1$ indicates bad time performance but $TP = 1$ or $TP < 1$ indicated good or better time performance, in which the project is finished on time or faster than planned. The scope of time performance is limited during construction phase only, where the contractor is the main party who is responsible for it. It is assumed also that the assignment of PT is correct.

Okuwoga (1998) stated that cost and time performances have been identified as general problems in the worldwide construction industry.

The failure of any construction project is mainly related to the problems and failure in the performance. Moreover, there are many reasons and factors which attribute to such problems. Ogunlana et al, (1996) stated that the construction industry performance problems in developing economies can be classified in three layers: problems of shortages or inadequacies in industry infrastructure (mainly supply of resources), problems caused by clients and consultants and problems caused by contractor incompetence/inadequacies. The problems shortages are usually expressed in shortage of basic resources such as construction equipment, materials or even skilled manpower. In Ethiopian, problems caused by the client is revealed through delay in clearing right way obstruction on time but poor design and lack of proper supervision and contract administration are problems created by the consultants. Okuwoga (1998) identified that the performance problem is related to poor budgetary and time control. Long et al (2004) remarked that performance problems arise in large construction projects due to many reasons such as: incompetent designers/contractors, poor estimation and change management, social and technological issues, site related issues and improper techniques and tools. Navon (2005) stated that the main performance problem can be divided into two groups: (a) unrealistic target setting

(i.e., planning) or (b) causes originating from the actual construction (in many cases the causes for deviation originate from both sources). The issue of proper target setting with the consideration of the resources availability and capacity of the local firms is important.

Good planning before implementation is a critical requirement for successful delivery of any project. However, there is an indication that there is often an insufficient time and effort for planning construction projects, especially at tender or pre-contract stage. The planning approach or procedure or process used by contractors also varies from company to company and project to project. There seem to be no "best practice" or standardized procedure that is capable of improving the accuracy of predictions of project cost and time.

"If everybody involved in a project can work to an agreed set of processes and procedures, the industry will not only be more efficient, but it will be in a much better position to meet the client's business needs and objectives" (Process Protocol level 2 (1999)).

The term planning is widely used in the construction industry and means different things to different people. Collins Dictionary defines a plan as a scheme; way of proceeding; drawing; mapping; or an arranging beforehand. Mawdesley et al (1997) defined a plan as a detailed scheme or method for attaining an objective. "Detailed scheme" includes the method, the activities to be carried out, the timing of the activities, the resources to be used and the finances required.

Schwartz (1961) suggested "the term planning appeals by its suggestion of considered, orderly and rational action. It implies tidiness, method, system, discipline, regularity and a measure of exactness. It gives the impression that someone is in charge and has a hand on the wheel, and a sense of direction and distinction. It represents cooperation and coordination, and contrast with the inevitable disorder which generally obtains when people or organizations act independently in their own interests with no overall framework into which they are constrained to fit".

Planning of construction work is normally categorized into two major aspects:

(1) Physical planning (this includes the processes of programming, scheduling and organizing of work that is required to complete a project). Programming is considered to be a diagram or a list showing work to be done with associated times.

(2) Financial planning (this is a plan that provides the amount of money that owes into and out of the project and when this happens).

Planning is a process that incorporates the different planning function such as, staffing function, organizing function, monitoring function and controlling function. The planning of construction work is a continuous iterative process with milestones. At each milestone, certain planning deliverables are produced either for communication purpose or as a contract document or both.

The milestones are normally synchronized with the stage of construction as: pre-tender, tender, pre-contract, contract, pre-construction, construction, commissioning, and post-construction stages in turn which each stage produces various planning deliverables done by the various parties involved in the project. The planning especially at the initial stage is critical starting from the assignment of experienced both in technical and managerial skilled project manager; allocating sufficient budget for the project and proper determination of the project time. These all are crucial for the future time performance of the project; either under estimated project cost or construction duration will negatively affect the performance of the project.

In general terms, Construction planning is made up of four main parts: (1) Method statements; (2) Programming and scheduling; (3) Organizational and systems set up; and (4) Site set up and layout. Each of these parts is considered in the context of physical and financial requirements and is made up of a number of components construction and post-construction (K.Gidado 2002).

Hence the employer needs to understand that comprehensive pre-construction planning often produce better performance in time and cost by eliminating none-value adding activities at a very early stage when it is most cost effective to change methods, procedures or even design. It also used to provide sufficient time and budget for the construction.

It will help to focus management's attention on the problems at role level during planning and hence simplify the project key performance controlling function (control of time, cost, quality, safety and end user satisfaction). Among other conditions, preconstruction planning at the right amount of detail and at the right time is an essential ingredient for successful delivery of projects. The other issue which requires proper consideration for better performance of the

project is the method of project delivery and bidding process. The history of contractual arrangements has shown that due consideration is not given for appropriates.

The project procurement and administrative arrangements currently in use in developing countries have been inherited from Western countries which have a different history, culture, collective experience and breadth of construction expertise. These arrangements determine the documentation, procedures and practices in the industry, and specify the roles of the participants and the relationships among them, and hence the networks of power and authority. They stress formality and the following of set channels of communication. Every project shall go through selected procurement process that can easily suited for that project and also easy administrative style that considered the skill, capacity and experience of the available expertise on the local markets.

Ironically, the countries of origin of these procurement arrangements have changed their approaches. For example, after a comprehensive review of the UK construction industry, Latham (1994) advocated the building of trust and a spirit of partnering in an industry characterized by mistrust, rivalries and adversarialism. Moreover, the “traditional” procurement approach, which is still predominant in the Commonwealth countries, is now only one of many possible ones. Furthermore, the influences on the UK construction have come from other industrialized countries, mainly the US. Rwelamila et al (2000) showed that the failure to consider and incorporate cultural traits in the procurement systems of construction project adopted in Southern Africa is a major contributor to the generally poor performance on projects. Studies in other countries might reach similar conclusions.

Darren R. Hale (2009) indicated that different project delivery systems within relatively homogeneous nature have shown different performance. Ibbs et al. (2003) concluded that DB projects outperformed DBB with respect to time, but the results relating to cost were not as convincing. Numerous studies have shown that time can be saved by using the DB project delivery method (Songer and Molenaar 1996; Konchar and Sanvido 1998; Molenaar et al. 1999). Songer and Molenaar (1996) used literature and survey results versus more empirical research. Konchar and Sanvido (1998) collected and analyzed data for 351 U.S. projects comprised of six facility types. They used a multivariate model to examine unit cost, construction speed, delivery speed, cost growth, and schedule growth. They concluded that DBB projects were more likely to

have changes in schedule than DB. They also concluded that the DB project delivery method would show cost benefits. Bennett et al. (1996) conducted a similar study in England that also used multivariate analysis. They compared cost, schedule and quality performance, with their results similar to Konchar and Sanvido. Molenaar et al. (1999) described the evolution of the DB project delivery method and analyzed 104 public-sector Design/ time, and quality data for DB projects, but they do not compare a similar sample of DBB projects within the same organization.

Uhlik and Eller (1999) provide an excellent description of perceived benefits of using DB versus DBB for military medical construction projects, but have no empirical data. They suggest that a shift to DB would decrease the time to design and build new military medical facilities. In 2006, Federal Highway Administration (FHWA) compared project performance of DB highway projects against similar DBB highway projects. DB highway projects were first built under Special Experimental Project 14 (SEP-14) after FHWA started using the DB method in 1990. The cost of projects selected for comparison were less than \$20 million and the researchers selected 11 pairs of comparable highway projects built under these two delivery methods. This report analyzes the project performance using descriptive statistics. The study results show that DB projects had higher cost growth but lower schedule growth in comparison to DBB projects (USDOT-FHWA 2006). Another recent study compared performance of DB and DBB highway projects with project cost higher than \$50 million. The DB projects were selected all over the US, whereas DBB projects were selected from the state of Texas. The total sample size of this analysis was fifteen. The statistical analysis showed that the average cost growth for DB was lower than DBB and statistically significant.

Hence selection of appropriate project delivery system which will best suited for a particular project type, condition, available resources and manpower will be one of the milestones for performance of a project. The organization structure of the contractor is also being considered during the selection of project delivery system. In usual way the DB project needs the design capacity of a contractor in which the contractor is expected to perform both design and construction. In contrary the DBB may be easy for price quotation as the volume of each work item is being known but for that of the DB it may require more engineering discipline for estimation of price with no design on hand. The type of material to be excavated, subsurface

condition, number and type of drainage structures all are not known. Beside the type and standard of the project shall also be properly specified to avoid design approval conflicts.

Dubem I. Ikediashi (2012) has reviewed the performance of Design and Build project with some key performance indicator for the Nigeria construction projects. In his study he put a set of key performance indicators for evaluating of DB projects and to perceive the performance failure of traditional DBB project delivery system.

It can be learnt that project performance especially time performance are affected with two stage of construction stage; pre construction stage and during construction period. The major factors that affect time performance during the preconstruction stage are unrealistic target setting and method of delivery with the appropriate procurement process. In order to evaluate the project time performance it is essential to fix the project duration of a particular project which is equivalent to the volume of work load, resources availability, site conditions, access, precedence requirement of some activity or technical requirements of specialized works. In the Ethiopian context basic problems with project duration is rested to the employer side. The contractor has no any involvement or fixing the time required rather to obey and accept the allotted time and take all the responsibility of performance failure.

The other factor of the pre tender is planning problems. The project delivery which is usually adopted in the country is DBB with limited case of DB system. As different researches dealt with each type of delivery system has great effect on each key performance indicators. Proper planning during the pre tender stage is expected by the employer, planning for section of a project, precedence of consecutive section, allocating sufficient budget, clearing of right of obstructions, assignment of skilled and experienced project manager for monitoring. Insufficient and poor terms of reference will lead to uncompleted and improper design which leads to excessive variation during the implementation stage. Problems associated with selection of designers, lead uncompleted and erroneous design. Too much design error will automatically result negative impact of the time performance of a particular project. Semi-completed or uncompleted design, specification or any document may lead a consequent factor for poor time performance. Completed, detailed and clear design in the case of DBB delivered projects and clearly stated specification in the case of DB best suited for that particular project. It is not uncommon to observe semi-completed design and generalized specification adopted for different

project that result in poor time performance. The contractor with poor or lack of proper planning before the tender stage is the other failure for his performance. The time allotted during tendering will lead poor pricing and poor resource allocations; failure to understand the project with respect to access, weather condition, material availability will lead poor bidding. Assignment of skilled professional for the tendering by the contractor lead substandard document; fails to check his capacity for that project to satisfy him before submitting his proposal.

Good planning before tendering will help the contractor to consider all the possible risks and to plan for alternative mechanism for minimizing the risks. Poor planning is usually failure to predict construction risks and result as one of major factor that affect his time performance during constructions. Good planning also used to anticipate his resource handling to check manpower requirements, equipment requirement either to purchase or to rent, material requirement and his financial capacity with possible credit facilities.

Uncompleted or unreliable documents submitted by the employer and/or the designer may result reduced performance or even suspension which in turn affected the time performance. Failure of the employer or the engineer to deliver all required documents, drawings, test results to the contractor on time will have its own impact. The availability and capacity of all required staff by the contractor and supervision staff as required; assignment of project manager having all the skill and experience is also vital.

Chan and Kumaraswamy (2002) remarked that studies in various countries appear to have contributed significantly to the body of knowledge relating to time performance in the construction projects over the past periods. And they proposed specific technological and managerial strategies to increase speed of construction and so to upgrade the construction time performance. It is remarked that effective communication, fast information transfer between project participants, the better selection and training managers, detailed construction programs can help to accelerate the performance.

Chan and Kumaraswamy (1996) stated that a number of unexpected problems and changes from the original design arise during the construction phase, leading to problems in the cost and time performance. It is found that poor site management, unforeseen site condition and low speed of decision making are most significant factors causing delays and problems of time performance.

Chan and Kumaraswamy (1999) remarked that project complexity, client type, experience of team and communication are highly correlated with time performance.

Any project with lack of good planning is lacks proper mobilization of resources and poor site management. There is a strong relation between project management and project performance. Management in construction industry is considered as one of the most important factors affecting performance of works.

Low Sui Pheng (2005), a project manager is vital and indispensable in any project. While project management is only one of the many criteria upon which project performance is contingent, it is also arguably the most significant as it is people formulating the processes and systems who deliver the projects. Hence the skill, experience of the project manager for handling the project with different characteristic of the project is vital. There have been widespread research studies of personal managerial skills of a project manager affecting the performance of the project. Research aims to study the area of improving a project manager's performance by identifying the working environment variables which affect his performance.

Poor site management is the output of lack of skilled and experienced project manger both technically and managerial skill. The project manager who is key person is important for good site management for better time performance and success of the project. Good and experienced project manager provides the necessary tools for the company to utilize its resources and finance more effectively and efficiently. A successful project requires effective leadership from the project manager. He is responsible for carrying out the project by insuring that all project activities are completed in accordance with time and budget requirements and at the highest level of quality. The undisputed leader of the project team, the project manger has the ultimate responsibility for the success or failure of the project.

“A good project manager will do what it takes to complete the assignment and met the overall project objectives” DOTD Project Delivery Manual 2005

The project manager plans, schedule and directs the project; to have a successful project, a capable project manger follow a project management process which includes project planning, team build(staffing), directing functions and control measures.

A number of studies have been conducted to examine factors impacting on project performance in developing countries. Faridi and El-Sayegh (2006) reported that shortage of skills of manpower, poor supervision and poor site management; unsuitable leadership, shortage and breakdown of equipment among others contribute to construction delays in the United Arab Emirates. The skill of professionals available for the implementation of that specific project has great impact on time completion of specific project.

Most construction especially road projects utilize huge number of equipments. Benjamin (1991) stated that equipment has long been considered as one of the key factors for improving contractor's capability in improving their work efficiently and effectively. But contractors usually face difficulties in getting all the equipments they need, especially capital investments, in the acquisition phase, due to financial constraints. As the project progress to the implementation phase, the problems of the contractors also change. One of the major problems faced during this stage is high breakdown of the equipments mainly due to unskilled operators as well as poor training on equipment utilizations (Edward and Nicholas 2002).

It is evident that underdevelopment of human resources is major factors inhibiting effective planning and implementation of construction projects in the developing countries. This problem is not one of scarcity of skilled personnel at all levels but also of major deficiencies at the managerial levels (Ignatitus 1990). The problem of management deficiencies will leads among other things, to poor planning, organizational instability, excessive bureaucracy, slow decision makings and low productivity. The developing nations is replete with examples of projects which have experienced poor conception, long delays and increased cost as a result of management deficiency. Deficiencies in management and technical skills also manifest themselves in physical areas such as land, communications, equipment and materials. Land may not be available when required because of poor planning and lack of foresight in recognizing difficulties likely to be created by ownership problems, rights-of-way and legal formalities. In case of equipment, breakdowns often occur because of poor maintenance management, low skilled operation and inadequate procedures for purchasing and stocking spares. Moreover, poor equipment management frequently leads to time (Ignatitus 1990).

The availability of skilled and experienced manpower for the implementation of a particular project from the initiation to the commissioning stage is very crucial. Assignment of skilled

project manager for initial planning who will be appointed for preparing standard terms of reference which used as bases for designer, setting appropriate criteria for selecting capable engineer for design works. The number of capacity, experience of skilled professional who will be participated in the design of particular project; a design team which organized full and skilled professional will deliver completed and error free design documents with required specifications. Design documents either no fully completed or numerous error has great impact for the performance of the project during implementations. These erroneous documents are usually resulted from inexperience and unskilled professional in different specialization required in the design stage. Moreover problems associated either in best selection or lack of appropriate professionals at each functional organizational level during the construction stage is also crucial factors for performance of road project in the country. The management capacity of local engineers is under scrutiny.

In most developing countries there is shortage of manager for construction or at the very least a shortage of adequately qualified ones. Developing and upgrading manager is a considerably difficult and time consuming process primarily because experience is so important. Effort to train managers for developing nations in industrialized countries has not been too successful since they are not geared to local conditions. The training in educational and specialized institutions in the developing countries needs considerable upgrading and lacks practical, on the job aspect due to lack of contact with the industry itself. More works also needs to be done in the area of upgrading existing managers, in terms of improving their management skills, teaching them new ones, and persuading them to adapt to technological changes. . In Ethiopia, for example, the Ethiopian Roads Authority has a Training and Testing Branch which gives courses to upgrade workers and supervisors. A rather interesting program somewhat along these lines in Kenya is that of the National Construction Company, established by the government in 1967 to assist African contractors by obtaining work for them, giving them advice and training, and providing them with finance

As per case study performed in Vietnam, The major problems faced by contractors in developing countries that affect their performance have been classified as: (1) problems imposed by the industry's infrastructure, (2) problems of inaccurate information and frequent changes in instructions and failure to meet obligations on the part of clients and consultants, and (3)

problems imposed by their own shortcomings. Research into the delays experienced in high-rise building construction projects in Thailand supports this classification. A recent study on East Asia cross-border construction identified five groupings of obstacles as business environment risk, regulatory restrictions, contractual arrangement, and differences in standards and culture. If the problems and/or obstacles are not solved swiftly, they can cause delays and cost overruns in projects, harm cooperative relationships, reduce efficiency, lead to claims and disputes, and probably invoke litigation proceedings. Other studies relating to industry problems concern causes of time delays and/or cost overruns. Stephen Ogunlana (2004) such studies have been conducted worldwide from developed countries such USA and UK to developing countries.

Hanson et al. (2003) examined causes of client dissatisfaction in the South African building industry and found that conflict, poor workmanship and incompetence of contractors to be among the factors which would negatively impact on project performance.

Ofori (1984) revealed chronic delay in the payments of contractors for work done, lack of credit facilities for the firm, poor communication structures and an unreliable material supply are potential factors that could affect the performance of contractors.

As per the study in Malaysia the three main causes of time-delays were, in order, the number of change orders, financial constraints and owners' lack of experience in construction, Aftab Hameed Memon (2010). It clear that repeated and too much variation orders and design modification, financial constraint for purchasing construction, either to purchase or rent equipment on the contractor side; inexperience client for initial planning or managing during the implementation period are factors that affect the time performance of the project.

Since there are many parties involved in a project, the communication between the parties is very crucial for the success of the project. Proper and effective communication between the parties must be established during the planning stage. Any problem with communication can lead to severe misunderstanding and therefore, delays in the execution of the project. Past studies such as Sambasivan and Soon (2007) and Tumi et al. (2009) indicated that inadequate communications among all project parties was an important reason for delays in the projects, which impeded the job and resulted in problems in the project coordination and schedules.

The World Bank in their procurement of audit of Ghana, the World Bank (1996, 2003), Westring (1997) and Crown Agents (1998) have continuously reported documentary evidence of contracts taking very lengthy periods to reach financial closure and also, often subjected to unnecessary delays, poor coordination and communication structures, fiscal constraints and extensive systems of controls and land ownership disputes.

Several literatures have grouped factors affecting construction time performance into categories of; labors, materials, equipment, site conditions, managerial, financial and others. A research paper conducted in the Western Australia by Kenny Wong (2012) has summarized the factors affecting construction time in different countries with ranking order by different Authors.

Table: 1 Summary of factors affecting construction Time Performance in different countries

Country	Author	Ranking factors for time performance
Malaysia	Sambasivan and Soon (2007)	<ol style="list-style-type: none"> 1. Contractor improper planning 2. Contractor's poor site management 3. Inadequate contractor experience 4. Inadequate client finance and payment for completed work 5. Problems with subcontractors 6. Shortage in material 7. Labor supply 8. Equipment availability and failure 9. Lack of communication between parties 10. Mistakes during the construction stage
	Alaghbari et al (2007)	<ol style="list-style-type: none"> 11. Financial difficulties and economic problems 12. Contractor's financial problems 13. Supervision too late and slowness in making decisions 14. Material shortages 15. Poor site management 16. Construction mistakes and defective works 17. Delay in delivery of material 18. Lack of consultant experience

Hong Kong	Chan and Kumaraswamy (2002)	<ol style="list-style-type: none"> 1. Poor site management and supervision 2. Unforeseen ground conditions 3. Low speed of decision making involving all project team 4. Client initiated variations 5. Necessary variations of works
Ghana	Fuga and Agyakwah-Baah(2010)	<ol style="list-style-type: none"> 1. Delay in honouring certificates 2. Underestimation of the costs of projects 3. Underestimation of the complexity of projects 4. Difficulty in accessing bank credit 5. Poor supervision 6. Underestimation of time for completion of projects by contractors 7. Shortage of materials 8. Poor professional management 9. Fluctuation of prices/rising cost of materials 10. Poor site management
Egypt	El-Razek et al. (2008)	<ol style="list-style-type: none"> 1. Financing by contractor during construction 2. Delay in contractor's payments by owner 3. Design changes by owner or his agent during construction 4. Partial payments during construction 5. Non-utilization of professional construction/contractual management
	Sweis et al. (2008)	<ol style="list-style-type: none"> 1. Financial difficulties faced by the contractor 2. Too many change orders by owner 3. Poor planning and scheduling of the project by the contractor
Libya	Tumi et al. (2009)	

		<ol style="list-style-type: none"> 1. Improper planning 2. Lack of effective communication 3. Material shortage 4. Design errors 5. Financial problems
Turkey	Arditi et al. (1985)	<ol style="list-style-type: none"> 1. Shortage of resources 2. Financial difficulties faced by public agencies and contractors 3. Organizational deficiencies 4. Delays in design works 5. Frequent changes orders/design 6. Considerable additional works
USA	Baldwin (1971)	<ol style="list-style-type: none"> 1. Inclement weather 2. Shortages of labor supply 3. Subcontracting system
Nigeria	Okpala and Aniekwu (1988)	<ol style="list-style-type: none"> 1. Shortage of materials 2. Failure to pay for completed works 3. Poor contract management
	Mansfield et al. (1994)	<ol style="list-style-type: none"> 1. Improper financial and payment arrangements 2. Poor contract management 3. Shortages of materials 4. Inaccurate cost estimate 5. Fluctuation in cost
Thailand	Ogunlana et al. (1996)	<ol style="list-style-type: none"> 1. Shortage of materials 2. Changes of design 3. Liaison problems among the contracting parties

Jordan

Al-Momani (2000)

1. Poor design
 2. Change orders/design
 3. Inclement weather
 4. Unforeseen site conditions
 5. Late delivery
-

Saudi Arabia

Assaf et al. (1995)

1. Slow preparation and approval of shop drawing
 2. Delay in payments to contractors
 3. Changes of design/design error
 4. Shortages of labor supply
 5. Poor workmanship
-

Ethiopia

Abdissa Dessal. (2003)

1. Shortage of spare parts
 2. Untimely payment to contractors
 3. Poor planning and control
 4. Increase in scope (design change)
 5. Different soil and site condition
 6. Unusual rainy weather condition
 7. Poorly equipped contractors
-

As different researches dealt with it, project time performance has affected by different factors among which, unrealistic target setting(planning), causes originating from actual construction, change from the original design, poor site management, unforeseen site conditions, delay in decision making, project type or complexity, experience of staff especially project manager, communication problems between participants, shortage and breakdown of equipments, payment delay and lack of credit facilities, unreliable material supply and other factors will be analyzed by this research for the Ethiopian road construction projects particularly for these executed by local firms. This research is also focus on upgrading and new construction project mainly to minimize time constraints.

In order to identify a comprehensive list of factors affecting the performance of construction projects, following this, the paper reports on the findings of a survey targeting project owners, consultants and contractors, in an attempt to shed some light on how each project party perceives the relative importance of these factors.

2.7 Mechanism to improve Time performance of a project

i. Developing Benchmarking

Benchmarking is an efficient tool for collecting data and information related to competitors' business, financial situations and possibilities for business in the specific market sectors. Benchmarking identifies production-related and other operations in the company that should be improved and goes much beyond the traditional analysis of the competitors. It implies deeper analysis of the best competitors, detailed examination of their achievements and how they did them as well as analysis of operation capabilities and characteristics of competitors' products aimed at taking actions to improve their own performance and business. Benchmarking benefits are well recognized and nowadays companies all over the world increasingly implement benchmarking to improve continuously business functions and products and to strengthen their positions into the global market. Performance measurement and information about performance are very rare in the construction companies. In the last few years, specific performance measurement systems for benchmarking in different countries - Brazil (SISIND), Chile (CDT), United Kingdom (KPI) and USA (CII) were established. Based on their experiences, rules supporting design and implementation of benchmarking system in the construction companies were formulated. These rules are related to choice of indicators, procedures for data collection and availability of the system to all participants in the project. More importantly, the development of a benchmarking tool against best practice in time performance will allow contractors to gauge the gap in performance and to set targets aimed at closing the gap and eventually achieving superiority. Moreover best practice benchmarking will also use to determine appropriate construction time setting. The client shall take all the possible consideration during fixing which used the contractor to execute the work described by the plan and specification.

ii. Risk assessment

The use of risk assessment improves project and construction management practices by helping transportation professionals to focus on the potential significant risk drivers in the planning phase. This practice would also improve cost and schedule performance through better management of potential risks. As per the study conducted in the US that the use of risk assessment has improved project performance and construction management practices which in turn led to low ratings of schedule impact of certain risk drivers. The use of risk assessment lowered the rating of cost and schedule impact for the risk drivers of; changes to unforeseen site environment requirements, poor coordination, inexperienced professional, unforeseen conditions, inexperienced project manager and safety issues, Mohamed F.Diab Ph.D (2012)

iii. Contractors prequalification criteria

Prequalification is a pre-tender process used to investigate and assess the capabilities of contractors to carry out a contract satisfactorily if it is awarded to them. This involves a screening procedure based on a set of prequalification criteria; it has been examined by several researchers (e.g. Hunt et al., 1966; Helmer and Taylor, 1977; Russell and Skibniewski, 1988; Merna and Smith, 1990; Ng, 1992; Holt et al., 1994; Potter and Sanvido, 1994), and a common set of criteria have been identified that are currently in use (Hatush and Skitmore, 1996a). These prequalification criteria (e.g. financial capacity of contractors), however, are only indirect measures of likely performance of contractors in meeting project objectives (i.e. time, cost and quality of the project). For the prequalification process to be logically complete, the effect of the criteria on the predominant project objectives needs to be known. Hatush and Skitmore (1996) have investigated this by a Delphic study in which a consensus was reached by several expert prequalifies via the PERT approach. Hatush and Skitmore (1996) found that all clients use what is implicitly the same type of criteria, but carry in the way they qualify the criteria, with most having to resort to a very subjective assessment based on information provided by the contractors.

They have summarized the criteria as follows

Table 2: Main criteria and sub criteria for Contractor Prequalification and bid evaluation

Criteria	Sub Criteria
Financial Soundness (FS)	Financial Stability
	Credit Rating
	Banking Arrangement and Bonding
	Financial Status
Technical Ability (TA)	Experience
	Plant and Equipment
	Personnel
	Ability
Management Capability (MC)	Past Performance and Quality
	Project Management Organization
	Experience of Technical Personnel
	Management Knowledge
Health and Safety (HS)	Safety
	Experience modification rating (EMR)
	Occupational safety and Health Administration incidence rate
	Management safety accountability
Reputation (R)	Past failures
	Length of time in business
	Past client/contractor relationship
	Other relationships

Ellis and Herbsman (1991) has also suggested additional criteria using time as a means of evaluation bids of highway construction contractors by a method that bidder enters a bid price together with a time to finish the contract, the total combined project bid being covered into cost terms by the formula

$$TB=BP+ (RU \times CT), \dots\dots\dots (Eq.1)$$

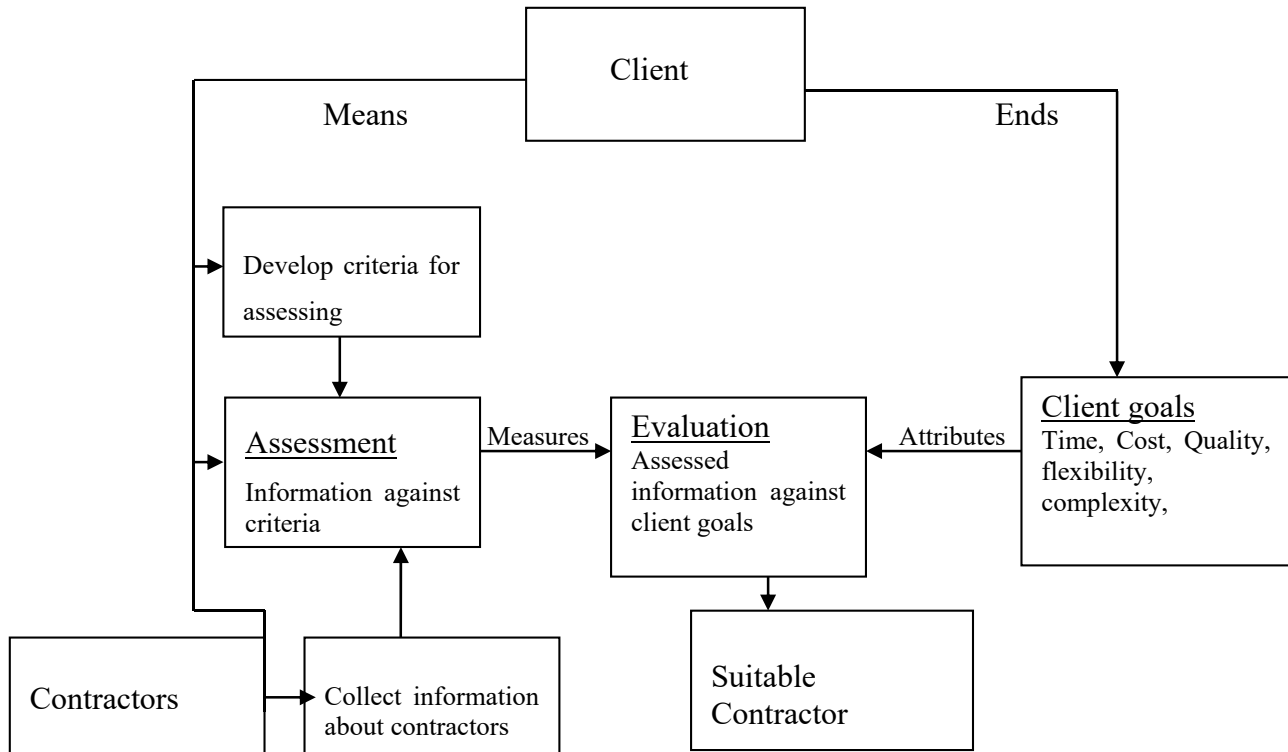
Where TB= total bid;

BP=contractor's bid price;

RU=time value of the road user cost;

CT=contractor's time bid

Fig. 1: Methodology for bid evaluation



Source; Assessment and evaluation of contractor data against, Client goals using PERT approach by Zedan Hatush and Martin Skitmore (1997)

iv. Procurement procedures

It can be learnt from different researchers that more cooperative procurement procedures will have positive effects on many aspects of project performance. The procedure from the design stage, bid invitation, bid evaluation, subcontractor selection, compensation form and performance evaluation have their impact with the project performance.

The design stage is very important for many aspect of project performance, such as life cycle costs, project cost and schedule (Andi and Minato, 2003, Faridi and El-Sayegh, 2006). Adequacy of plan and specifications and a design with high constructability have been indentified to improve overall project performance (Chua et al., 1999). The client can choose varying degrees of detail in the design work. The extremities are to specify the technology in detail (i.e. design-bid-build contracts) or merely the performance and functions of the product (i.e. design-build contracts). In design-bid-build contracts the client performs detailed design work together with consultants before contractors are procured, in order to develop a solid base for competitive

bidding. In design-build contracts, contractors are procured very early based on the project brief or sketchy drawings, after which the contractor performs detailed design. This facilitates solutions with high constructability, due to contractor focused design (Tam, 2000). The drawback is diminished client influence in the design work. Between these extremes, where design relies heavily either on the client or the contractor, there are alternatives in which the client and the contractors together with consultants cooperate in developing the detailed design. As for design-build, the contractors need to be involved early in the design process. This approach is often called joint specification (Eriksson and Nilsson, 2008) or concurrent engineering, since it make parallel and integrated design and construction possible (Brown et al., 2001).

In order to decrease the risk for defective design increased coordination between design and contractors is suitable (Andi and Minto, 2003). Early involvement of contractors in concurrent engineering facilitates cost savings and shortened project duration due to increased buildability. Hence the higher the level of collaboration between client and contractors in the design stage will result in better time performance. Focus on low bid price also increase the risk for cost and schedule growth due to several change orders (Assaf and Al-Hejji, 2006, Wardani et al., 2006).

Factors related to competence and experience, such as poor site management, supervision and planning on behalf of the contractor, are common causes of cost and time overruns (Chan and Kumaraswamy, 1997, Odeh and Battaineh, 2002, Assaf and Al-Hejji, 2006, Sambasivan and Soon, 2007) and poor customer satisfaction (Maloney, 2002). Careful partner selection (through bid evaluation based on suitable soft parameters) considering desired competences, experiences and attitudes can therefore reduce cost growth (Chua et al., 1997, Iyer and Jha, 2005, Wardani et al., 2006) and time overruns (Chan and Kumaraswamy, 1997), and improve quality performance (Yasamis et al., 2002), work environment (Ai Lin Teo et al., 2005), and innovation (Manley, 2008, Bosch-Sijtsema and Postma, 2009). Environmental management systems (EMS) may not guarantee improved environmental performance (Tam et al., 2006a). Instead, relevant training, expertise and commitment among management staff is the most important success factor for improvements in this area (Shen and Tam, 2002, Tam et al., 2006b). Most clients are, however, not committed to environmental performance, but for those who are, the inclusion of environmental management aspects in tendering requirements is important (Shen and Tam,

2002). Hence, bid evaluation based on suitable soft parameters that consider various environmental aspects can improve environmental performance. Compensation based on incentives connected to different aspects of project objectives facilitates economical performance (Tang et al., 2006), time performance (Eriksson, 2009), quality (Eriksson, 2009), innovation (Dulaimi et al., 2003) and a good project performance in total (Olsen et al., 2005). The following table summarized relationship between procurement procedures and project performance (the + sign indicates logical relationship)

Table 3: Relationships between procurement procedures and project performance

Procurement procedures	Success criteria					
	Economic Performance • Overall project cost • Cost overruns	Time performance • project duration • Schedule overruns	Quality • Overall project cost Cost overruns	Environmental performance • Environmental friendly choices and use	Work Environment • Health • Safety	Innovation • Product and process innovation
Design Stage The higher the level of collaboration between client and contractors in the design stage	+	+	+	+	+	+
Bid invitation The fewer the number of contractors that are invited in the bid invitation	+	+	+	+	+	+
Bid Evaluation The higher the focus on soft parameters in the bid evaluation		+	+	+	+	+
Subcontractor Selection The higher the extent both client and contractors are jointly involved in subcontractor selection		+	+	+	+	+
Compensation forms The more the compensation form is based on incentives connected to joint objectives	+	+	+	+	+	+
Performance evaluation The more the performance evaluation is based on contractors self control	+	+	+			

Source: Per Erik Eriksson, Lulea University of Technology, Sweden; *Effects of procurement on construction project performance, (2009)*

Performance-based contracting allows the opportunity for innovation by giving the contractor freedom to choose the construction method and materials to be used, as long as the end product meets the performance measure(s) stated in the contract.

v. Use of alternative Contracting approach

Design-bid-build has been the default contracting approach used by the Ethiopian Roads authority similar to most of other nation for construction of highway projects. Major limitation of this approach includes little or no opportunity for contractors to use experience, innovation, and new technology. Reference to study in the US (Brain Carpenter 2003), alternative contracting approaches impetus by addressing some of the limitations including reducing construction time, developing advanced and improved technologies relating to materials, construction equipments and methods; encouraging contractor innovation, and reducing impacts to public. These alternative contracting approaches includes warranties, design build, cots-plus-time and lane rentals (Brain Carpenter 2003).

- Warranties, fixed price maintenance contracts- incentive for contractors to deliver high quality since the contractor is responsible for the maintenance and repair of the finished product
- Design build- significant reduction in overall project duration, which could be attributed to overlap better coordination between design and construction team
- Cons-plus-time- significant time reduction because there is cost incentive to the contractor to use new and innovative construction techniques and equipment for early project completion
- Lane rental- reduction in the construction time.

Alternative contracting approaches based on the type of project will improve time performance either by involving the contractor in the design process or creating financial advantage for early finish of the project.

vi. Pre tender planning and pre-construction planning

It is important to highlight that comprehensive pre-construction planning at tender/ contract stages can only be brought to fruition if the client is to demand for the information such as programming and schedule, method statement, organization and system set up and site set up as a part of the bid requirement that would be used for tender appraisal. Properly prepared pre-construction planning will provide the contractor the opportunity to appreciate the amount of effort that is required by him and more reliable estimate of time and cost at the tender stage.

It will help to focus management's attention on the problems at role level during planning and hence simplify the project controlling function (control of time, cost, quality, safety and waste), which is normally implemented at role level. This will encourage proper supervision and create a considerable depth of knowledge concerning the role processes on site. This could be captured by the use IT database set in the TMS format and be used continually on future projects for learning and evolving in an adaptive manner. There is a need of a radical change in the processes used by contractors to cost projects. We may need to replace the current methods of measurement with a more detailed approach that is driven by financial and physical planning based upon current knowledge, experience and expertise. To reduce the cost implication of detail pre-tender planning, tendering subcontractors may collectively employ a Project Planning Consultant (PPC) to produce detailed plans for common elements, leaving individual bidders to concentrate on other specialized elements. It must be remembered that good pre-construction planning reduces project complexity. It may be true that time and cost may be up at the first instance of implementation, but from then onwards the process would continue to improve performance and ultimately save time and cost. All experiences have shown that an investment in effective planning is always fruitful and recording of achievements offers opportunities for improvement (Kassim Gidado 2004). The more proper the schedule, the better the productivity of the labor and accordingly the better the time performance of a specific project will be.

vii. Training professional and project managers

An issue to fundamental important is that of the development of human resources and its has become evident over the last decades that their underdevelopment is the major factor inhibiting effective planning and implementation of construction projects in developing countries. The

problem is not only one of scarcity of skilled personnel at all levels but also of major deficiencies at the managerial level, a situation aggravated by dearth of managerial competence in the society at large. If we examine the issue of management deficiencies closely, we find that it leads, amongst other things, to poor planning, organizational instability, excessive bureaucracy, unnecessary legality, slow decision making and low productivity. The nature of human resources problem and its pervasive effects indicate the need for extraordinary action to upgrade managerial and technical skills, broaden their range and increase their totality. Education and training are, consequently, needed at all level and across a wide spectrum of technical disciplines. Programs of education and training at all levels should have as one of the prime concerns of technology progress and changes which leads to development of innovative methods and techniques which are compatible with the local condition. It has been recognized that this deficiency can be reduced by the establishment of in-house or on-the-job programs in the form of short courses, workshops and seminars. Besides, the other important is the increment of labor productivity by means of better wages, close supervision and motivation mechanisms Aftab Hameed Memon (2010).

viii. **Equipment and material management**

As per the different research made in deferent developing counties, the availability of material on the right time and quality has positive time performance value. The contractors should exercise a good material management system which involves both suppliers, to appropriately deliver the materials when needed and also the contractors to have a sound schedule for the deliveries and to select and manage his suppliers. More over proper scheduling from the very early tending stage and strict monitoring of equipment fleet management is among the crucial action to improve time performance of the road construction project

Generally from the previous researches as indicated above the following remedial measures have been considered for improvement mechanism for time performance;

- *Developing of benchmarking*
- *Properly fixing of project duration*
- *Use of risk assessment for expected risk drivers*
- *Selecting proper procurement procedures*

- *Use alternative contracting approaches*
- *Detailed pre-tender and pre-construction planning*
- *Training of professional and managers with motivation*
- *Good equipment and material management*
- *Allocate sufficient budget*

Finally, the paper formulates a number of recommendations in order to bridge the gap between the different perceptions thus improving the level of project performance in the future.

3 METHODOLOGY

3.1 Introduction

This study was conducted on major factors affecting time performance of local road contractors in the federal road construction projects. The thesis basically dealt with the project either new construction and/or upgrading of existing road in which the Ethiopian Roads Authority is a client. In order to find out the possible factors affecting time performance, the research mainly focused on local projects either fully completed or their current progress reached minimum of sixty percent (60%) of the contract work load.

In the literature review, similar studies were conducted in different part of the world; researchers time and time again dealt with the issues of project performance as a whole, identification of key performance indicator, benchmarking of key performance indicator to attain project success, factors affecting these performance indicators and some more on different managerial and contractual measures to minimize these performance hindrance.

These different researches used different methodologies and methods to attain their objectives. Most of them use questionnaires survey, interviewing of selected individuals or groups who have participated in the sampled projects namely project managers, resident engineers and counterpart engineers. By taking into consideration the practiced research format used by researchers in this field of study, the researcher sampled twenty two projects to analyze the causes of their poor time performance: Besides the researcher conducted case studies to strengthen the findings.

Moreover, two selected respondents who involved in more than three sampled projects were asked to comment on the identified problems through questionnaire survey and case studies. This was done to make the experts forward possible solutions for the identified problems on the basis of their rich experience that they developed through their long year of services. This in turn made the researcher to cross check the findings of the study at hand with scholarly suggestions of the experts.

3.2 Methodology used by previous researchers

The department of Civil and Coastal Engineering of University of Florida (2007) studied the alternative contracting techniques on Florida Department of Transportation construction projects in order to evaluate the impact on the project performance. They collected data from different parties in state transport construction in the US. Kenny Wong (2012) has conducted a survey to investigate how project completion time is affected by series of delay factors. He designed questionnaires to assess the experience of engineers in the construction of Western Australia.

Chan and Kumaraswamy (2002) have also conducted a survey in Hong Kong to determine and evaluate the relative importance of the significant factors affecting the construction delay. Basheka (2011) has also adopted to fold method to identify impact factors that are useful for measuring contractors performance in Uganda; first a self administered questionnaires to a group of construction professionals (Engineers, managers which are coordinated by the Uganda National Roads Authority) and secondly conducted in depth interviews with the representative of Uganda National association of Buildings and Civil Engineering Contractors and Ministry officials.

3.3 Study Design

For the purpose of this research, data were collected from aforementioned projects through case study, questionnaire survey and interviews. During the case study an attempt was made to examine both contract completion and ongoing projects through the reports forwarded by consultants. Tendering and contract awarding procedure and regulation that mainly used by the Ethiopian Roads Authority were also assessed. The research design used for this thesis was largely both quantitative and descriptive. Information regarding the companies that performed project in the federal highway project work in the past ten years and current ongoing project were collected from the Ethiopian Roads authority. Moreover, survey data regarding with the factors that contribute to poor time performance were collected through prepared questionnaires to the contractor Project managers, Resident Engineers and Counterpart Engineers of the sampled projects.

3.4 Study area

This research is focused on factors affecting time performance of local road contractors who involved in federal road construction projects mainly on new and/or upgrading work only. The projects which were considered by this research were either fully completed under ERA's RSDP III or whose progress was above 60% under RSDP IV.

3.5 Population

The population for this study was local road construction projects mainly that of new construction and/or upgrading whose employer are the Ethiopian Roads authority. The project which had been completed under RSPD III (from July 2007 to June 2010) and projects whose current progress reached more than 60% of the accomplishment under the program RSDP IV (from 2010/11 to 2014/2015) were considered as a population of the research. Accordingly, a total of twenty two projects were sampled out of thirty two populations which were listed by the Ethiopian Roads Authority.

3.6 Sample size determination

Sampling is the process of selecting a number of study units from a defined study population. Often research focuses on a large population that, for practical reasons, it is only possible to include some of its members in the investigation. Hence we will draw a sample from the total population using Kish (1965) sample size calculating formula at 94% of confidence level;

$$n = n' / (1 + (n' / N)) \dots \dots \dots (Eq. 2)$$

Where:

- N= total number of population
- n= sample size from finite population
- n'= sample size from infinite population= S^2/V^2 ; where S^2 is the variance of the population elements and V is a standard error of sampling population. (usually $S = 0.5$ and $V = 0.06$)

For 32 projects

$$n' = S^2/V^2 = (.5^2)/(0.06^2) = 69.44$$

$N=32$, total number of population

$$n = 69.44 / (1 + (69.44/32)) = 21.9 \sim 22 \text{ projects}$$

Hence twenty two (22) projects will be used as sampled projects

This means that the questionnaire should be distributed to 22 project participants' of which three personnel from each contracting parties; contractors' project managers', Resident Engineer and Counterpart Engineer working on each the 22 project. From the listed projects ten of them were dropped with systematic sampling method; take first two and drop the third continuously which automatically reduced the ten projects from listed population.

3.7 Questionnaire design and contents

A questionnaire is a type of survey where respondents write answers to questions posed by the researcher on a question form. Properly designed questionnaires can be used as an effective and affordable tool for gathering large amounts of data within a relatively short period (Hague 1993). Constructing meaningful and interpretable questions is a complex process and requires careful word selection to ensure that the questions are asked in such a way that they are fully understood by the respondents. This research is basically descriptive type of research which involves gathering of survey data and case study of limited projects.

There are two types of research strategies namely quantitative research and qualitative research (Naoum, 2007). Quantitative approaches seek to gather factual data and to study relationships between facts and how such facts and relationships accord with theories and the findings of any research executed previously (Fellows and Liu as cited in Al-Najjar, J., 2008). This particular research is often qualitative type of strategy which typically involves in-depth interviews, group discussions, artifact studies, projective techniques, and observations without formal measurement. A case study, which is an in-depth examination of one project, is a form of qualitative research.

After the researcher was referring deferent related theories and conducting interviews with two senior respondents, he developed questionnaire survey. (Attached in Annex 1). The questionnaire

was provided with a covering letter which explained the purpose of the study, the way of responding, the aim of the research and the security of the information in order to encourage high response.

3.8 Case study

Besides, conducting questionnaire survey on the selected twenty two projects, this research also used case study on randomly selected four projects for prevailing factors affecting their time performance. Case study is an ideal methodology when a holistic, in-depth investigation is needed (Feagin, Orum, & Sjoberg, 1991). Case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships. The unit of analysis is a critical factor in the case study. It is typically a system of action rather than an individual or group of individuals. Case studies tend to be selective, focusing on one or two issues that are fundamental to understanding the system being examined.

For the case study data such as contract completion report from the client or the consultant for completed project; progress report of the ongoing projects were collected. Based on the current progress and condition of their time performance, identified factors for poor time performance were analyzed as per the set questionnaires.

Yin (1994) identified six primary sources of evidence for case study research. The use of each of these might require different skills from the researcher. Not all sources are essential in every case study, but the importance of multiple sources of data to the reliability of the study is well established (Stake, 1995; Yin, 1994). The six sources identified by Yin (1994) are:

- documentation,
- archival records,
- interviews,
- direct observation,
- participant observation, and
- Physical artifacts.

For the purpose of the case study, the following documents were collected for analysis:

- Works contract document to take proposed project duration
- Actual completion date or current completed percentage with todate elapsed time
- Problems recorded in the project (or with interviewing the representative of the three parties)
- Variation order, time extension including any justification with them
- Resolved and pending claim issue, if any
- Site and head office professional organization and availability
- Data related to the list factors under the literature review

4 DATA ANALYSIS

4.1 General information

Table 4: Name of party of the respondent with their frequency

Name of the party	Number of respondents	Percent
Client(ERA)	12	27.91%
Consultant	14	32.56%
Contractor	17	39.53%
Total	43	100%

Sixty six questionnaires were distributed to construction sectors mainly for twenty two for each party that consist of client counterpart engineers, consultant resident engineers and contractor project managers and/or project coordinators. The total respondent rate was found as 65% comprised of forty three respondents; twelve from the client side, fourteen from the consultant and seventeen from the contractor.

The respondents were generally involved on each respected project as counterpart engineers, project managers, project coordinators and resident engineers and who have minimum of first degree in civil engineering.

4.2 Respondent backgrounds

Part one of the questionnaire is to obtain general information about the involvement of the respondents. It consist of information related to their organization type, their project delivery system, method of procurements, method of planning and evaluation schedule, communication method and practices, method of contract time determination and percentage of time performance of their specific project. From the respondents, 27.91% is from the client side, 32.56% is from the consultant side and 39.53 % is from the contractor side.

As per the respondents; all projects except one (that mistake DBB for BOT) put into practice Design Bid Build (DBB) as a system of delivery. Seven projects used CPM and Bar chart, four projects used CPM and five projects used Bar chart methods are adopted for planning and scheduling. It is responded that major projects were evaluated, monitored and/or updated in

most cases with weekly and monthly time intervals. Most common communication systems were using letter, site meetings and verbal discussions. Most of the respondents noted that the pre-construction planning is mostly crucial factor for poor time performance and they recommended that it should be important to incorporate as part of the contract document. As per the respondents, most project time performance was observed to have time performance increment of 40 to 60% from the original contract time. More than 62% of the contractor project managers responded that the contractor was highly responsible for the poor time performance. As to the respondent the employer usually monitored the project in monthly basis. The client usually adopted letters, site meetings and verbal discussions for communication practices. The counterpart engineers also confirmed that the contractor was highly responsible for their project time performance.

The consultants responded that the project time performance was usually monitored monthly and quarterly time interval. The communication mechanisms were similar to that of the client. They also indicated that the pre-construction planning was the crucial for project time performance, but they did have reservation on the necessity of including the pre-construction planning in the contract document part. Most resident engineers and consultant representatives (85.7% of the respondents) firmly blamed the contractor for poor time performance.

Almost all projects except one, DB project, approached through the questionnaire revealed poor time performance. Therefore, on the basis of the addressed findings so far and the data presented below, it could be possible to say that there were undoubtedly certain factors that affect the time performance in every project.

4.3 Factors that affect project time performance

The factors that affect project time performance in this research were taken from the literature review and with some addition from the expert interviews. The factors investigated under this study were grouped under pre-construction planning, management factors, financial factors, technical factor, material factors, equipment factors, and construction workers factors.

4.4 Respondent Data Analysis

The response from each party was separately evaluated for the ranking of the basic factors affecting the project time performance.

Results have been divided and separately discussed for each party for each factors. Referred the table 5 below; respondents were requested to rank the factors using a Likert scale as:

Table 5: Likert scale for ranking factors

Description of Weightings	Scale
Extremely Important	5
Very important	4
Moderately important	3
Slightly important	2
Not important	2

Accordingly the rating scale is arranged as follows

1. Not important ($1.00 \leq \text{average index} < 1.50$)
2. Slightly Important ($1.50 \leq \text{average index} < 2.50$)
3. Moderately important ($2.50 \leq \text{average index} < 3.50$)
4. Very Important ($3.50 \leq \text{average index} < 4.50$)
5. Extremely Important ($4.50 \leq \text{average index} < 5.00$)

This five point scales were converted to a Relative Important Index(RII) for each individual factor using the following formula, as adopted by Kumaraswamy and Chan (1997, 1998), Assaf et al (1995) and Iyer and Jha (2005):

$$\text{Relative importance index (RII)} = (\sum w \div (H \times N)) * H \dots\dots\dots (\text{Eq. 3})$$

Where w is the total weight given to each factor by the respondents, which ranges from 1 to 5 and is calculated by an addition of the various weightings given to a factor by the entire respondent; H is the highest ranking available (i.e. 5 in this case) and N is the total number of respondents that have answered the question. (The calculated RII for each factor is attached in the annex of the thesis)

From the analysis, all respondents from each party scored RII greater than 4 (four) for unrealistic resources assignment, improper utilization of advance payment, budget shortage for purchasing construction materials and spare parts and late delivery of materials in terms of the degree of contribution to poor performance of project time. If the construction of a specific project consists of good planning, it will pave ways to anticipate the resource requirements, to check manpower requirements, equipment requirements either purchased or rental, and to identify material and financial requirements. It is common practice that 20% of the project amount is released as advance payment by ERA in order to disburse for the project to facilitate mobilization and similar expenses especially at the beginning of that project. But the contractor usually utilizes the part or full of the released amount for different purposes which do not go in line with the already proposed plan such as purchasing of new equipments. Consequently, the project fails to commence as scheduled and actual works start late which result in bad time performance just at the beginning of the project. Thus, when advance payment is disbursed improperly, the projects face financial shortage for purchasing construction materials and spare parts. According to Alaghbari (2007), El-Razek (2008) and Sweis (2008) project which face financial difficulties or cash flow shortage will result in poor time performance. Okpala and Aniekwu (1998) has indicated that material shortage in the Nigerian projects has negative impact on time performance of a project, similarly it is underlined that delay in material delivery was one of the very important factor for bad performance of project in Ethiopia too.

The client responded (RII=4.33) for improper utilization of advance payment and rising material cost as first factors for poor time performance since they make the contractors fail to commence project and delay in mobilization. Similarly, the project managers also ranked (RII=4.59) first claiming that they were tired of their head office for their inability to supply the required resources on time. But the resident engineers ranked third (RII=4.29).

The client counter parts ranked first the rising of construction materials cost, but the contractor project managers and the consultant ranked ninth (RII=3.88) and seventh (RII=3.93) respectively for the rising cost of materials.

Similar to Chan and Kumaraswamy (1996) Poor estimation of quantities and unforeseen site condition which are both design related problems with RII=4.25 and RII=4.17 are ranked second and third by the counterpart engineers for their impact which usually leads the client for time

extension. The initial bid quantities have increased and the contractor need additional time for the construction. Similar impact has concurred with the case study; two projects in the case study were forced to extend from their original completion time mainly due to an increase volume of rock excavation and change of unforeseen subsurface condition for bridge foundation.

The resident engineers ranked planning related problems such as; lack of budget allocation (RII=4.57) followed by poor controlling of resources (RII=4.36) first and second factors for project poor time performance. Tumi (2007) and Samasivan (200) have indicated that improper planning ranked as the main factor for bad time performance. Chan (2002) has also indicated poor site management in controlling of resources as key factor for project bad performance. However, client has ranked ninth (RII=3.67) and seventh (RII=3.83) while contractor ranked fourth (RII=4.24) and sixth (RII=4.06) respectively.

Besides, the improper utilization of advance payment, the consultant also ranked poor leadership of project manager, equipment maintenance problem (RII=4.29) as the third factor for bad time performance. Similarly, Low Sui Pheng (2005) stated the importance and impact of the project manager for time performances of a project.

Similarly, the contractor project managers have responded, improper utilization of advance payment (RII=4.59), financial problem for spare parts (RII=4.47) and budget shortage for construction materials (RII=4.41) as the top three factors in the order for poor project time performances. The project managers have replied all the top three factor in related to financial problem; first just at the beginning of the project cash is disbursed out of the project and unable them to commence the project followed by cash flow shortage. In the case study for four projects it has been concurred that the employer has granted additional ten percent advance payment(as pre-financing) to assist the contractor for material purchasing of fuel, cement, bitumen and reinforcement bar. Moreover, having understood the contractor financial management problems, the employer has been arranged these advance payment to be paid directly to material suppliers up on delivery after signing supplementary agreements.

Generally, the following table 6 summarized the priority of the three parties

Table 6: Responded parties with their top three factors that affect their project time performance

Party	Rank of factors		
	First	Second	Third
Client	Financial and material related	Design related	Design plus management related
Consultant	Management related	Management related	Management, Financial and equipment related
Contractor	Financial related	Financial related	Financial related

Refer to the table below, a combined analysis has also made by combining all the three parties; accordingly improper utilization of advance payment (RII=4.42) has ranked first followed by budget shortage for spare part and construction material (RII=4.23) followed by poor financial planning (RII=4.19) as the top three crucial factors for road construction projects.

Table 7: showing top five ranking factors affection time performance combined of each party

Factors	Client		Consultant		Contractor		Combined	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Improper utilization of advance payment	4.33	1.00	4.29	3.00	4.59	1.00	4.42	1.00
Budget shortage to purchase construction material	4.08	4.00	4.14	5.00	4.41	3.00	4.23	2.00
Financial problem for increasing spare part cost for equipment	4.00	5.00	4.14	5.00	4.47	2.00	4.23	2.00
Lack of proper budgeting allocation for the project	3.67	9.00	4.57	1.00	4.24	4.00	4.19	3.00
Late in purchasing and delivery of construction material	4.00	5.00	4.21	4.00	4.24	4.00	4.16	4.00
Financial problems for purchasing, renting construction equipment	3.92	6.00	4.21	4.00	4.24	4.00	4.14	5.00
Unrealistic resources; labor, equipment and material assignment	4.17	3.00	4.21	4.00	4.06	6.00	4.14	5.00

In the distributed questionnaires, most respondents has blamed the contractor for causing problem of major factors such as financial, management, construction material, equipments and workers related factors but the Engineer has taken responsibility for technical related factors.

The general respond of the three parties with respect to the main factors that affect project time performance is elaborated and described as follows:

i) Financial

The responds of the three parties who involved in the project gave much weight for financial related problems to directly associate to the project time performance. The Ethiopian Public Procurement Agency (PPA) law allows and advances payment up to 30% of the project cost, and it commonly releases 20% of the project cost as advance payment to be utilized strictly for that specific project. However, as respondent points as “very important factor”, the financial problem started at this stage immediately after the advance payment released for it is expended for contractors’ other interest out of the project consumptions which automatically delayed the contractor mobilization and the commencement following project preparatory work as per the contractual schedule. In the case study, it was confirmed that every project was supplemented by pre-financing; with newly modified supplementary agreement denied direct payment of the cash to the contractor but critically reduce the contractor’s cash flow problem. From the newly adapted supplementary agreements one can learn that improper utilization of advance payment was leading the contractors to the problem of cash flow for the smooth progress of the projects. In other words, the newly adapted supplementary agreement which came at the result of mismanagement of advance payments by the contractors forced the client to provide the contractor with materials in kind.

This argument was also confirmed even by the project managers. Generally, responses from both parties show the existence of financial related factor; cash flow shortage for material and equipment purchasing is very important factor for poor CTP; hence, poor financial management followed by cash flow shortage contributed very important role to major project time performance. But in the case study it was understood that most effect of project cash flow problem were minimized by the employer’s additional advance payment.

ii) Management

The problem of management in the construction may be manifested through problem of planning and scheduling, controlling and monitoring, evaluation and motivating. Planning especially at the beginning or pre-construction stage has crucially important for on time performance of a project; physical planning for detail processes of programming, scheduling and organizing of work that is required to complete a project and financial planning enables the amount of money allotted to be used fairly throughout the life of the project. The respondents revealed that management related factor either initial during the planning stage that assign unrealistic resource and/or budget is the start of the deficiency which consequently lead to un avoidable delay of the project. Moreover, selection of proper project manager, leadership and coordination capacity of the project manager, poor controlling and evaluation of the different level of the organization, unclear organizational relation with the head office are others major management related factors which result delay of a project. Low Sui Pheng (2005) and Chan and Kumaraswamy (1996) explained the impact in a similar way too.

In questionnaires survey, planning related factors have ranked as a very important factor following poor controlling and coordination of the site resources. Management decision delay which output project delay was responded through delay in clearing of right of way by the employer was also weighted more than RII of 4.00 to contribute very important factor for project delays.

iii) Technical or design factor

The consultant ranked technical related factors as moderately important contributor, but the contractors and client took them as very important to put their impact on the specific project TP. In the questionnaires survey, the counterpart engineers responded that among the technical or design related factors which expressed in poor estimation and lack of detailed design for subsurface and material classification critically affected the completion of a project. It was also concurred through the case study that three projects out of the four (seventy five percent) were fully delayed by design related problem: either poor classification and quantification of earthwork items or poor or incomplete design of bridge substructures.

iv) Construction Material

Both respondents from each party ranked late delivery of construction material as a very important factor for project delay followed by rising cost of materials. The progress of construction project is directly related with continuous supplies of construction material as per the schedule and site consumption; otherwise, if there is any interruption of the same supply could consequently result in delay and poor time performance. Lack of construction materials in the local markets was ranked by respondent within the top ten factors. In the impact of shortage of materials becomes more visible when we see what ERA did in the past to tackle the shortage of cement in the local markets. As we all might know, ERA granted 180 calendar days of time extension for almost all projects due to shortage of cement in the local market in the year 2010.

v) Equipment related factor

Ignatius (1990) at the University of West Indies stated that poor equipment management could lead bad project time performance. Similarly, it was responded that poor equipment management for utilization followed by bad maintenance schedule of mobilized construction equipments ranked as the crucial and very important factors for poor CTP. Besides, among the four studied projects, the completion of one project is still unpredictable due to some factors such as shortage of equipments

vi) Construction worker related factor

High turnover and stability of construction workers followed by availability of skilled workers with different specialization ranked as a very important factor for CTP.

4.5 Finding of the case study

A case study was conducted on four projects in order to check the identified factors on each specific project. Similar to very important factor ranked through questionnaire survey, these projects faced financial problem which was resolved by the employer by granting up to 10% additional pre-financing assistance for purchasing material (fuel, cement, bitumen and or explosive).

The four projects which were designed and constructed by different consultants and contractors were studied for identification of the main factors that result in their poor time performance. These projects vary from new construction on previously inaccessible route to the upgrading of existing low standard road. They are also located geographically in the Northern, North Western, Western and Southern part of the country having different weather condition: dry desert to highly rainy months of the years. All projects were delivered as Designed Bid Build (DBB) with open invitation contract awarding system and the contracts also awarded for least bid offered contractor among the participants during the bid time.

During the preparation of this thesis, all projects were completed except one which is still on progress. Moreover all four projects have poor time performances which are delayed from the original agreed contract time varying from 39% to 91% except one which is expected to increase above the current percentage due to the listed causes. The first project is fully delayed from the initial contract time by 39% mainly due to client change of the scope of the project; initially it was designed as DS5 gravel road with carriage width of 7m and it was changed to DS4 DBST surface having 10m carriage width road after some portion of the project was executed. The contractor was forced for re-work on widening of earthwork and drainage structures following the scope modification. The second project was delayed by 90% in which all time has granted by the Employer principally; volume of rock excavation increment (poor design in classification of roadway excavation between soft and hard) and volume of drainage structures were increased basically due to faulty hydrological assumption.

The third project was also performed by 49% of extra time basically associated with the problem of one bridge design. The whole project was delayed for some period due to unexpected wet weather, and the commencement of the bridge work was delayed due to increment of the river water level on the scheduled months. The foundation of the bridge, which was investigated during the design period, took significant period for investigation and design work after part of the excavation was executed. Moreover, the location of the bridge which would have been easily observed during the design time has result in negative impact on the performance of the project.

The fourth project which is still under progress has observed multiple factors and both the contractor and the consultant representatives are pessimist for expected completion of the project due to unresolved prevailing problems. Among the different factors, the base line for the

comparison, the contract time is totally incomparable to the project work load and its nature; the project scope was also found to be problematic; 90km new and inaccessible project except the two extreme ends would have been better awarded into two contracts. In the tender stage, the criteria set by the employer for contractor selection seemed incomparable to the project nature and work load; the project required more than triple resources mobilization beyond pre-tender requirements. This lastly led the contractor for financial shortage since more than 90% of the 20% advance payment was disbursed for purchasing of heavy equipments. There was no pre-tender planning by the contractor for the need of resources and proper pricing; the project manager concurred that the contractor started to know the project nature as construction progressed and faced the problem especially material shortage and access problems. During the construction stage the effect of poor design, bad weather and contractor related problems (management, financial, equipment and labor) are clearly visibly. The project workload is increased due to poor design that manifested in terms of erroneous estimation of earthwork quantities and failure to design a bridge on pre-determined foundation level. The project is located in areas with extended rainy months (from five to six month in a year) that forced the contractor to pend his construction and idle the resources. Even though the employer has granted extension of time for weather and design related problem which result in the indicated 90% time performance increment, problem related to the contractor would undoubtedly increase the completion date of the project more than 190%. The project entertained multiple management problems: there is no valid work program, huge communication problems between the site staff and head office, the number of mobilized equipment are incomparable to the project work, material supply problem such as fuel and cement, cash flow for working capital, high professionals' turnover and shortage. The financial problem aggravated mainly poor price of the contractor and improper utilization of the advance payment at the beginning of the project. Moreover, the ERA's contract pre-qualification criteria are not fully performance based which allowed the contractor to participate and get another project and shared owned equipment which further aggravated the problems.

Generally, the following facts were drawn by case study from these sampled projects thought to be as the main factors that affect the time performance of the project;

- Defective scope definition of the client

- Improper time fixing by the employer, it is surprising issue that all four projects have different work load, nature and weather condition but similar 1095 calendar days of contract time
- Lack of contractor pre-tender planning
- Poor design, poor estimation and incomplete design
- Loose ERA's pre qualification criteria
- Cash flow shortage and financial management problems which is more or less solved by the employer
- Adverse weather condition
- Site Management problems
- Resources shortage; material, equipment and labor
- Material shortage in the local market like cement

In general, the employer shall take more responsibility to avoid the possible occurrences of time performance from the initiation period by properly defining the scope of the project that will be manageable by the capacity of the local contractors. The time allotted for the specific project shall also be scientifically determined which will be equivalent to the volume of designed work load of the project. More cooperative procurement procedures have positive effect on the performance of a project hence it will be advantageous to adopt cooperative procurement procedure from the design stage, bid invitation, bid evaluation and contractor selection stages.

The prequalification criteria for specific project are very important parameter that used to investigate and assess the capabilities of a contractor to carry out the contract of a specific project satisfactorily. This will done based on the information provided by the contractor for different set of criteria such as financial soundness, technical ability, management capability and reputation before the award of the project.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 General

Following the analysis of survey data results and the output of the case study, the crucial factors affecting project time performances were identified and investigated in a great depth by interviewing experienced professionals in order to forward possible recommendations for upcoming projects. The interviews were made following the data collection and major time performance ranking factors forwarded by the respondents were identified. During the interview sessions questions were specifically raised for respondents for their opinion on the degree of agreement of the factor and their possible recommendation to improve the prevailing poor time performance of the road construction sector in the upcoming projects

5.2 Conclusions

Setting detailed pre-construction planning that take into consideration the sources (owned or rent) of equipment, set up project management team, assignment of proper project manager and other professionals, authorization of the project manager, line of resource supply and monitoring mechanism of the performance of the project team is found to be crucial. The project manager with his/her site management team must have full authority of the decision making power.

The allotment of insufficient time to design the project will automatically result in poor design which in turn brings incomplete and/or erroneous design which affects the daily performance of the project during construction.

In most developed countries, as shown in the literature review, alternative project delivery systems such as DB other than the usual DBB are practiced to improve time performance of road construction projects. However, through the course of the present study, the researcher leaned that applying DB project delivery system in Ethiopian context could be quite pre-matured due to lack of design experience of the contractors and Lack of secondary data such as geological and geographical data which makes estimation difficult.

As per this research, it is found that financial related factors are the very important to affect the time performance of the selected road projects. Moreover, financial management of projects that result in poor time performance is expressed in improper utilization of advance payments; as the advance is improperly utilized, the contractor fails to start as schedule, and the financial shortage reduce the daily output which consequently result in delay of the project. This problem of financial shortage is aggravated following lack of credit facilities. Short-term bank loan and/or credit facilities from material suppliers especially bitumen, equipment sellers and renting firm in important, but the Ethiopian situations is still far from the developed world and it is all the responsibility of the main contractor which threat his financial capabilities. Besides, it is also concurred by the case study that the Ethiopian Roads Authorities has implemented in recent year to allow pre-financing for material purchasing with separate rules and regulations to alleviate the financial problem and improper utilization of the advance payment. This financial assistance will facilitate timely commencement of projects and smooth supply of construction material and spare for smooth progress of the project without delay.

The planning related problems are addressed in many ways; planning is intentionally neglected by contractor either due to shortage of professionals, or due to resource shortage. The resource shortage usually results in assigning of unrealistic resource which usually incomparable to the project work load or capacity problem of the contractor.

5.3 Recommendation

- a) It is recommended that the client has to set equivalent criteria to the project requirements, and avoid the participation of contractors with bad time performance or arrange the project in to lots or sections in order to fit to the capacity of the local firm
- b) It needs appropriate contractual clauses for proper utilization of the release amount of advance payment explicitly for the specific project cash flow purpose.
- c) Financial problem mainly due to lack of credit facilities for material, equipment or bank loan and unavailability of subcontractor will result in problems on the capacity of main contractors. It is recommended that till these banks loan and credit facilities are available, the only proposal is further client assistance with pre-financing for material purchasing. But the pre-financing should be implemented taking into strict rules and regulations which set transparent guide line to contractors

- d) Policy makers should set appropriate and convincing rules and regulations in order to manage the inflow and outflow of cashes effectively. In addition, in line with creating fertile and binding grounds, the concerned body needs to conduct trainings (short and long terms) so that each party internalizes the rules and regulations.
- e) Develop benchmark which used as reference for scheduling; such as equipment or labor hourly output. Moreover proper recording is also necessary for future planning data such as equipment and labor output
- f) Poor and/or erroneous design has resulted in poor time performance; hence the quality of project design needs improvement
- g) The employer time fixing need some transparency to solve problems in some projects
- h) The respondents also commented on the current least bidder project awarding system which increases low bidding and consequently cash shortage and poor time performance.
- i) The respondents proposed that the license criteria of the contractors need to revisited with respect to the power, requirement of professionals more than financial and resources requirements
- j) The contractor shall require to check his capacity with detail pre-contract planning for all resource requirements and satisfied himself for the project.
- k) Professionals training should be given in various aspects of the project activities. particularly, planning, designing, site management and equipment management strictly demand the touch of professional, and they of course, deserve due attentions from deferent parties.
- l) Thus, care need to be taken in assigning proper and skill full project manager with full delegation and accountability.
- m) Finally the researcher is recommended the following issues for future researches
 - method and procedure of contract time determination,
 - method and procedure of time extension
 - effect of Procurement selection criteria and tendering methods on project time performance for the Ethiopian conditions

- The financial management of the contractor needs to research with respect to the utilization of the advance payment and cash inflow and outflow of a particular project for better controlling.

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Questionnaire**PART-I- General Information about Respondents**

Please tick \checkmark in the space provided or circles your choice

1.1 The type of organization you represent?

Client		Contractor		Consultant	
--------	--	------------	--	------------	--

1.2 What was your project delivery system, please specify (DBB, DB, BOT etc)

1.3 please specify your project procurement method(open invitation,

1.4 What kind of method did you use for project planning and scheduling?

Choose all appropriate

a. Bar Chart Method b.CPM c. any other method please specify_____

1.5 How often your project being evaluated, monitored, updated and controlled?

Choose all appropriate

a. Daily b. Weekly c. Monthly d. Quarterly
 e. NA

1.6 What were your communication practices with the parties and your staff in the project? choose all appropriate

a. Letter b. Site meeting c. Verbal discussion d.if any other method, please specify_____

1.7 Do you feel that pre-construction planning is crucial for better time performance?

a. always b. often c. sometime
 d. may not have any impact

1.8 Do you feel that pre-construction planning shall be included as part of contract document

a. always b. often c. sometime

d. may not have any impact

1.9 If you are working for employer how much do involve the consultant during contract duration determination

- a. More often b. often c. not necessary to
involve at all d. depend on the contract type

1.10 If you involved, which of the following method you used in contract time Determination?, choose all appropriate

- a. Construction season limit b. Quantity or Production Rate
 c. Work flow technique d. Estimated cost e. if any other
method please specify _____

1.11 How was the percentage of time performance(actual increased/contract) of your projects which you have been working

- a. 0-20 b. 20-40 c. 40-60 d.60-80 e.80-100
 f. above 100

1.12 In your opinion which party is highly responsible for time performance problems on your specific project case

	Highly	medium	low	No responsibly
a. Employer				
b. Consultant				
c. Contractor				
d. Both				

1.13 (**Optional**)

Your name _____

Job title _____

E-mail Address _____

Date _____

PART-II Questionnaire survey on factors affecting project time performance

Section 1: The aim of this section is to obtain information on factors affecting time performance on local road contractor in federal road construction projects

Instruction: please tick (√) or (X) in the space provided as per the scale given below, you may check your choice as per your opinion and experience in the construction sector

Scale indicators

1	Not important
2	Slightly important
3	Moderate Important
4	Very important
5	Extremely important

FACTORS AFFECTING CONSTRUCTION TIME PERFORMANCE

No	Description of the factors	Scale Indicator				
		1	2	3	4	5
1	Unrealistic target setting (planning);					
	problem during the tendering stage in fixing project duration					
	Improper fixing of project precedence and consecutive project					
	Inappropriate Procurement method and procedures;					
	In appropriate project delivery system (DBB, DB etc...)					
	Experience of the contractor for the project					
	• Lack of specific experience of the contractor for that project					
	• Lack of specialized resource; manpower, equipment...					
	Nature of the project					

No	Description of the factors	Scale Indicator				
		1	2	3	4	5
	<ul style="list-style-type: none"> Vague or unclear specification of the of the project 					
	<ul style="list-style-type: none"> Scope of the project was not clearly defined or changed every time 					
	Adverse weather condition					
	<ul style="list-style-type: none"> Incremental weather condition on site 					
	Problem during Construction					
2	MANAGEMENT FACTORS					
	1. Planning and scheduling					
	<ul style="list-style-type: none"> Lack proper pre construction planning and detail work program before commencement of the project and indentify the project millstones 					
	<ul style="list-style-type: none"> Unrealistic resources; labor, equipment and material assignment 					
	<ul style="list-style-type: none"> Lack of proper budgeting allocation for the project 					
	<ul style="list-style-type: none"> Proper selecting of Project Manager 					
	<ul style="list-style-type: none"> Unclear organizational structure and delegation of professional and staffing 					
	<ul style="list-style-type: none"> Low usage of information technology and new ideas 					
	2. Coordination					
	<ul style="list-style-type: none"> Poor controlling of workers, materials and equipment 					
	<ul style="list-style-type: none"> Lack of experience in dealing with the consultant, client, local authority 					
	<ul style="list-style-type: none"> Poor relation with site staff and head office 					
	<ul style="list-style-type: none"> Poor leadership skill of project manager 					
	3. Communications					
	<ul style="list-style-type: none"> Misunderstanding between project team 					
	<ul style="list-style-type: none"> Problem and late delivery of information among the team 					
	<ul style="list-style-type: none"> Speed of information transfer between project participant 					
	<ul style="list-style-type: none"> Unclear instruction from the supervisor and client 					
	4. Approval from the client and/or the consultant					
	<ul style="list-style-type: none"> Late response for working drawing and material approval by the Engineer or delayed decision 					
	<ul style="list-style-type: none"> Insufficient follow up for issues requiring approval 					
	<ul style="list-style-type: none"> Delay in site handover and right of way clearance 					
	<ul style="list-style-type: none"> Delay in payment by the client 					

No	Description of the factors	Scale Indicator				
		1	2	3	4	5
	5. Variation and changes					
	<ul style="list-style-type: none"> Frequent change made on the original design and specification 					
	<ul style="list-style-type: none"> Too much variation order issued 					
	<ul style="list-style-type: none"> Approval of variations being delayed and unfair analysis 					
	6. Documentation					
	<ul style="list-style-type: none"> Poor recording and record keeping 					
	7. Evaluation and Motivation					
	<ul style="list-style-type: none"> Lack of proper monitoring/evaluation and motivation 					
	<ul style="list-style-type: none"> Lack of training for contractor staff 					

8. please specify if any other management factors that affect project time performance _____

No	Description of the factors	Scale Indicator				
		1	2	3	4	5
3	FANANCIAL FACTORS					
	9. Problem of cash flow management					
	<ul style="list-style-type: none"> improper utilization of advance payment 					
	<ul style="list-style-type: none"> Low risk management for cost increment 					
	10. Cash flow shortage					
	<ul style="list-style-type: none"> No budget to speed construction or extended working hours 					
	<ul style="list-style-type: none"> Budget shortage to purchase construction material 					
	<ul style="list-style-type: none"> Financial problems for purchasing, renting construction equipment 					
	<ul style="list-style-type: none"> Financial problem for increasing spare part cost for equipment 					
	<ul style="list-style-type: none"> Failure to employ skilled and experienced staff and operators due to high salary 					
	11. claim					

No	Description of the factors	Scale Indicator				
		1	2	3	4	5
	<ul style="list-style-type: none"> Failure of the client to pay payment resulted from claim 					
	<ul style="list-style-type: none"> Claim Processing is extended not treated fairly 					
	12. Lack of credit facilities					
	<ul style="list-style-type: none"> Lack of credit facilities for capital investment to acquired all required equipment 					
	<ul style="list-style-type: none"> Lack of credit facilities for working capital 					

13. please specify if any other financial factors that affect project time performance _____

No	Description of the factors	Scale Indicator				
		1	2	3	4	5
4	TECHNICAL FACTORS					
	14. Design related problem					
	<ul style="list-style-type: none"> Errors made due to misunderstanding, mistakes, miscommunication or in adequate experience 					
	<ul style="list-style-type: none"> Incomplete design and/or document 					
	<ul style="list-style-type: none"> Poor estimation of quantities 					
	<ul style="list-style-type: none"> Unforeseen site condition especially subsurface 					
	<ul style="list-style-type: none"> Employer change of original planning during or/and after design is completed 					
	15. Poor site supervision and contract administration					
	<ul style="list-style-type: none"> Experience and capacity of consulting firm 					
	<ul style="list-style-type: none"> Availability of the Resident Engineer and site technician 					
	<ul style="list-style-type: none"> Skill and experience of senior Engineers; Material Engineer, highway Engineer, structural Engineer etc 					
	<ul style="list-style-type: none"> Skill and experience and of site technician 					
5	MATERIAL FACTORS					
	16. Procurement					
	<ul style="list-style-type: none"> Late in purchasing and delivery of construction material 					

No	Description of the factors	Scale Indicator				
		1	2	3	4	5
	<ul style="list-style-type: none"> Lack of material in local market (unreliable supplier) 					
	<ul style="list-style-type: none"> Rising cost of material 					
	17. Credit facilities					
	<ul style="list-style-type: none"> Failure to get construction material on credit bases 					
	18. Defective material					
	<ul style="list-style-type: none"> Substandard material supplied by dealers 					
	<ul style="list-style-type: none"> Time take to rectify defective material and difficulties to identify the defects 					

19. please specify if any other material related factors that affect project time performance

No	Description of the factors	Scale Indicator				
		1	2	3	4	5
6	EQUIPMENT FACTORS					
	20. Availability					
	<ul style="list-style-type: none"> Availability of equipment on local market for renting or purchasing 					
	<ul style="list-style-type: none"> Excessive time taking to purchase equipment from abroad 					
	21. Breakdown and Maintenance					
	<ul style="list-style-type: none"> Failure to maintenance on schedule and regularly due to lack of skilled and experienced mechanics 					
	<ul style="list-style-type: none"> Unable to determine the life span of equipment 					
	<ul style="list-style-type: none"> Time taken for repairing or ordering spare parts when there is breakdown 					
	22. Equipment utilization					
	<ul style="list-style-type: none"> Poor equipment management 					
	<ul style="list-style-type: none"> Availability of skilled operators in the local market 					
	<ul style="list-style-type: none"> Lack of training for equipment utilization 					

23. please specify if any other equipment related factors that affect project time performance

No	Description of the factors	Scale Indicator				
		1	2	3	4	5
7	CONSTRUCTION WORKERS					
	24. Availability of skill labor in the local market					
	<ul style="list-style-type: none"> Effect of skill workers on site and head office to perform defect free work 					
	<ul style="list-style-type: none"> Availability of skilled and experienced workers 					
	<ul style="list-style-type: none"> Availability of experienced project manager for plan, schedule and directing 					
	<ul style="list-style-type: none"> Lack of specialized engineers like Material, structural, claim Engineer 					
	<ul style="list-style-type: none"> Excessive re-work for defective resulted from poor workmanship 					
	25. Efficiency, training and motivation of works					
	<ul style="list-style-type: none"> Capacity and efficiency of works for defect free work to avoid rectification 					
	<ul style="list-style-type: none"> Stability of workers in the project, high turnover 					
	<ul style="list-style-type: none"> Low labor Productivity 					
	<ul style="list-style-type: none"> Lack of training for project site professional and Forman etc. 					

26. please specify if any other labor related factors that affect project time performance

27. In your opinion is the resources mobilization for your project especially equipment is sufficient in type and number as required by your project and as scheduled? Usually/ seldom,

please

note

your

recommendation

28. Is the manpower mobilized to your specific project site sufficient in number throughout the project life? Sometime/usually, please note your recommendation

29. In your opinion are man powers mobilized for your project capable both technically and management wise with acceptable rang or below standard? please note your recommendation

30. In your opinion is the man powers mobilized for your project well understood the project specification, contract document, detail drawing or need training, please note your recommendation

31. Do you fill the project delivery system for your project appropriate for the specific situation or would have been better to other alternative contracting method please specify and reason your recommendation

Case study guideline and analysis

The following guideline is undertaken to analysis a case study of the selected projects

Research question	variables	documents	In-depth interviews	Observation
Factors affection TP	planning	Contract document/progress report, clause 14.1 work program	Project manager/Resident Engineer	
	Management factors	Progress report, Variation orders issued, archives	Ditto	
	Financial factors	Progress report, amount of advance payment, claims	Ditto	
	Technical factors	<u>Archives</u> Variations orders issued Extension time granted		
	Material factors	Progress report, correspondence	Ditto above	
	Equipment factor	Ditto		
	Construction works	Ditto above		
	Adverse weather condition	Archives , EOT granted		
Action taken for poor time performance		Archives and payment assisted by the client	General manager of contractor and consultant counterpart engineer	

As indicated in the methodology of this research, the following four projects have been analyzed for factors that affect the time performance. All of the four projects have poor time performance in which the project have completed or under progress on extended time beyond their original contract completion period.

Gidami-Mugi Road project

The project is part of Tongo-Begi-Mugi project located in the western part of the country in west Wollega Zone of the Oromiya Regional state which is dominated by rainy weather especially from May to November. The project is design under categories of DS5 of the Ethiopian Roads Authority roads classification with gravel wearing course surface finish. The total length of the project is 90km which was fully inaccessible and majority part of the project stretch is covered with forest. Gidami-Mugi project is started under the implementation of RSDP III and currently on progress as part of RSDP IV. The project was delivered as design bill build (DBB) system with open competitive procedure of contractor selection

Data taken from the Resident Engineer monthly progress report and archive records

Contract Duration =1095Calendar Day from June 4, 2008 to June 3, 2012

Contract Amount=ETB372, 420,036.56, including PS, 10% contingency and 15% VAT

Variation order issued to date;

- VO1=4,546,663(omission),
VO2=14,850,359.56(addition),VO3=21,795,557.85(addition),VO4=8,477,743.98(addition)

Revised contract amount=417,480,898.15

Percentage increment=12.10%

To date extension of time granted 999 Calendar days; mainly the Extension of time issued was due to adverse climatic condition and increased quantity of earthwork and drainage.

Revised completion date become February 24, 2014

Percentage of time increased= $2094/1095=191\%$

Current elapsed time=1730 or 82.62% as per the revised contract time

Current accomplishment=61.37% against the 82.62% of time elapsed

From the above, it can be learnt that the project time performance has increased by 91% following the issued variation orders and adverse weather condition and beyond that the contractor current accomplishment is also need further time.

Causes for time extension

- ❖ Increased quantity
 - ✚ The amount for Earthwork bill item has increased by ETB16,257,875 mainly the encounter hard excavation which was not considered in the design stage
 - ✚ Minor drainage has increased by an amount of ETB 17,404,321.73 mainly due to introduction of masonry and concrete retaining wall for high fill slope protection
 - ✚ Major drainage structure has increased by ETB 10,861,569 due the revision of substructure detail for one bridge from Masonry to concrete abutment following the foundation investigation
- ❖ Adverse weather condition

Interview taken from the Resident Engineer and the project manager

There was no consideration of any rock/hard excavation and retaining wall for fills and/or cut slope. In the initial time calculation impact of rainy weather condition with the resulting after effect (the excess moisture content will not reduce after month of the rainy period due to high forest coverage) was not properly considered in which both parties agree.

Moreover, even after the granted time extension and with the current condition, the contractor will lagging behind time and there will be further extension of the completion date

- The advance payment is fully utilized for purchasing of equipment which result in working capital shortage and delay in purchasing and supply of construction materials
- Scope definition; having 90km for one project and one stretch which has no any access. The project is fully inaccessible, so the contractor has constructed his and the engineer's camp two times; at km 0+000 (one at beginning of the project) and move to middle of the project when work progress and he get access with single payment
- Improper contract duration (unrealistic contract time); no consideration for weather condition, and access to and within the site and, no consideration for forest coverage effect. The project is far from the head office which takes longer time for material supply, no access through the project corridor which makes the preparatory work difficult. They viewed that special consideration shall be given to new construction during time calculation

- Poor design; the variations are resulted from poor design mainly lack of detail site investigation along the project route; hard excavation was not considered in the design stage which forces the contractor for new resources mobilization and required additional time.
- Contractor pre tender planning; the contractor has not well understood the project site condition during the tendering stage and at start of the project. The contractor fails to see the whole route before his tender submission and unable to identify the availability of material sources such as GWC, method of construction and proper billing
- Adverse weather condition; the site area is dominated with five to six month of rainy weather per year and more than one month time after effect. Equipment are usually idle five to six month per year due to weather condition
- Tender criteria; the requirement set for contractor selection was too small in comparison to the project. The work load of the project requires huge resources in which the contractor fail to mobilization with his capacity
- Poor contractor site management, there is no proper planning and currently there is no revised schedule even EOT is granted to the contractor
- Shortage of professional and high turnover; in past three and half year of the project time the project face high professional turnover and the project is now suffer in shortage of Engineers, Forman and operators
- Shortage of equipment; even the current deployed equipments are still not comparable to the work load
- Lack of communication; the area is far from town and difficult to communicate from the head office and within site

Delbena –Jinka Road project

The project is part of Arbaminch-Jinka road upgrading project located in the Southern part of the country in the SNNPR state. The project is design under categories of DS4 of the Ethiopian Roads Authority roads classification with double surface treatment wearing course surface finish. The total length of the project is **90km** which was initially have gravel access. The project is started under the implementation of RSDP III and currently on progress as part of RSDP IV. The

project was delivered as design bill build (DBB) system with open competitive procedure of contractor selection

Data taken from the A/Resident Engineer monthly progress report and archive records

Contract Duration = 1095 Calendar Day from May 6, 2006 to May 14, 2009

Contract Amount = ETB 434,567,292.42, including PS, 10% contingency and 15% VAT

Variation order issued to date;

- VO1 = 442,605 (addition) and VO2 = 1,388,436 (addition)

Revised contract amount = 436,398,333.42

Percentage increment = 0.42%

Time extension granted = 536 calendar days

Time performance = $(1095 + 536) / 1095 = 149\%$

The main reason for the major part of time extension was associated with the construction of Weito River Bridge, rise in river water level result 92 days, revision of the Delbena and Jinka side abutment results 62 days, revision of road alignment to avoid the conflict to existing old bailey bridge, unexpected wet season of the 2010 year result 92 days and disturbance of the planned progress for mobilization and demobilization of equipment for the bridge results 30 days. Hence a total of 356 calendar days have been granted for the contractor and the revised completion date becomes June, 1, 2011.

Moreover, it can be learnt from the claim expert analysis report that of the total 184 calendar days was granted as adverse weather condition in the project vicinity which hamper the construction work due wet weather and an increase of the river water level in which the construction has depended on the scheduled months. The rest of the granted extension which is 172 calendar days was the outcome of design related matters. In the original contract document, the abutment of the Weito River bridge was designed with a given foundation level, but as the excavation was completed to the designed foundation level, the foundation material was observed to be unacceptable. Hence further foundation investigation was required and the same was ordered to the contractor. Following the geotechnical investigation, the substructure detail for Delbena side abutment has increased both in height and width to suit the prevailing bearing capacity and revised drawing is issued. Originally there was sufficient space between the new Weito Bridge and the existing serving Bailey bridge. But as the width of the substructure increases it

automatically become too close to the existing road especially the Bailey bridge and endanger its stability, hence horizontal alignment modification is required to preserve the existing road and the Bailey bridge for public traffic till the main construction is completed. Moreover, as a result of heavy flood, the Jinka side river bank has scoured below the original design level and the design abutment height become more than the permissible height for masonry wall. Hence revision was made by increasing the span far from the river course to get reduced height.

Generally the original design for the Weito River Bridge lacks, detail foundation investigation work during the design stage, the alignment didn't considered sufficient gap to avoid any interference to the existing Bailey bridge which has been used for public traffic till the new road is opened to traffic.

So, the project time performance increased by 33% mainly, incomplete design which lacks detail subsurface investigation and alignment problem. Furthermore the client, ERA has granted 180 calendar day administrative for whole project due to cement supply problem in the country in the year 2010 which increase the PTP further by 16%

Moreover, beside design problems, the project has not yet fully completed due to problem associated supply and management, cash flow shortage.

Maytsebry-Dima Road project

The project is part of Maytsebry-Dima-FiyelWeha-Abiy Adi-Hawzen Road project located in the Northern part of the country in the Tigray Regional state. The project was design initial under categories of DS5 but revised after the construction was started to DS 4 of the Ethiopian Roads Authority roads classification with Double surface asphalt treatment wearing course surface finish. The total length of the project is 73.20km which was fully dry weather accessible with poor geometric alignment. Maytsebry-Dima project is started under the implementation of RSDP III and currently on progress as part of RSDP IV. The project was delivered as design bill build (DBB) system with open competitive procedure of contractor selection

Data taken from the Resident Engineer monthly progress report and archive records

Contract Duration = 1095 Calendar with the completion date of May, 14, 2012

Contract Amount = ETB 258,721,412.42, including PS, 10% contingency and 15% VAT

Variation order issued (four in number); 206,296,393.46

Revised contract amount = 519,732,519.36

Percentage increment=79.74%

The total extension of time granted 425 Calendar days; mainly the Extension of time issued was due to the issued variation basically change of the scope of the project standard

Revised completion date become July 13, 2013

Percentage of time increased=2520/1095=139%

Current elapsed time=1447 or 95.20% as per the revised contract time

From the above, it can be learnt that the project time performance has increased by 39% as a result of the issued variation orders and

Causes for time extension

- ❖ Change of the scope of the project from DS5 to DS4
 - ✚ VO1 is issued with amount of 2,441,752.36 for modification of alignment but with no time impact
 - ✚ VO2 is issued with amount of 183,454,445.13 for change of the 7mwidth gravel wearing surface to 10m width DBST road with time impact of 365cal. days
 - ✚ VO3 is issued for revision of paved ditch detail but no time impact
 - ✚ VO4 is issued with amount of 13,549,053.28 with time impact of 60cal days

It can be learnt that the employer has changed the whole project scope from the DS5 gravel road to DS4 double bituminous surface treatment road standard after the construction was started. Furthermore the provision of fog spare is also supplemented as the project was under progress.

Hence the main factor for the project delay is the employer failure to properly defining the scope of the project in the initial planning time. The project manager and the resident engineer in their interview has concurred that the project has no any supply problem for daily execution of the project and will be completed on the revised project time.

Shawera-Gelego Road project

The project is part of Durbete-Kunzula-Dengelber-Gelego new Feeder road project located in the Amehra regional state in North West part of the country. The project is design under categories of DS5 of the Ethiopian Roads Authority roads classification with gravel wearing course surface finish. The total length of the project is **147km** which was initially have no any access. The project is started under the implementation of RSDP II and completed in the year as part of

RSDP IV. The project was delivered as design bill build (DBB) system with open competitive procedure of contractor selection

Data taken from the Resident Engineer monthly progress report and archive records

Contract Duration =1095Calendar Day from October 10, 2005 to October 09, 2008

Contract Amount=ETB341, 479,872.47, including PS, 10% contingency and 15% VAT

Variation order issued to date;

Total granted time was 993Calendar days; mainly the Extension of time issued was due to increase volume of rock excavation and drainage structure; pipe culverts has changed to slab and slab is also changed to bridge and cement shortage in the local market

Revised completion date become June 29, 2011

Percentage of time increased= $2088/1095=190.70\%$

Causes for time extension

- ❖ Increased quantity
 - The original volume of rock excavation has increase
 - Due to hydrology error additional pipes culverts are included, pipes culverts have changed to slab and some slab culverts are increased their size
- ❖ Shortage of cement in the local market, ERA has granted 6month administrative time extension

The resident engineer has confirmed that design error is observed mainly in classification of roadway excavation in stretch which was designed as soft excavation has significantly changed to roach as work progress. Hydrological design has miss some structure and/or underestimate their capacity which result in additional drainage structure works. Generally, the overall project load has increased by 12.28% in which earthwork has increased by 18%, minor drainage has increased by 67.86% and Major drainage has increased by 31.16%

An interview guideline and interview for possible mitigation measures of poor time performance

Following the analysis of survey data results, for major factor affecting project time performances were investigated in a great depth by interviewing experienced professional to alleviate the problem and possible recommendation for upcoming projects. These also lead to possible list of measure that will mitigate the problems. This stage of the study was achieved through a series of in-depth interviews, which was already indicated in the research methodology. Accordingly, two senior professional which have been participating in the local road construction sector for more than twenty years were selected for interview; one being the general manager of local consulting firm and the other being general manager of one GC1 contractor.

The interview was made following the data collection and major time performance ranking factor from the respondents are indentified. Question was specifically raised for expert interview for their opinion on the degree of agreement of the factor for their possible recommendation to improve the prevailing poor time performance of the road construction sector in the upcoming project.

- literature has shown in the developed nation an alternative project delivery system such as DB has considered as option to improve construction project time performance; they responded that the develop nation have sufficient secondary data; Arial photo, Geographical and Geological maps which facilitate the estimation for proper biding. But for the Ethiopian situation these secondary data are not available on easily updated condition which make problem for the contractor in addition to their low level of design capacity of the local contractor. They responded that the alternative project delivery system not yet expected to merit any time performance with the two main situations lacks of secondary data and low design capacity of the local firm.
- The criteria set for the contract during the tendering is not incomparable to the work load, the contractor has lack experience, resource but fulfill the bidding criteria set by the employer. It recommended that the client has set equivalent criteria to the project requirement and avoid the participation of contractors with bad performance or arrange

the project in to lots or section to a minimum the capacity of the local firm. Moreover tender floatation shall also consider the capacity of the local firm.

- Among the many poor planning followed by lack commitment, coordination and monitoring is among the factors that results poor time performance. The head office, especially the owner and the site management has no clear structural arrangement, poor coordination. It is not uncommon to observe problem related to planning, controlling, communication in every project; detailed pre-construction planning is the crucial issue in consideration to the source (owned or rent) of equipment, set up project management team, assignment of proper project manager and other professional, authorization of the project manager, line of resource supply and monitoring mechanism of the performance of the project team. The project manager with his site management team must have full authority of the decision making power.
- The time given to the design will automatically result poor design which in turn result incomplete design, and/or erroneous design which affect the daily performance of the project during construction. The client has to give due consideration during design to minimize the amount of variation which impact the performance during construction.
- Improper advance utilization by the contractor which is very important factor for poor time performance need strict control by the employer; so it need contractual clauses for proper utilization of the release amount explicitly for the specific project cash flow purpose.
- Financial problem mainly due to credit facilities for material, equipment or bank loan and unavailability of subcontractor will results to problem on the capacity of the main contractors; from the literature review it learnt that the capacity of the main contractor can be improved through subcontracting for suppliers and different specialization. Short-term bank loan and/or credit facilities from material suppliers, equipment sellers and renting firm, but the Ethiopian situations still far from the develop world and all the responsibility rest on the main contractor which threat his financial capabilities. Hence till these banks loan and credit facilities are available the only proposal is further increment of the current advance payment amount up to 40% but with strict bounding clause for disbursement to the project purpose or provide assistance through pre-financing for material purchasing.

- Financial management of individual project which is totally neglected by most construction company needs correction; the project manager either not interested or allowed to check profit- lose statement of his project; even though the projects has generating sufficient monthly payment failed to supply the required supply as scheduled and required by the project. The monthly payment is usually utilized on the will of the owners and implementation proper financial management for the project inflow and outflow of the project either imposing state regulation may be mandatory.
- The other major problem planning; they noted that the sector has intentionally avoided planning. The contractors planning are simply for submission purpose not for proper implementation and monitoring of the project work. Beside there is also planning professional's shortages in the country and benchmark used as reference for scheduling; such as equipment or labor hourly output. Moreover proper recording is also necessary for future planning data such as equipment and labor output
- Improve human resources management, delegation of the project manager, training and upgrading of project manager and other staffs, and sharing of benefit to create ownership of the professional to increase stability followed accountability as per the given delegation.
- Develop professional accountability of the staff
- The employer time fixing need some transparency which semis some problems in some projects
- They also noted that currently contractor have participate beyond their capacity of resource either equipment or management; hence avoid giving contractor beyond their capacity. Moreover the bidding criteria of need revision to increase the requirement of performance based with strict project evaluation. He also commented the current least bidder project awarding system which increase low bidding and consequently cash shortage and poor time performance
- Finally he proposed that the license criteria of the contractor need to researched with respected to the power, requirement of professionals more than financial and resources requirements

Declaration

I the undersigned, declare that this thesis entitled “FACTORS AFFECTING TIME PERFROMANCE OF LOCAL ROAD CONTRACTORS ON FEDERAL ROAD CONSTRUCTION PROJECTS” is my original work. This thesis has not been presented for any other university and is not concurrently submitted in candidature of any other degree, and that all sources of material used for the thesis have been duly acknowledged.

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Place: Addis Ababa, Ethiopia

Signature: _____

Annexes

Annex 1

(Questionnaire survey and Responded questionnaire)

Annex 2

(Case study guidelines and analysis)

Annex 3

(Interview guidelines and interview)

Annex 4

(Interview guidelines and interview)