Addis Ababa University

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Comparative Evaluation of Project Performance Between Domestic and Chinese Contractors in Selected Federal Road Projects in Ethiopia

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Addis Ababa, Ethiopia

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(Construction Technology and Management)

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Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

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"**Comparative Evaluation of Project Performance Between Domestic and Chinese Contractors in Selected Federal Road Projects in Ethiopia"**

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Table of Contents

List of Tables

List of Figures

List of Appendix

List of Abbreviations

ADB	African Development Bank
ADLI	Agricultural Development Led Industrialization
CII	Construction Industry Institute
CSF	Critical Success Factors
DBB	Design Bid Build
DBST	Double Surface Treatment
DED	Detail engineering design
EEC	European Economic Commission
EOT	Extension of Time
ERA	Ethiopian Road Authority
ETB	Ethiopian Birr
FDRE	Federal Democratic Republic of Ethiopia
GC-1	General Contractor Grade one
GNP	Gross National Product
GOE	Government of Ethiopia
GTP	Growth and Transformation Plan
ICB	International Competitive Bidding
IDA	International Development Association
IHA	Imperial Highway Authority
Km	Kilometer
KPI	Key Performance Indicators
MoFED	Ministry of Finance and Economic Development
MoWUD	Ministry of Works and Urban Development
NCB	National Competitive Bidding
PLC	Private Limited Company
PM	Project Management
PMBOK	Project Management Body of Knowledge

PMP	Project Management Performance
PMS	Procurement Management System
PPI	Project Performance Indicators
PSB	Parts and Supplies Branch's
RC-1	Road Contractor Grade one
RSDP	Road Sector Development Program
RSDP I	Road Sector Development Program Phase I
RSDP II	Road Sector Development Program Phase II
RSDP III	Road Sector Development Program Phase III
RSDP IV	Road Sector Development Program Phase IV
SNNPR	Southern Nations and Nationalities Peoples Region
UCBP	University Capacity Building Program
UK	United Kingdom
URRAP	Universal Rural Road Access Program

Abstract

This study was conducted to evaluate comparatively the project performance of domestic and Chinese contractors with regard to key performance indicators. The scope of the study was limited to examine the performance of road construction projects in the road sector development program of phase IV. The study had developed its research framework through the non-probability sampling technique particularly the purposive or judgmental sampling methods. Accordingly first, it assessed 13 Federal road projects executed either by the domestic or the Chinese contractors. Subsequently, the overall performance of both domestic and Chinese contractor's was low. It was strongly associated with design related problems, unexpected ground conditions, right of way related problems, variation order and finally poor contractors' capacity respectively. Besides, the key differences between domestic and Chinese contractors, was found resource capacity. Generally, in both the domestic and Chinese contractors there was low performance during the construction of the federal road projects due to internal and external factors. Finally, the study had also developed improvement interventions based on the findings; to solve the internal problems of the contractors, there should be a joint venture between the domestic and Chinese/foreign contractors. Ethiopian Road Authority should also solve as much as possible the external factors that affects the performance of both the domestic and Chinese contractors during the construction of the federal road projects.

Key words: Domestic and Chinese Contractors, Federal Road Projects, Key Performance Indicators, and Performance.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Construction industry is one of the largest industries and contributes to about 10% of the gross national product (GNP) in industrialized countries (Navon, 2005).The performance of the construction industry can be measured by key indicators for evaluation. Key performance indicators (KPIs) such as time, cost and quality that clients want their projects delivered: on time, on budget, free from defects. So, clients expect continuous improvement from their construction team to achieve year-on-year: reductions in project costs and time.

In addition, the key performance indicators (KPIs) can be used for benchmarking purposes, and will be a key component of any organization in achieving best practice. Clients, for instance, assess the suitability of potential suppliers or contractors for a project, by asking them to provide information about how they response to a range of indicators. Some information will also be available through the industry's benchmarking initiatives, so clients observe how potential suppliers compare with the rest of industry in a number of different areas (Saleh, 2008).

The performance of construction industry is one of the major development constraints in developing countries since their development highly depends on the growth of their physical infrastructures. As a matter of this fact, developing countries allocate a considerable amount of their scarce financial resources towards the development of their infrastructure needs. However; most of these infrastructure projects in developing countries encounter considerable low performance in terms of time, cost and quality etc. Construction sector is an important sector. Growth in this sector is critical for growth in national economy as it was among the largest sectors that generates employment within the country as well as a key indicator of the economy of Ethiopia (Wubshet, 2004).

In the context of Ethiopia's geography, pattern of settlement and economic activity, transport plays a vital role in facilitating economic development as 95% of the movement people, and goods is still carried out by road transport. In particular, it is road transport that provides the means for the movement of people, utilization of land and natural resources, improved agricultural production and marketing, access to social services, and opportunities for sustainable growth (ERA, 2014).

Recognizing the importance of the road transport in supporting social and economic growth and its role as a catalyst to meet poverty reduction targets; the Government of Ethiopia has placed increased emphasis on improvement of the quality and size of road infrastructure in the country. To address constraints in the road sector, mainly low road coverage and poor condition of the road network, the Government formulated the Road Sector Development Program (RSDP) in 1997(ERA, 2014).The RSDP has already been implemented over a period of seventeen years and in four successive phases, as follows:

- RSDP I - Period from July 1997 to June 2002 (5 year plan),
- RSDP II - Period from July 2002 to June 2007 (5 year plan),
- RSDP III - Period from July 2007 to June 2010 (3 year plan),
- RSDP IV - Period from July 2010 to June 2015 (5 year plan, 4 years elapsed).

The program has received significant donor support with its focus on creating adequate capacity in the sector and facilitating the economic recovery process through the essential restoration of the road network, to an acceptable condition. Specifically, the program has captured rehabilitation and upgrading of main roads; construction of new roads; and the execution of regular maintenance on the road network (ERA, 2014).

According to the report of MoFED (2013), for the fiscal year of 2011/12 of GTP; the road construction program in Ethiopia has also contributed to the development of the domestic capacity in construction of roads. In this year, the number of projects handled by domestic contractors accounted for 63 percent of the total number of road projects, which shows a5 percentage point increment compared to the 58 percent recorded in 2010/11.

1.2 Statement of the problem

Expansion of the Ethiopian road network, developing the organizational capacity of the Ethiopia road authority and regional road agencies for effective management of the road sector programs and improving the quality of the overall road network are the strategic directions of the road sector in the five year Growth and Transformation Plan. During the five year period, it was planned to execute a total of 47,652 Kms by federal, regional and district road authorities and offices overall at the country level both new construction and maintenance (GTP, 2010).

According to the annual progress report MoFED (2013), for the fiscal year of 2011/12 of Growth and Transformation Plan (GTP); the poor performance of some asphalt overlay road projects and delay in completing design study, delay in procurement process, and poor performance of some contractors are among the major problems for the low accomplishment of construction industry. In addition to this, the major problems encountered in the road sector in the reporting periods are; capacity limitations, low level of competency, increasing construction cost, shortage of skilled human resources and shortage of construction materials. The contractors taking part in road projects implementations were national and international companies. Most of the local contractors limited capacity and rarely do meet the requirements to participate in donor financed projects. Hence, international contractors, who meet the requirements, have been participating in donor financed projects (Getachew, 2009).

The motivation for this research was largely due to the above report and circumstances observed in the construction industry of Ethiopia. These covered largely public construction projects in Ethiopia and reports on evaluation of these project performances. The other point which served as an additional motivation for this study was “I have always a question in my mind; why Chinese contractors mostly participated in execution of the road projects of the country?” These and other issues enlarge my interest to investigate the project performance of the road construction projects in Ethiopia.

Consequently, its centre of attention was focused on comparative evaluation of project performance between domestic and Chinese contractors in Ethiopia selected federal road projects.

1.3 Research questions

The inquiry was aided by trying to address the following main questions:

a. How do domestic and Chinese contractors are executing federal road projects, in terms of the key performance indicators (Time, cost and quality)?
b. What are the key differences in road project performance between domestic and Chinese contractors?
c. What are the best practices that domestic contractors learn from Chinese contractors? Or Chinese contractors from domestic contractors?

1.4 Objective of the Study

The specific objectives of this study are:

a. To investigate performance of domestic contractors with regard to key project performance indicators,
b. To investigate performance of Chinese contractors with regard to key project performance indicators,
c. To Evaluate the performance comparatively between domestic and Chinese contractors,
d. To indicate the key difference and best practice in project performance between domestic and Chinese contractors,

1.5 Significance of the study

The main objective of the study was to assess the performance of road construction projects in selected road projects in Ethiopia, through comparative evaluation between domestic and Chinese contractors. Therefore, the findings of this study work are expected to:

a. Contribute towards the improvement projects implementation performance in Ethiopian construction industry,
b. Provide experience for the main parties of the construction industry of the country,
c. suggest the best practice of foreign contractors to domestic contractors as a lesson,
d. contribute towards the enhancement of the main practical problems of federal road construction projects, by analyzing past experiences,

e. Serve as an input for researchers to conduct furthers study.

Hence, the Ethiopian Road Authority (owner), consultants, contractors and others professional may benefit from the findings of this study.

1.6 Scope and Limitations of the study

The study was intended to examine the performance of road construction projects in the road sector development program of phase IV (RSDP IV), with a special attention given to the beginning of phase IV or Growth and Transformation Plan (GTP).

The scope of the study has been limited to the cases of selected federal road construction projects in Ethiopia. The starting period of commencement of the selected road projects are in 2011. Whilst it may appear that the number of cases considered is small in number, it is nevertheless hoped that it would be sufficient to give an overview of the comparative evaluation of project performance between domestic grade one (GC/RC-1) contractors and Chinese contractors with regards the key performance indicators in the selected road projects in Ethiopia.

1.7 Organization of the Study

The final written report has a set structure consisting of six chapters.

Chapter 1: Introduction to the research and includes seven sections that present the background, statement of problem, research questions, objectives, significance, scope and limitations and organization of the study.

Chapter 2: Covers literature review,

Chapter 3: Methodology which includes; research approach, research design, data collection and data analysis

Chapter 4: Focuses on results of the analysis,

Chapter 5: Covers discussions on the results,

Chapter 6: Conclusions and Recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Definitions and Concepts

2.1.1 What is a Project?

Many authors and references have defined project in different ways emphasizing its different aspects. Summarizing those definitions given, this research defines a project as: A temporary endeavor (that has definite beginning and end time)undertaken following specific cycle of initiation, definition, planning, execution and close to create a unique product, service, or result through novel organization and coordination of human, material and financial resources (Project Management Guidebook,2003). A project has a defined scope, is constrained by limited resource, involves many people with different skill and, usually progressively elaborated throughout its life cycle. A project is "a unique endeavor to produce a set of deliverables within clearly specified time, cost and quality constraints".

According to the Project Management Guidebook, Projects are different from standard business operational activities as they:

- Are **unique** in nature. They do not involve repetitive processes. Every project undertaken is different from the last, whereas operational activities often involve undertaking repetitive (identical) processes
- Have a defined **timescale**. Projects have a clearly specified start and end date within which the deliverables must be produced to meet a specified customer requirement,
- Have an approved **budget**. Projects are allocated a level of financial expenditure within which the deliverables must be produced to meet a specified customer requirement,
- Have limited **resources**. At the start of a project an agreed amount of labor, equipment and materials is allocated to the project,
- Involve an element of risk. Projects entail a level of uncertainty and therefore carry business risk,
- Achieve beneficial change. The purpose of a project, typically, is to improve an organization through the implementation of business change.

2.1.2 Project Lifecycle: The following diagram outlines the project life-cycle

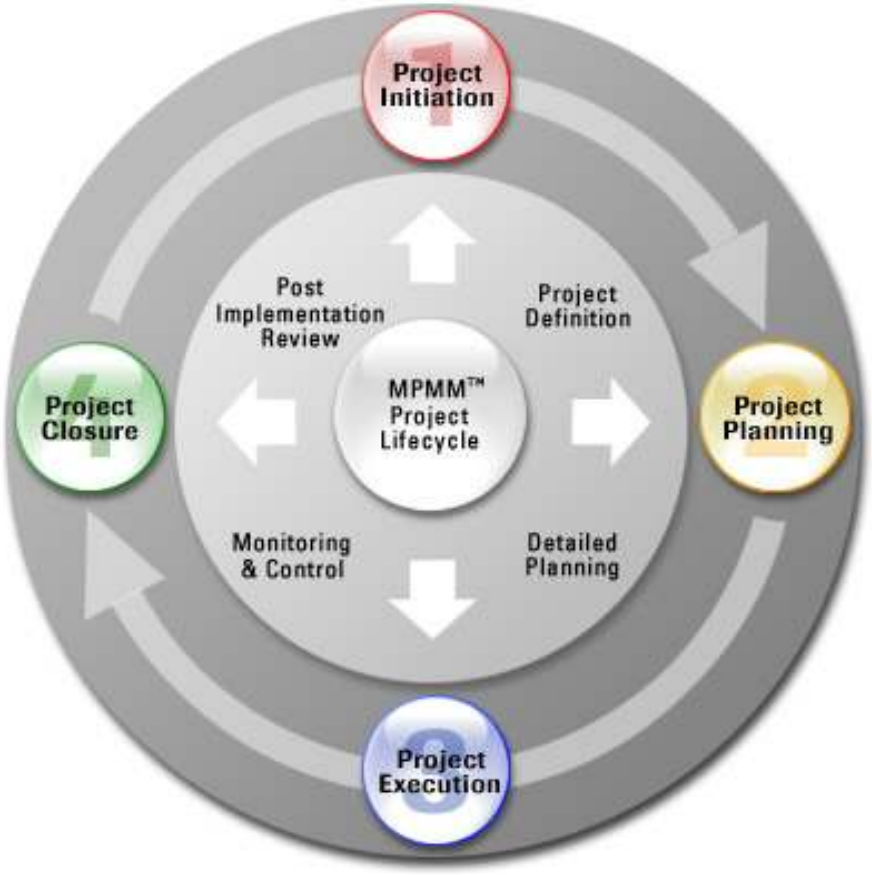

Figure 2.1: Project life-cycle (Source; Project Management Guidebook)

The Project Lifecycle consists of four phases:

1. **Project Initiation**

The initiation phase is the first phase in the project. In this phase a business problem (or opportunity) is identified and a business case which provides various solution options is defined. A feasibility study is then conducted to investigate the likelihood of each solution option addressing the business problem and a final recommended solution is put forward. Once the recommended solution is approved, a project is initiated to deliver the approved solution.

A "project Charter" is completed, which outlines the objectives, scope and structure of the new project, and a project manager is appointed. Project manager begins recruiting a project team and establishes a project office environment. As mentioned in the project management guidebook, the approval is then sought to move into the detailed planning phase (PM Guide book, 2003).

2. Project Planning

Once the scope of the project has been defined in the project charter, the project enters the detailed planning phase. This involves the creation of a:

- Project plan (outlining the activities, tasks, dependencies and timeframes),
- Resource plan (listing the labor, equipment and materials required),
- Financial plan (identifying the labor, equipment and materials costs),
- Quality plan (providing quality targets, assurance and control measures),
- Risk plan (highlighting potential risks and actions taken to mitigate them),
- Acceptance plan (listing the criteria to be met to gain customer acceptance),
- Communications plan (listing the information needed to inform stakeholders),
- Procurement plan (identifying products to be sourced from external suppliers),

At this point the project has been planned in detail and is ready to be executed.

3. Project Execution

This phase involves the execution of each activity and task listed in the project plan. While the activities and tasks are being executed, a series of management processes are undertaken to monitor and control the deliverables being output by the project. This includes the identification of changes, risks and issues, the review of deliverable quality and the measurement of each deliverable being produced against the acceptance criteria. Once all of the deliverables have been produced and the customer has accepted the final solution, the project is ready for closure.

4. Project Closure

Project closure involves releasing the final deliverables to the customer, handing over project documentation, terminating supplier contracts, releasing project resources and communicating the closure of the project to all stakeholders. The last remaining step is to undertake a post implementation review to quantify the overall success of the project and list any lessons learnt for future projects.

2.1.3 What is Project Management?

Similar to the case for project, many and different definitions were given for project management. Summarizing those definitions this research defines project management as: "The application and integration of modern management and project management knowledge, skills, tools and techniques to the overall planning, directing, coordinating, monitoring and control of all dimensions of a project from its inception to completion, and the motivation of all those involved to produce the product, service or result of the project on time, within authorized cost, and to the required quality and requirement, and to the satisfaction of participants (Carmichael,2004)."

Project management deals mainly with coordinating resources and managing people and change. Generally "managing a project includes: Identifying requirements, establishing clear and achievable objectives, balancing the competing demands for quality, scope, time and cost; adapting specifications, plans, and approach to the different concerns and expectations of the various stakeholders"(PM Guide, 2003)."Project Management is the skills, tools and management processes required to undertake a project successfully".

According to the project management guide book (2003), project management comprises:

- A set of **skills**. Specialist knowledge, skills and experience are required to reduce the level of risk within a project and thereby enhance its likelihood of success.
- A suite of **tools**. Various types of tools are used by project managers to improve their chances of success. Examples include document templates, registers, planning software, modeling software, audit checklists and review forms.
- A series of **processes**. Various management techniques and processes are required to monitor and control time, cost, quality and scope on projects. Examples include time management, cost management, quality management, change management and risk management.

2.1.4 Project Management vs. General Management

The fundamental difference between project management and general management stem from the difference in the type of work they manage. Project management deals with management of projects (which are temporary and unique) whereas, general management deal with management of operations which are ongoing and repetitive (PMBOK Guide, 2004). Generally; project organization changes continually as the project progresses through its various phases and terminate when the mission is accomplished; whereas the ongoing organizations that manage operations sustain at least over a period of time and continue assuming a broader outlook (Carmichael, 2004).

Abadir (2011) said that, despite the existence of fundamental difference between project management and general management; both general management and project management share many things in common. Both share the same basic philosophies, both make and implement decisions, allocate resources, manage organizational interfaces, and provide leadership for the people who are involved in performing the work.

2.2 Performance and Construction Projects

Success of construction projects depends mainly on success of performance. Many previous researches had studied performance of construction projects. Saleh (2008) remarked that one of the principle reasons for the construction industry's poor performance has been attributed to the inappropriateness of the chosen procurement system. It was also identified that the main performance criteria of construction projects as financial stability, progress of work, standard of quality, health and safety, resources, relationship with clients, relationship with consultants, management capabilities, claim and contractual disputes, relationship with subcontractors, reputation and amount of subcontracting.

It was obtained by Navon (2005) that, a control system was an important element to identify factors affecting construction project effort. For each of the project goals, one or more project performance indicators (PPI) are needed.

2.3 Performance and Construction Management

Management in construction industry is considered as one of the most important factors affecting performance of works. Pheng and Chuan (2006) stated that project management one of the many criteria upon which project performance is contingent. It was also stated that an adequate understanding and knowledge of performance are desirable for archiving managerial goals such as improvement of institutional transformations, and efficient decision making in design, specification and construction, at various project-level interfaces, using appropriate decision-support tools.

Ling et al,(2007) investigated project management (PM) practices adopted by Singaporean construction firms. It was determined the performance level of their projects in China; identifies PM practices that led to better performance; and recommended key PM practices that could be adopted by foreign construction firms in China to improve project performance.

2.4 Key Performance Indicators

A wide variety of Key Performance Indicators (KPI) have been identified and used to measure the success of construction projects (Langston, 2012). These include indicators of client satisfaction, stakeholder engagement, service delivery, investment return, defect minimization, dispute avoidance, safety and standard. The most commonly cited KPIs are on-time completion (time), within agreed budget (cost) and non-defective workmanship as specified (quality).Time, cost and quality necessarily interact. It was well understood in the industry and in the literature that tradeoffs occur between optimizing performance for any of these KPIs. For example, accelerating completion of a project will usually involve extra cost, reducing cost will tend to lower quality, and increasing quality standards will take more time to deliver.

Meng (2012), found that construction projects often suffer from poor performance in terms of time delays, cost overruns and quality defects, and from an analysis of previous research findings concluded that *"time, cost and quality are the three most important indicators to measure construction project performance"*.

Brown and Adams (2000) undertook case studies derived from UK data, and found that project management as implemented in the UK failed to perform as expected in relation to the three predominant performance evaluation criteria of time, cost and quality. In fact, they showed that project management had little effect on time performance, no effect on cost performance, and a strong yet negative effect on quality performance. Other factors were assumed to be at play.

2.4.1 Time Performance

Langston (2012), said that time performance usually means the project is completed on or before the agreed handover date. Sometimes contractual documents refer to time being the 'essence of the contract', which exemplifies the criticality of timely completion due to subsequent plans that cannot be delayed. Time on construction projects can be measured in days, weeks or months. Obviously large projects take more time to construct than small projects. A high value for this KPI would mean that the construction process was fast, and vice versa.

Walker (1995) found four factors that significantly affect construction time performance. These comprised and can be summarized as:

1. Construction management effectiveness (i.e. competence),
2. The sophistication (complexity) of the client and the client's representative in terms of creating and maintaining positive project team relationships with the construction management and design team (i.e. teamwork),
3. Design team effectiveness in communicating with construction management and client's representative teams (i.e. communication), and
4. A small number of factors describing project scope and complexity (i.e. work definition).

Prediction of construction time has been studied at length. One of the earlier studies was Bromilow (1969), in which a predictive model was developed using the relationship between cost and duration. It was found that the time taken to construct a project is highly correlated only with the project's size, as measured by its final cost. Love et al. (2005) proposed an alternative model to Bromilow and concluded that gross floor area and the number of storey were also key determinants of time performance in forecasting construction project duration.

2.4.2 Cost Performance

Cost performance is normally judged relative to an agreed budget. Sometimes projects may have no budget, which means that cost is not a consideration, but this is rare. Completion close to budget is usually preferable; in some cases being well below budget is seen as an advantage, although often not (Langston, 2012). Clients tend not to like surprises, so the final project cost should be the result of prudent cost management processes and therefore, by definition, deliver an end result close to the agreed budget. Construction cost is measured in pure financial terms, usually in local currency, and should focus on the building rather than the land (i.e. should exclude site purchase costs). Since construction often spans many years it is necessary to bring costs to a common date. The conversion to a common date is undertaken using building price indices that reflect inflationary change appropriate to the current level of construction intensity.

Chau (1993) demonstrated that construction productivity could be measured from an analysis of only cost and price data and the relative value shares of inputs. These data are in general more readily available than the detailed information required by other methods, and therefore his proposed approach was less restrictive. A ratio of output to multiple inputs was used in his model, and all were expressed in monetary terms.

Construction has been considered as a dynamic industry which is constantly facing uncertainties in its budgets, processes and technology (Chan*, et al.*, 2004). These uncertainties, the complexity of projects and the increase of stakeholders make the management of costs difficult in a construction project. These facts result in many of the time and cost overruns in the project (Doloi, 2011). Even though there have been improvements in the management of construction projects, the problems of cost and time overruns are still a critical issue in the construction industry (Reichelt and Lyneis, 1999). Due to the excessive cost and time overruns, construction projects usually have poor reputation.

Cost overruns occur when “the final cost of the project exceeds the initial estimate or budget” (Avotos, 1983). Nevertheless, the estimate or initial budget is constantly changing during the execution of the project. For this reason, it is important to be careful with the budget that is going to be taken into account to calculate the overrun of the project.

Some authors consider that the initial budget is created when the decision of commencing building is made (Flyvbjerg*, et al.*, 2002; Odeck, 2004). On the other hand, some other authors uphold the idea that cost overrun should be found comparing the original contract value with the final cost of the project at the time of completion.

Le-Hoai, et al. (2008) also considered that the magnitude of cost overruns may or may not vary depending on the size of the project, the location of the project and the type of project. Eden et al. (2005) pointed out that although there is more information about cost overruns in public projects, this does not mean that there are no cost overruns in the private industry. In fact, the authors uphold the idea that projects of private sector tend to have larger cost overruns. On the other hand, Koushki, et al. (2005) expressed that cost and time overruns are common not only in large projects, but also in small and simple projects. This issue was also discussed by Frimpong, et al. (2003) who stated that overruns are more frequent and significant in large projects than small projects. Gkritza and Labi (2008) supported this idea and they also added that cost overruns are also more common in long duration projects.

Nevertheless, Odeck (2004) contradicted this statement. He considered that large projects have fewer cost overruns because managers pay more attention to the management of these types of projects than the attention they usually pay to small projects. Cost overruns are common in different type of projects and locations. In addition, cost overruns have become a norm, rather than an exception in the construction industry (Baloi and Price, 2003).

In the past, Arditi, et al. (1985) carried out a survey in public projects in Turkey. The authors concluded that the main reason for cost overruns was the increase in materials' prices, mainly caused by the fast growth of Turkish inflation in those years. In addition, the increase in inflation also made it difficult for contractors to buy materials at reasonable cost. This fact was considered as the second most important reason for cost overruns. Shortages in resources, changes in design specifications and financial problems were some of the factors which caused delays in projects. These delays were considered the fourth reason for cost overruns in public projects in Turkey. Finally, the authors concluded that the fifth reason for cost overruns was the underestimation of cost at the time of creating the budget of the project.

Similarly, some studies were conducted in Nigeria by Okpala and Aniekwu (1988) who aimed to understand the main causes of high costs of construction projects. The results were analyzed taking into account the different professions and the role of each respondent in the project. Therefore, the authors concluded that the three main reasons for cost overruns were:

- Increase of material's prices due to fast growth of inflation,
- Inflation increase make difficult for contractors to produce products at its official price,
- Delays caused by changes in design specification and financial problems.

Causes of underestimations of cost at the moment of creating the budget of Nigerian projects were: "shortage of materials, finance and payment for completed works, poor contract management, price fluctuations and fraudulent practices" (Okpala and Aniekwu, 1988). The most important causes of cost overruns were the cost of the materials; as the authors mentioned: materials prices increment, high cost of machineries and poor planning. The authors added that the lack of geotechnical studies before starting the construction and the delays caused by the involvement of complicated rules to check and approve construction processes, can also be reasons for cost overruns in Nigerian constructions.

Kaming, et al. (1997) conducts a study through and interview in Indonesia to find the main factors that influence time and cost overruns in high-rise construction projects. The authors concluded that lack of materials due to the inaccurate planning and estimating, increase of materials' cost, complexity of works, poor contractor management and unpredictable weather were the main factors that cause cost overruns in Indonesia.

Another study that had similar results in a developing country was the research done by Frimpong, et al. (2003), who wanted to find the causes of delay and cost overruns in the construction of groundwater projects in Ghana. The results pointed out that the main factors that caused overruns in Ghana are similar to those in other developing countries. These factors were: the increase of cost of the materials, poor contractor management, and problems with agencies' payments, poor technical performance and inaccurate estimation of costs (Frimpong*, et al.*, 2003).

Flyvbjerg, et al. (2003) stated in their book "Megaprojects and Risk: an Anatomy of Ambition" that the factors that affect cost performance and caused cost overruns in a developing country can be generalized to all developing countries because they have similar problems in construction projects. The review of some studies has shown that the main causes of cost overrun in developing countries are similar in the construction industry.

The author also mentioned that the main reason for cost overruns in mega construction projects is the underestimation of costs and length of delays during the planning stage. Other factors mentioned by the author were: the absence of a plan that takes into account not only the geological risks, but also the design and specification changes that the project can have in the construction phase, the lack of knowledge about changes in exchange rates between currencies and safety and environmental risks during the execution.

Some studies of cost overruns have been carried out in the United Kingdom. A study made by Jackson (2002) attempted to find the reasons why construction projects spend more money than the initial budget. The author also complemented the study with the analysis of some projects in year, which were exceeding the initial budget. Moreover, he mentioned that the main reason for cost overruns is the changes in the design, mainly caused by clients. Additionally, the results showed that incomplete designs, lack of availability of information in the planning stage, absence of design details during the execution stage and inaccurate estimations, are severe factors that cause overruns in construction projects in the UK. The author also mentioned that the main reasons for cost overruns in the construction of UK were: the changes in inflation, problems of one of the underground stations under this place, delay in designs and approval of costs, significant design changes, delays in construction and changes in the construction requirements.

2.4.3 Quality Performance

Quality performance is referenced to the standard of the delivered project and that specified in the contract documents (Langston, 2012). The expectation is to receive what is specified, no more and no less, and often this is judged in the detail of the finishes and the workmanship applied. There is no convenient unit of measurement for quality, and it therefore involves a collection of issues, some of which are objective (e.g. number of identified defects) and others are subjective (e.g. craftsmanship).Langston (2012) also said that quality is influenced by a number of related factors, all of which would normally add cost and time to some extent as the level of quality increases. These include build ability, innovation, building height, extent of fit-out, environmental performance, compliance, standard of finish, supervision levels and efficiency. While quality defies objective measurement, relative comparison is possible.

Yang (2009) found that the quality of project deliverables is significantly associated with automation technology usage in the front-end, design, procurement and construction phases. Furthermore, using a case study methodology, Tchidi et al. (2012) found that prefabrication improved project quality and reduced construction waste. Quality management has grown in prominence over the years. It is believed that quality was probably the best strategy to ensure customer loyalty, defend against foreign competition and secure continuous growth and profits in difficult market conditions.

2.5 Benchmarking and Performance

Tolosi (2000) cited by saleh (2008), defined benchmarking as a process in which continuously measure the products, services and operational practices of a given organization to compare the organization's performance and operational practices with a selected sample group.In addition to create a basis for comparison, benchmarking is a good development tool because it enforces a self-critical approach, indicating the points of operation the company must improve. The benchmarking analysis consists of the following parts:

- The user satisfaction analysis which concerns the identification of customer preferences and includes the estimation of the relative importance, and
- The satisfaction benchmarking analysis which is mainly focused on the performance evaluation of the competitive organizations against the satisfaction criteria.

Benchmarking through the application of performance measurement systems has in recent times become a total issue in the construction industry.

Luu et al (2007) presented how benchmarking approach can be applied to evaluate and improve the construction project management. A conceptual research framework was generally developed to perform a benchmarking study of the project management performance (PMP) from the contractor's viewpoint. It was remarked that benchmarking approach can help construction firms to learn from the best practices of others and carry out continuous improvement. It provided a comprehensive view of benchmarking and performance measurement service for the evaluation and comparison of scheduling techniques. Benchmarking has generated a new philosophy and thinking in the understanding and use of parameters for assessing project success and also improving performance and the performance management of future projects. Kingsley (2010) has attributed this new philosophy and thinking to the fact that benchmarking has become an integral part of the planning and on-going review process to ensure a focus on the external environment and to strengthen the use of factual information in developing plans.

2.6 Project Success and Performance

There was not an exclusive definition of project success due to the fact that the meaning is different for each person, project team and company (Chan*, et al.*, 2004). Pinto and Mantel (1990) also support the idea of the lack of a unique definition of project success. In addition, the authors also added that the project success should be assessed based on different criteria, which usually change depending on the eye of the beholder. Pheng and Chuan (2006) defined project success as the completion of a project within acceptable time, cost and quality and achieving client's satisfaction. It can be achieved through the good performance of indicators of the project. The discussion below will seek to define project success criteria, ascertain their difference with success factors and assess their importance in performance measurement.

Project success seems to be one of the unclear project management concepts. Individuals or project teams executing a project have different needs and expectations. Therefore it is not strange to find them construction project success in their own way of understanding (Cleland and Ireland, 2004) cited by (Kingsley, 2010). Project success is normally taught of as achievement of some pre-determined project goals while the public had different opinions usually founded on user satisfaction.

Al-Momani (2000) stated that the success of any project is related to two important features, which are service quality in construction delivered by contractors and the project owner's expectations. Managing the construction so that all the participants perceive equity of benefits can be crucial to project success. It is obtained that the complete lack of attention devoted to owner's satisfaction contributes to poor performance. Declining market shares, low efficiency and productivity, and the rapid construction cost escalation also lead to poor performance.

Nitithamyong et al (2004) remarked that the success of construction projects depends up on technology, process, people, procurement, legal issues, and knowledge management which must be considered equally. So, success refers to project success and performance refers to performance of indicators such as project managers. There have been many studies regarding the factors and issues that have an influence on the success of a project (Pinto and Mantel Jr, 1990). These factors have been called Critical Success Factors (CSFs) which have been defined as those attributes that predict the success of projects (Sanvido*, et al.*, 1992).

Many authors have suggested that some of the reasons behind the failure of projects are the lack of critical success factors during the execution of the project (Pinto and Covin, 1989). However, to understand the benefits of the critical success factors, it is important to define project success. The main barrier is that this term has been defined by many people and there has not been a consensus regarding its definition.

Some authors have suggested that time; cost and quality should be the basic criteria to measure project success (Chan, et al., 2004). However, some others consider that "perceived performance" should be the right criteria to measure success, instead of time, cost and quality (Baker, et al., 1983). On the other hand, the authors suggested that meeting these three objectives helps to have project management success. In addition, the authors defined project success as the combination of project management success and project product success. In other words, the authors conclude that if a project meets the time, cost and quality objectives and at the same time the end-product is considered as a success, it can be said that the project is a success.

2.7 Project Performance Measurement

Kuprenas (2003) stated that project performance measurement means an improvement of cost, schedule, and quality for design and construction stages. The performance measurement was a basis for progressive improvement and monitoring of company productivity. According to previous studies, it was conclude that performance measurement is a process includes the key performance indicators.

Tangen(2004) obtained that performance measurement is a complex issue that normally incorporates at least three different disciplines: economics, management and accounting. Measurement of performance has garnered significant interest recently among both academics and practitioners. It was also remarked the choice of a suitable measurement technique depends on a number of factors, including the purpose of the measurement; the level of detail required; the time available for the measurement; the existence of available predetermined data; and the cost of measurement.

Navon (2005) defined performance measurement as a comparison between the desired and the actual performances. For example, when a deviation detects construction management analyzes the reasons for it. The reasons for deviation can be schematically 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). It was also stated that performance measurement is needed not only to control current projects but also to update the historic database.

Iyer and Jha (2005) stated that measuring the performance of any construction project is a very complex process because modern construction projects are generally multidisciplinary in nature and they involve participation of designers, contractors, subcontractors, specialists, construction managers, and consultants. In the construction industry's present scenario, the systematic ways of performance measurement have influenced many construction firms, government sectors, public and private clients and other project stakeholders(Kingsley2010).Performance measurement has been used in collecting and reporting information about inputs, efficiency and effectiveness of construction projects. Again, construction firms use performance measurement to judge their project performances.

Both in terms of the financial and non-financial aspects and to compare and contrast the performance with others in order to improve programme efficiency and effectiveness in their organizations (Kagioglou et al. 2000) cited by (Kingsley2010). It was also stated that,performance measurements are needed to tract, forecast and ultimately control those variables that are important to the success of a project, and this has been agreed by many researchers and practitioners. It has been mentioned that in assessing the performance of contractors, 'a common approach is to evaluate performance on the extent to which client objectives like cost, time and quality were achieved'.These traditional measures have become so popular and entrenched due to the objectivity and simplicity surrounding their measurement. Again, in today's construction environment, timely completions within budgetary allocations are highlighted as critical to client requirement in order to attain 'first in the market' advantage over competitors (Kog et al., 1999).

2.7.1 Characteristics of Good Performance Measurement System

If the right things are not measured or measured accurately, those using the data will be misled and bad decisions are likely to follow. Flint (2005) cited by Kingsley (2010) highlighted the following as some of the characteristics of a good performance measurement system:

A. It should be results oriented i.e. focused primarily on desired outcomes, less on outputs;
B. It should be reliable i.e. accurate, consistent information over time;
C. It should provide useful information that is valuable to both policy and programme decision-makers and also provide feedback on performance.
D. The measures should be quantitative i.e. expressed in terms of numbers or percentages;
E. The measures should be easy to interpret i.e. do not require an advanced degree in statistics to use and understand;
F. The measures should be credible i.e. users have confidence in the validity of the data;
G. It should be comparable such that it can be used to benchmark against other organizations internally and externally;
H. It should be realistic such that the measures set can be calculated.

The above characteristics imply that as the study seeks to develop some performance measurement criteria for the Ghanaian construction industry. The criteria to be adopted should embrace all the above characteristics.

2.7.2 Importance of Performance Measurement

Kingsley (2010) mentioned that failure to measure results means that a distinction cannot be made between success and failure, and if success is not appreciated, it cannot be rewarded. This means that, if success is not rewarded, then, probably failure is being rewarded and the inability to recognize failure means it cannot be corrected. But if results can be demonstrated, then, improvement can be achieved. A major use of performance measurement is to establish accountability so that stakeholders in the construction industry can assess what programmes have been achieved with the funds provided.

Another major use was to help stakeholders develop and then justify budget proposals i.e. supports strategic planning and goal-setting. Performance measurement also helps or assists stakeholders in determining effective use of resources. Hatry (2006) said that, public and private managers often say that performance information will not help them because their problems were too few resources to do what needs to be done. Yet managers need performance measurement to enhance their decision making process as how to increase their ability to get the job done with whatever resources they have. Performance measurement also assists in the improvement of customer service. Performance measurement gives a basis for rating the outcomes and competitiveness of programmes or activities.

The importance of performance measurement in the construction industry is believed to accrue to the major stakeholders in the industry, that is, the client, consultant and the contractor (Nassar, 2009) cited by (Kingsley, 2010). The author mentioned to the client, the author mentioned that best value for money will be achieved since the project stands the chance of being delivered on schedule to and to quality standards as spelt out in the specifications. In addition to this, performance measurement provides also the client with an objective and consistent means of implementing pre-qualification process since performance information of different contractors would be available for comparison and selection. To the consultant, performance measurement will help the consultant to know specific areas of the contractor's performance to focus during construction supervision to ensure a smooth implementation of the project. Also, it will provide the consultant with reliable, accurate and consistent means to assess contractor performance.

Similarly for the contractor, the author again mentioned that performance measurement will provide the contractor with an objective assessment of performance with strength and weaknesses pointed out. Also, the contractor will know which areas need strengthening in order to improve performance. Furthermore, performance measurement will help the contractor to institute improvement measures which will lead to an increase in quality of work, cost effectiveness and efficiency of operations. Performance measurement has also assisted in productivity measurement and benchmarking (Alfeld, 1988). To be able to assess whether progress has been made in the construction process it was important to make reference to the results as a change in productivity for the activity being measured.

A classical definition of productivity was a comparison of the output of a production process to its corresponding input i.e. the output to input ratio. However, productivity measurement and performance measurement are two separate management functions. Productivity measurement involves the collection of information about various activities – specifically, work in place and the corresponding work-hours over a given period of time. On the other hand, performance measurement involves a more comprehensive analysis of these same factors to compare budgeted as against results; hence, productivity is just one part of performance (Thomas, 1988) cited by (Kingsley, 2010). It was also mentioned that, although, performance measurement and productivity measurement are separate management functions, the objective of the two was for organizations to focus attention on the use of resources by measuring how productive they have been and finding ways to optimize resource use and further increase efficiency in their operations, while maintaining or improving results.

2.8 Performance Problem in Construction Industry

The failure of any construction project was mainly related to the problems and failure in performance. Moreover, there were many reasons and factors which attribute to such problem. 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. It was also 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). It also remarked that the traditional project performance control is usually generic (e.g., cost control techniques).

Ling et al, (2007) remarked that international construction projects performance was affected by more complex and dynamic factors than domestic projects; frequently being exposed to serious external uncertainties such as political, economical, social, and cultural risks, as well as internal risks from within the project.

2.9 Factors Affecting project Performance

Kuprenas (2003) studied the impact of the use of a project management based organizational structure, project manager training, frequency of design meetings, and frequency of design reports on design phase cost performance. The process of a design team meeting frequency and the process of written reporting of design phase progress were found to be statistically significant in reducing design phase costs. Chan and Kumaraswamy (1996) stated that a number of unexpected problems and changes from original design arise during the construction phase, leading to problems in cost and time performance. It is found that poor site management, unforeseen ground conditions and low speed of decision making involving all project teams are the three most significant factors causing delays and problems of time performance in local building works.

Okuwoga (1998) stated that, cost and time performance has been identified as general problems in the construction industry worldwide. It was also remarked that project complexity, client type, experience of team and communication are highly correlated with the time performance; whilst project complexity, clients and contractor characteristics are highly correlated with the cost performance.

Iyer and Jha (2005) remarked that, the factors affecting cost performance in Indian construction projects were: project manager's competence, top management support, project manager's coordinating and leadership skill, monitoring and feedback by the participants, decision making, coordination among project participants, owners' competence, social condition, economical condition and climatic condition. Coordination among project participants was as the most significant of all the factors having maximum influence on cost performance of projects.

Chan and Kumaraswamy (2002) proposed specific technological and managerial strategies to increase speed of construction and to upgrade the construction time performance. It is remarked that effective communication, fast information transfer between project participants, the better selection and training of managers, and detailed construction programs with advanced available software can help to accelerate the performance. The managing speed in engineering, procurement and construction projects is a key factor in the competition between innovative firms. It is found that customers can consider time as a resource and, in that case, they will encourage the contractor to improve the time performance.

2.10 Construction Industry in Ethiopia

The construction industry is vital for the development of any nation. In many ways, the pace of the economic growth of any nation can be measured by the development of physical infrastructures, such as buildings, roads and bridges. Construction project development involves numerous parties, various processes, different phases and stages of work and a great deal of input from both the public and private sectors, with the major aim being to bring the project to a successful conclusion (Wubishet, 2004). The level of success in carrying out construction project development activities will depend heavily on the quality of the managerial, financial, technical and organizational performance of the respective parties, while taking into consideration the associated risk management, the business environment, and economic and political stability.

The author also concluded that the general state of the domestic construction industry in Ethiopia is low. The deficiencies were characterized by:

- An inadequate capital base, specifically to construction contractors,
- Old and limited numbers of equipment and their low level of utilization,
- Deficiencies in human resources with regard to technical, managerial, financial and entrepreneurial skills, and
- Very limited experience and participation construction works and provisions of consulting services.

These all mean, enormous volume of infrastructure (construction) works is coming to the industry. Nevertheless, the construction industry of the country looks unprepared for these huge volumes of works to come. The industry is still in the infancy stage, growing unfortunately, slowly both technically and financially.

Like the construction industry in other developing countries, the construction industry in Ethiopia was plagued by many problems (Abadir, 2011). The author said that generally the current state of the construction industry was characterized by:

- An inadequate capital base,
- utilization of old equipment and low levels of availability,
- Severe shortage of construction materials,
- Low level of management, especially project management knowledge and practice (Low level of Contract administration, Project planning and Project monitoring capabilities),
- Deficiencies in technical, financial management and entrepreneurial skills,
- Small-scale local contractors which lack experience in construction management,
- Outdated technology (insufficient and ineffective labor-based construction technology),
- Inadequate and inappropriate project organization structures, which lead to problems of authority, responsibility, communication and coordination, etc.

2.10.1 Construction Project Management in Ethiopia

"A detailed literature on the management practices of construction projects in Ethiopia is difficult to find. As a result research works in such an industry is difficult" (Wubshet, 2004).Like any developing country the construction industry plays major role and contributes highly to the development of the economy of the country. Next to agriculture, the industry provides one of the largest employment opportunities. Developing countries like Ethiopia , spend substantial amount of their budgets in infrastructure development that involve significant construction works in projects such as construction of roads, buildings, water works, telecom civil works, etc. This is also the case in Ethiopia. For example, the Ethiopian government has spent about 50% of its total budget in fiscal year 2007/2008 for capital projects out of which road construction accounts about 33% (MoFED, 2008).

It was also stated that, from project expenses in other sectors, the construction part accounts for the major part as most socio economic projects such as school and healthcare involve significant construction component. Even though significantly large amount of money is being poured in to infrastructure development, the infrastructure of the country is still considered to be very poor, even when seen by the standards of the Sub-Saharan countries. For example, the country's passengers and freight traffic, road density is one of the lowest compared to other Sub-Saharan Countries. From the huge hydropower potential the country has, only less than 10% of it has been put in use (MoFED, 2008).

Generally, according to Wubshet (2004), there was not enough construction and management capacity in the country. The practitioners are less experienced in project management. The management of construction project is highly influenced by the utilization of scarce financial and physical resource with controlling activities limited to cost and time monitoring dimensions only. Contractors cannot properly administer contract, most of them are not properly trained to prepare cost and schedule reports, quality records, safety reports, change order records, claims records, progress reports, payment requisition, etc. Most local contractors even don't have claim management knowledge or are not interested to pursue legitimate claim for fear of damaging working relationships and their reputation in the industry as they will be dealing usually with few public institutions.

Many studies in the area have indicated the need to improve the capacity of contractors in areas such as financial management, project estimating and costing, total quality management, change management ,claim management, business planning , personnel and general management skill, etc which almost all can be included under the project management body of knowledge areas of construction project management.

This shows that improving the project management capacity of contractors can significantly improve the current status of the construction industry in the country (Abadir, 2011).The need for the improvement and development initiative has already been acknowledged by the government of Ethiopian, and university capacity building program (UCBP) has been initiated with the assistance of the German government to support the capacity of local contractors by providing managerial and entrepreneurial training and coaching to increase their competency

Contractors under the program were given training in areas such as modern contract and project management, modern financial and construction equipment management systems, general management and leadership, marketing, project and quality management (Abadir, 2011).

2.10.2 Road construction in Ethiopia

During the 1936-1941 Italian occupation, the building of roads increased mobility of people and resource throughout the country and also helped Italy consolidate its rule over Ethiopia (Behailu, 2006). In 1941 there were about 7,000 Kilometers of roads, of which about half were surfaced with asphalt. After liberation, road construction and maintenance stagnated because of lack of funds, equipment, and expertise. Until 1951, when the government established the Imperial Highway Authority (IHA) with the help of World Bank funds and the technical assistance from the United States Bureau of Public Roads, the development of Ethiopia's highway system continued.

According to Behailu (2006), the Imperial Highway Authority played a major role in the construction of roads until the revolution. The "derg regime" restructured the Imperial Highway Authority as the Ethiopian Road Authority and the Rural Roads Task Force. The government created the latter to develop rural roads outside the main system and to expand feeder roads within the main system. The World Bank, which had financed four previous highway programs, funded this project also. In addition, the African Development Bank (ADB) and the European Economic commission (EEC) provided assistance for road construction and maintenance activities. Despite these efforts, Ethiopia's road network remained primitive and quite limited, even by African standards. This shortcoming had tragic consequences during the 1984-85 famine when the lack of adequate roads contributed to Ethiopia's inability to distribute food and other commodities to the famine victims. As a result, many thousands of Ethiopians perished. In 1991, completion of an adequate nationwide highway system continued to be one of Ethiopia's major development challenges for the new transitional government. The road sector development, which is considered as one of the crucial factors for the countries socioeconomic development was given great emphasis at governmental level with continuous increase in the allocation of budget ranging on the average from 15 % to 20% and of the total yearly allocated budget (Behailu,2006).

Even though the road transport in Ethiopia accounts forever 97% of the total domestic traffic carried out by motorized transport system, most of the connecting roads are not properly maintained which results in frequent accidents costing the life of many people and the loss of valuable resources every year. In 1991, in addition to the 13,000 Kilometers of all-weather roads, of which about 4,000 were asphalted and 8,900 Kilometers of all-weather gravel roads; there were 4,900 Kilometers of rural roads, making a total of nearly 18,000 kilometers of all types of roads. The road network in Ethiopia, centered in Addis Ababa radiates in all directions in a spoke-like pattern (Behailu, 2006). However, substantial parts of the country, notably in the West, Southwest, and Southeast, still lacked all-weather connections to this network. Only about 12 % of the population living in these parts of the country had ready access to roads. Most roads in the national network were concentrated in the central, eastern, and northern highlands.

In 1997, ERA with the support of other development partners launched the Road Sector Development Program (RSDP) to tackle the shortcomings in the road sector and complement other sectoral development programs. This program provides a comprehensive approach of integrating the implementation of key road investments with major policy and institutional reforms (ERA, 2014). Accordingly, the major goals defined by RSDP are directed to:

- Improve transport operating efficiency and reduce road transport costs for freight and passengers so as to encourage production, distribution and export,
- Provide access to previously neglected food deficit rural areas to support efficient production, exchange and distribution throughout the country, and
- Develop adequate institutional capacity of the road sub-sector both at central as well as regional level.

The RSDP has already been implemented over a period of seventeen years and in four successive phases, as follows:

A. RSDP I - Period from July 1997 to June 2002 (5 year plan),
B. RSDP II - Period from July 2002 to June 2007 (5 year plan),
C. RSDP III - Period from July 2007 to June 2010 (3 year plan), and
D. RSDP IV - Period from July 2010 to June 2015 (5 year plan, 4 years elapsed).

A. RSDP I (1997 – 2002)

The main objective of RSDP I has been the improvement of the road network that has been continuously deteriorating to hamper the efficiency of the road transport system throughout the country. The first phase of the RSDP was completed in June 2002. RSDP I focused on rehabilitation and upgrading of main roads, and new construction of link and regional roads. During RSDP I, a total of 8,709 km of roads were rehabilitated, upgraded, constructed and maintained of which 2,709 km of roads were federal roads, 6,000 km of roads were regional roads.

At this time, 7.3 billion ETB was disbursed of which 5.5 billion was on federal roads and 1.7 billion ETB was on regional roads. With regard to the federal road network, 975 km of trunk roads were rehabilitated, 549 km of trunk and link roads upgraded and 928 km of new link roads were constructed during this program. In parallel with these works, a total of 257 km of heavy/emergency maintenance work was carried out on federal paved and gravel roads. Physical and Financial performance against plan during RSDP I was 98% and 74% respectively. By the end of RSDP I, achievements were registered in improving rural accessibility and condition of the road network. The road network of the country increased to 33,297 km in 2002 from 26,550 km in to 1997. As a result, Road density per 1000 sq. km increased to 30.3 km in 2002 from 24.1 km in to 1997. The proportion of the road network in good condition increased to 30 % in 2002 from 22% in 1997(ERA, 2014).

B. RSDP II (2002- 2007)

The focus of RSDP II is to continue the momentum to achieve the road condition targets, as well as to reinforce the process begun under RSDP I and provide a sustainable level of essential road infrastructure to people in rural areas. The second phase of the RSDP, like the first phase, is consistent with the economic policy of the country. The primary objective of RSDP II is to restore and expand Ethiopia's road network, which have become an obstacle and major impediment to sustainability of the economic development program. A total of 12,006 km of roads were rehabilitated, upgraded, constructed and maintained of which 7,483 km of roads were federal, 4,523 km of roads were regional roads. At this time, 18.1 billion ETB was disbursed of which 14.7 billion was on federal roads and 1.8 billion ETB was on regional roads.

With regard to the federal road network, 970 km of trunk roads were rehabilitated, 1,702 km of trunk and link roads were upgraded and 612 km of link roads were constructed during RSDP II. In addition to these works, a total of 4,199 km of heavy/emergency maintenance work was carried out on federal paved and gravel roads. Physical and Financial performance against plan during RSDP II was 141% and 113% respectively. Performance of RSDP II was remarkable as physical performance was much higher than plan and financial performance was also higher than plan. By the end of RSDP II, achievements were registered in improving rural accessibility and condition of the road network.

The road network of the country increased to 42,429 km in 2007 from 33,297 km in 2002. As a result, Road density per 1000 sq. km increased to 38 km in 2007 from 30km in 2002. The proportion of the road network in good condition increased to 49 % in 2007 from 30% in 2002(ERA, 2014).

C. RSDP III (2007- 2010)

During RSDP III, a total of 19,250 km of roads were rehabilitated, upgraded, constructed and maintained of which 7996 km of roads were federal roads, 11,254 km of roads were regional roads. During RSDP III, 34.9 billion ETB was disbursed of which 31.4 billion was on federal roads and 2.4 billion ETB was on regional roads. With regard to the federal road network, 344 km of trunk roads were rehabilitated, 2,723 km of trunk and link roads upgraded and 1603 km of link roads were constructed. In parallel with these works, a total of 3,326 km of heavy maintenance work was carried out on federal paved and gravel roads. Overall physical and financial performance against plan during RSDP III was 93% and 101% respectively. By the end of this program, achievements were registered in improving rural accessibility and condition of the road network. The road network of the country increased to 48,793 km in 2010 from 42,429 km in 2007. As a result, Road density per 1000 sq. km increased to 44.4 km in 2010 from 38.6km in 2007. The proportion of the road network in good condition increased to 56 % in 2010 from 49% in 2007 (ERA, 2014).

D. RSDP IV (2010- 2015)

During four years of RSDP IV, a total of 70,197 km of roads were rehabilitated, upgraded, constructed and maintained of which 10,970 km of roads were federal roads, 19,355 km of roads were regional roads and 39,096 km of roads were URRAP roads. During four years of this program, 120.5 billion ETB was disbursed of which 90.4 billion was on federal roads and 8.5 billion ETB was on regional roads and 21.2 billion was on URRAP roads. With regard to the federal road network, 439 km of trunk roads were rehabilitated, 3.631 km of trunk and link roads were upgraded and 3,184 km of new link roads were constructed. In addition to these works, a total of 3,714 km of heavy maintenance work was carried out on federal paved and gravel roads. The overall physical and financial performance against plan during four years of RSDP IV was 78% and 121% respectively.
By the end of forth year of RSDP IV, achievements were registered in improving rural accessibility and condition of the road network. The road network of the country increased to 99,522 km in 2014 from 48,793 km in 2010. As a result, Road density per 1000 sq. km increased to 90.5 km in 2014 from 44.4 km in 2010. The proportion of the road network in good condition increased to 70 % in 2014 from 56% in 2010 (ERA, 2014).

As major component of the RSDP-IV, Universal Rural Road Access Program (URRAP) was launched envisaging connecting all Kebeles by standard and affordable all-weather roads that provide year round access. Within the program implementation period it is planned to construct 71,523 km of all-weather roads throughout the country at an estimated cost of more than ETB 40 billion. The full-fledged implementation of URRAP will ensure close to 80% of the total rural population year round access to road. The program is fully financed by the Government of Ethiopia. During the first year of implementation, which was largely a year of preparation, only 854 km of roads were constructed. Some of the preparation works were even extended to second quarters of the 2nd year of RSDP IV budget year in some regions. Though the preparation work took more time than anticipated, it has laid the foundation for the success of the program and same is reflected by the promising performance being observed recently (ERA, 2014).

In general, the overall performance of the seventeen years of RSDP performance has brought significant improvements in the restoration and expansion of Ethiopia's road network. Physical achievements have been matched by significant improvements in the condition of the network, strengthening of the management capacity of the road agencies and delivery on policy reform. A total of 110,162 km of major physical road works excluding routine maintenance was carried out of which 29,155 km was on federal roads, 41,132 km was on regional roads construction and maintenance and 39,096 km was on URRAP roads. Overall physical accomplishment against plan was 86%. Total disbursement was about ETB 180.9 billion and this disbursement was 113% of the plan. With regard to federal roads, 2,728 km of rehabilitation of trunk roads and 8,604 km of upgrading of trunk and link roads and 6328 km construction of new link roads were carried out under the program. In parallel with this, heavy maintenance on 11,496 km of federal road was also carried out.

2.10.3 Review of the Ethiopian Road Authority practices

It is well known that transportation is fundamental to the development and operation of any society. It permits that geographically distant resources become accessible with transportation, connect people, transfer of technology and also goods needed in different places. This make evident that the economic growth of any society in any part of the world is directly related to the availability of transportation. Without question, a society without an advanced transportation system remains primitive. In order to facilitate adequate transportation system the construction of adequate road infrastructure is a vital requirement (ERA, 2014). According the Road Sector Development Program (RSDP) report, the review of the different subsystems integrating in ERA and practices are discussed to give the reader a better understanding of the Authority's working procedures and to a deep understanding and appreciation of the system for further detail analysis of the problem.

Procurement Management System (PMS): ERA has long been committed to central procurement but random or piece meal purchasing has been the principal mode of procurement of goods for some time. Procurement in ERA is organized under the supply and equipment division with local and foreign purchases being handled by two separate sections.

Competitive tendering is used whenever advantages are found and the legal requirements met, some civil and consultancy works are directly awarded to public enterprises (generally when a project is locally financed). Award is made in all cases to the lowest responsive bidder meeting the required specifications. However, this practice overlooks the competitive bidding process and frequently results in lower performances *(*ERA, 2014*)*.

Financial Management System: The financial management system in ERA is not computerized. Though the manual for computerizing of all subsystems is already prepared; still some of the subsystems are not integrated with the central financial management system, causing inaccuracies and delays in the monthly cash reports and making complex the timely acquisition of the required cost related information.

Supply Management System: Supply is the process of materials handling between procurement and the end users (i.e. projects and districts). In ERA Parts and Supplies Branch's (PSB) operations were systematized and based on the principles of modern warehousing systems. When the manual was revised, PSB was assigned immediate responsibility for the ordering unit of stock replenishment, receiving, storage, inventory control, transport pool and administration. In Ethiopia, the key parties involved in road projects implementations are the Government of Ethiopia represented by the Ethiopian Roads Authority, Contractors and Consultants.

Wubshet, (2004), said that project performances in developing countries revealed low performances which are strongly associated with Time and Cost Overruns. Projects in construction of building were strong associations with time overruns and quality related issues. In addition, both signaled that their contribution to their program objectives was influenced by their low performances for their projects. Further to these, Cost overrun in road construction and quality related issues in building were found related to claims; and stakeholders' participations and beneficiary satisfactions causal factors respectively. Disputes over claims was found to vary between three to five years and often engaged between the implementing agency and foreign contractors from the developed nations. However, time delays were found strongly associated with domestic contractors once projects had entered into their construction phases.

Currently, the Contractors taking part in road projects implementations are National and international companies. Most of the local Contractors are of limited capacity and rarely do meet the requirements to participate in donor financed projects. Hence, international Contractors, who meet the requirements, have been participating in donor financed projects. The contracting Design Company after winning the contract will take the responsibility to complete construction of the project in accordance with the contract document. Consultants, like Contractors, will take the responsibility for the design and/or supervision services they render in accordance with the contract document. International Consultants' have also been participating in donor financed projects (Getachew, 2009).

Some studies indicated that the amount of cost overrun as compared with original contract amount for road construction projects and the major reasons leading to these overruns. Turkey (2011); identified the major factors that causes cost overrun in Ethiopian Federal road construction projects, material price escalation. Claims due to late removal of obstructions, failure to give possession of site, late issue of drawings, widening of road section at some towns and change in alignment, scope change, changes in quantity (inaccurate quantities), unforeseen ground condition, construction of additional length and additions (variations). The author also identified that, price escalation /price adjustment, variations, right of way, claims, design problems (design risk) and scope change are identified as major factors leading to cost overrun. It was also noted that consequential delays related to design modification has contributed to excessive cost overrun, the costs being quantified as time extension cost. Most of the factors such as variations, scope changes, design problems and unforeseen ground conditions are related to lack of clarity and comprehensiveness of documents (survey, design, tender and contract documents) used in the process and poor planning.

Zerfu (2009) also stated that poor design and technical specifications were among the major factors for the challenges faced by the Ethiopian Roads Authority (ERA) in road construction projects. The other factors such price escalation; claims, right of way problem and failure to give possession of site are related to economic factor and improper planning respectively. Hence it is essential to address the issues related to right of way before mobilization of the contractor to the site and taking into account factors such as price escalation, location of the project, material and labor availability during the engineering estimate and properly forecast the escalation trend.

2.11 Summary and Gap Identified

From the literature review, it was obtained that there were many fields and topics which are related to performance such as, construction management, factors affecting project performance, project performance measurement, key performance indicator and benchmarking. The key performance indicators such as time, cost and quality are used to evaluate performance of construction projects. These indicators can then be used for benchmarking purposes. According to previous studies, it can be said that the performance problems occur in large construction projects due to many reasons; such as incompetent designers/contractors, poor estimation and change management, technological issues and site related issues. The different factors that affect project performance are:

International practice: Design changes from original during the construction phase, poor site management, unforeseen ground conditions, low speed of decision making involving, increase of materials' prices due to fast growth of inflation, delays caused by changes in design specification, financial problems, complexity of the client and the client's representative, etc

National practices: Inadequate capital base, shortage of construction materials, lack experience in construction management, usage of outdated technology, design changes and problems, unforeseen ground condition, right of way problems and variations etc.

Poor performance of some asphalt overlay road projects and delay in completing design study, delay in procurement process, and poor performance of some contractors are among the major problems for the low accomplishment of construction industry. In addition to this, the major problems encountered in the road sector in the reporting periods are; capacity limitations, low level of competency, increasing construction cost, shortage of skilled human resources and shortage of construction materials. The contractors taking part in road projects implementations were national and international companies especially; Chinese contractors mostly participated in execution of the road projects of the country. Most of the local contractors limited capacity and rarely do meet the requirements to participate in donor financed projects. Hence, international contractors, who meet the requirements, have been participating in donor financed projects.

Consequently, the centre attention of thesis was focused on comparative evaluation of project performance between domestic and Chinese contractors in selected federal road projects in Ethiopia.

CHAPTER THREE

METHODOLOGY

3.1 Research Approach

When conducting a research it is necessary to determine which approach is being implemented, because "scientific inquiry in practice typically involves alternating between deduction and induction. Both methods involve interplay of logic and observation.

According to Gulati (2009), Research approach can be divided into two categories:

- Deductive approach and
- Inductive approach.

Main distinction between inductive and deductive research approach relates to the existence and placement of hypotheses and theories. Specifically, if the researcher adopts a range of hypotheses the research is aimed to explore, then it will be deductive research. On the other hand, if hypotheses are absent at the start of the research then it will be the case of inductive research. In other words, the relation of hypotheses to the study can serve as the main point of difference between these two approaches. Specifically, it has been noted that "two important functions that hypotheses serve in scientific inquiry are the development of theory and the statement of parts of an existing theory in testable form.

Therefore, this study followed the deductive approach. A deductive approach is concerned with developing a hypothesis (or hypotheses) based on existing theory, and then designing a research strategy to test the hypothesis. In addition to this both the qualitative and quantitative research approaches are used in this research, and compare the results of this research with other research to access to the fact.

The procedures applied to achieve the objective of the research are: problem identification, literature review, research design, data collection, research analysis and discussion and draw conclusion from the result of data analysis and forward recommendations (See figure 3.1).

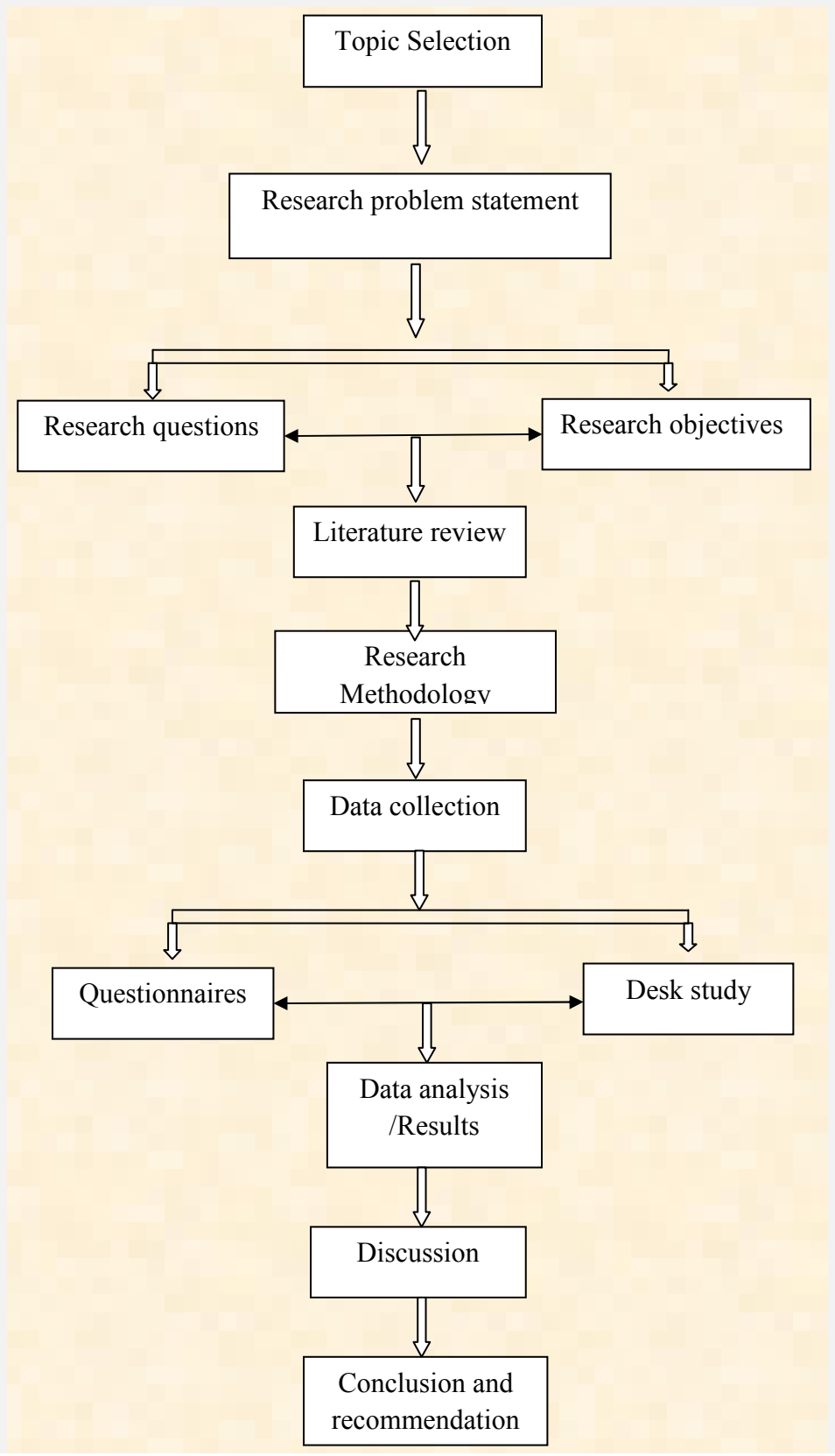

Figure 3.1: Research Methodology flow chart

3.2 Research Design

The research design had looked into the research questions in section 1.3.The study was intended to examine the performance of road construction projects in the road sector development program of phase IV (RSDP IV), particularly with the beginning of phase IV or Growth and Transformation Plan (GTP) as cases study. To study these cases, the study populations were recognized on their organizations levels. Consequently, the study population was formulated based on their involvement for their different purposes and formed three categories.

3.2.1 Research Population and sample size

The approach used to select sample size was the non-probability sampling technique particularly the purposive or Judgmental sampling methods. This was because the approach was used to select sample projects in which a sample that serves the real purpose and objectives of the research achieved. The researcher believed that this sampling method would be best to answer the research questions. Non-probability is a sampling technique where the samples are gathered in a process that does not give all the individuals in the population equal chances of being selected.

The projects were selected from the road sector development program of phase IV (RSDP IV) of federal road projects in which their starting period of commencement are in 2011. This was because of the contractual period of the road projects were mostly from three to four years, so in order to get completed or nearly completed projects it was important to take the sample from the beginning of the RSDP IV. In addition to the commencement period, contractors of the projects should also be either domestic or Chinese contractors. This was because the main objective of the study was to comparative evaluating the project performance between domestic contractors and Chinese contractors with regards the key performance indicators. Types of project delivery systems of projects were also delivered by design-bid-build (DBB) types of project delivery systems. Because under projects executed by the Chinese contractors, no project was executed by the design- build (D-B) type of project delivery system. The types of projects were also only new construction or upgrading federal road projects, no term maintenance because of the same reason given above (no Chinese contractors involved).

According to the data collected from the Ethiopian road authority (ERA), based on the above set selection criteria, from the 13 projects executed by domestic contractors, 6 projects were rejected and only 7 projects were selected, in which 3 of them were completed. The reason for the rejection of the 6 projects was that they were delivered based on the design-build (DB) types of project delivery system. Similarly from the 8 projects executed by Chinese contractors, 2 projects were rejected and 6 projects were selected, in which one of them was completed. The reason for the rejection of the two projects was that they are not executed by Chinese contractors. They are executed by the Arab and Yemen contractor.

Therefore, based on the above set selection criteria, from the total 21 population of the study, (Federal road projects executed by domestic and Chinese contractors), only 13 projects fulfill the criteria and they are selected as a sample size. From the selected 13federal road projects 4 of them were completed projects, whereas the remaining 9 projects were on-going projects.

On the other hand three types of respondents are considered in this study. The first type respondents are the project owner of the federal road projects (ERA). The second types of respondents are the consultants of the projects. The final types of respondents are the contractors of the projects (both domestic and Chinese contractors). The sample size selection of projects owners, consultants and contractors, were selected depending on their direct exposure to the above selected road construction projects of the road sector development program of phase IV (RSDP IV).

Accordingly, 13 processionals were selected from the Ethiopian road authority (ERA). Since 2 consultants, have involved in two projects, only 11consultants were selected based on their involvement of the selected federal road projects above and all of them were class I consultants. Their lists were taken from the Ethiopian road authority (ERA).Through the same reason of the consultants, 11 contractors were also selected based on their involvement of the selected federal road projects of phase IV. Based on these6 domestic and 5 Chinese contractors were selected and both of them were grade I contractors. Their lists were taken from the ministry of construction and urban development and Ethiopian road authority (ERA).

Table 3.1: Selected federal road projects, their consultants and contractors

No.	Project Name	Consultants	Contractors	Financial Resource	Contract	
					Cost (ETB)	Period (Cal. Days)
1	Seret Village -Werei Bridge	Construction Design Share Company	SUR Construction	FDRE	460,257,521.26	1080
2	Nehile–Abala	C-Tech Engineering PLC	MACRO General Contractor and Trading Plc	FDRE	272,704,620.78	820
3	Dima-Fiyel Weha	Core consulting Engineering	Gemshu Beyene Construction Plc	FDRE	777,078,942.38	1095
4	Menebegna - Lemlem Berha	Engineer Zewdie Eskindr Consulting plc	SUR Construction	FDRE	1,192,072,064.49	1095
5	Otolo- Sawla	Robust consulting and Engineering services PLC	FAL Trading General Contractor	FDRE	453,990,619.00	1095
6	Mekele - Seret Village	NET Consult Consulting Engineers and Architectures PLC	Ministry of National Defense, Construction Enterprise	FDRE	482,672,383.62	1080
7	MehalMeda-Km 72	Engineer Zewdie Eskindr Consulting plc	Sunshine Construction PLC	FDRE	802,248,892.71	1096
8	Yabelo-Mega	Renardent Consulting Engineers	China Tiesiju China Engineering Group	IDB and FDRE	770,007,996.78	1080
9	Wolkite-Arekit	Compton Engineering and planning associates joint venture Beza Consulting Eng.	China Gezhouba Group Company Ltd. (CGGC)	IDB	717,440,576.41	912
10	AbiAdi_ Fireweyni	Renardent in sub consulting with UNICONE	China Railway No3 Engineering Group Co ltd	FDRE	874,321,916.68	1080 42

11	Ayra - Chinka	NET Consult Consulting Engineers and Architectures PLC	China Int. Water & Electric Corp.	IDA	669,000,000.00	910
12	Chinka- Dembidollo	Lea in sub-consulting with UNICONE	China Highway Group	IDA	648,000,000.00	910
13	Mekenajo - Ayra	Sheladia in sub-consulting with Hitcon	China Highway Group	IDA	633,000,000.00	910

3.2.2 Research instrument

The research instruments were designed properly to ease examining, categorizing and tabulating the research responses. The research questions are given for the different responses both for interview and questionnaires. Accordingly, questionnaire survey was selected as the research instrument owing to its suitability to the level of information required. Informal interviews were also conducted with some contractors while distributing and collecting the questionnaires. The interview provided additional information, either which were not included in the questionnaire or which participants failed to mention on the form. The questionnaire survey was conducted among the selected road projects and their corresponding stake holders like owner, contractors and consultants. The other instrument approach that was used to conduct the research process was a desk study or secondary research through surveys of reports and different documents having descriptive outputs.

Generally; the study focused primarily, as a case study, in analyzing the contract administration experiences, and in particular focuses on the selected federal road construction projects executed in Ethiopia either by the domestic both grade one general and road contractors (GC/RC-1 contractors) or the Chinese contractors.

3.3 Data Collection

3.3.1 Data Sources

The study was used both primary (field) data and secondary (documented) data for the comparative evaluation of project performance between domestic and Chinese contractors in selected road projects in Ethiopia.

3.3.2 Primary Data collection

The primary data was collected through questionnaires and interviews from the selected federal road projects in Ethiopia. In order to obtain appropriate and adequate responses from the respondents, a combination of fixed response and open end type of questionnaires will be prepared and distributed through direct contact to the respondents' in such a way that the options of the respondents were required on the subject of the study.

For the selected project owners (13 different professional), 11 Consultants, 6 domestic and 5 Chinese contractors; the questionnaires were distributed for projects engineers, team leaders, projects co-coordinator, engineering department head and construction directors. Responses will be collected on individual basis and also interviews will conduct with respondents in respect of questionnaires earlier distributed. Interview was conducted with the deputy general manager /directors, engineering head department and team leaders based on the semi-structured interview guideline and detailed descriptions to support information which was collected through the questionnaires.

3.3.3 Secondary Data collection

The secondary data was collected from different published and unpublished performance related documents, reports/documentations in the government offices running the indicated projects, Journals related to the issues, books about construction management and analysis of available data with regard to key project performance indicators in these projects. Archival documents were mostly project reports, which are used to identify the recurrent problems in the Ethiopian construction sector. In addition, they are used to judge the management systems that are traditionally practiced by the industry. Archival documents which are important for the study such as project monthly reports and contract documents were referred.

3.4 Data Analysis

Analysis of a research involves examining, categorizing, tabulating, testing or otherwise combining mixed evidences to address the initial problem statement. The analysis of the data depends on the specific research problem and question. The descriptive statistics is a method of analysis which provides a general overview of results. Frequency distribution, which shows the frequency of observation of each response to each variable under investigation, is used to analyze the result of some questions. Rating scale is one of the most common formats for questioning respondents on their views or opinions of an event or attribute.

All data collected were organized and relevant answers were adopted in order to ensure a meaningful presentation and analysis of the data collected. Secondary data was used as supplementary. Theoretical concepts obtained through literature were used to interpret and compare the findings. Analytical tools was basically the descriptive statistical, which includes percentage and tables; and qualitative approach can also be used to describe the analysis qualitatively such as low, moderate high etc.

The referenced materials include, reports, journals related to the issues, and books about construction management. A significant portion of the information however, was obtained through the review of reports. As international projects are financed through bilateral or multilateral governmental financing arrangements, all the projects surveyed have been under government agencies. Finally, based on the findings of the analysis, conclusion and recommendation was given and forward.

CHAPTER FOUR

RESULTS

4.1 General Overview

This chapter deals with the survey results of the information gathered from both the desk study and the questionnaire survey; which includes analysis of project performance of domestic and Chinese contractors with respect to key performance indicators (Time, Cost and Quality), comparison between domestic and Chinese contractors in their performance, key differences between domestic and Chinese contractors, Best practices and lessons learned of the selected Ethiopian federal road construction projects.

A desk study was conducted within the owner of the federal road construction projects, Ethiopian Roads Authority (ERA). The documents referred during the desk study include progress and completion reports, contract documents, variation orders, correspondences and other important documents of the systematically selected Ethiopian federal road construction projects. In the questionnaire survey respondents were presented with a range of questions designed to assess their perception on the research topic. They were asked to express their opinion on the existence of projects performance of the federal road construction projects with respect to time, cost and quality performance.

Analysis of results from both desk study and questionnaire survey would be discussed in detail in the following sections, on the basis of which recommendations to construction industry of Ethiopia were made. In the analysis that follows, the survey responses have been grouped for discussion into categories associated with particular aspects of project performance of domestic and Chinese contractors in Ethiopian selected federal road construction projects.

Questionnaires distributed to the respondents have been collected 100% and the entire were valid and used in the research analysis and their results were presented in the following section in both domestic and Chinese contractors respectively.

4.2 Project Performance of Domestic Contractors

4.2.1 Time Performance

4.2.1.1 Delay During Construction of Selected Federal Road Projects

The respondents were asked if there is a delay during the construction of the federal road projects, 100 % all the respondents (Contractors, Consultants, and Owners) agreed that there is a delay during the construction of selected federal road projects.

4.2.1.2 Main causes of Delay of Federal Road Projects

According to the responses of all the informants' (Contractors, Consultants, and Owners), there were different causes of delay during construction of the federal road projects. The main causes of delay are; 32% of the respondents responded design related problems like: faulty design, design change and modification and delay in approval of modified design. 25 % unexpected ground conditions such as: adverse climate condition (rain), un foreseen site condition, changes in sub-soil conditions and actual site conditions may be changed until construction begins.16% of both right of way related problems and variation order. Right of way related problems which include: late site hand over after the contract award, delay of local administration/federal government decision, and untimely resolution of problems in regards to right of way case. Variation order like: new additional work order due to the public request, quantity increment because of faulty design and additional work due to design change and modification. Finally, the rest 11% poor contractors' capacity includes: Lack of resource, commitment problem, lack of experience, and improper planning and implementation or project management problems.

In addition to these shortages of construction materials like cements and inflation are also mentions as causes of delay in the selected federal road projects.

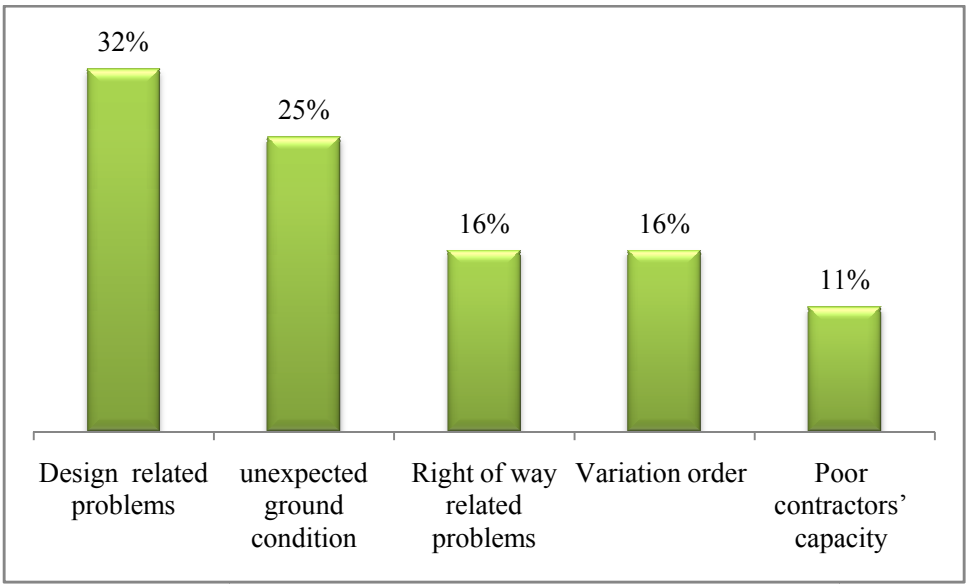

Figure 4.1: Main cause of delay in selected federal road projects

4.2.1.3 Progress of the Projects versus Contract Period (Schedule)

On average 81% of all the respondents agreed that progress of the projects were not appropriate with regards to the contract period. But the rest 19 % of the respondents responded that the progress of the projects were appropriate with regards to the contract period. On the other hand according to the responses of each the respondents', 100% of the owners', 71% of both consultants' and contractors' respondents agreed that progress of the projects were not appropriate with regards to the contract period. The rest 21% of both the consultants' and contractors' respondents responded that the progress of the projects were appropriate with regards to the contract period. This was because those amount contractors had appropriate planning and logistic, enough resource and proper project management systems in implementations of road construction projects.

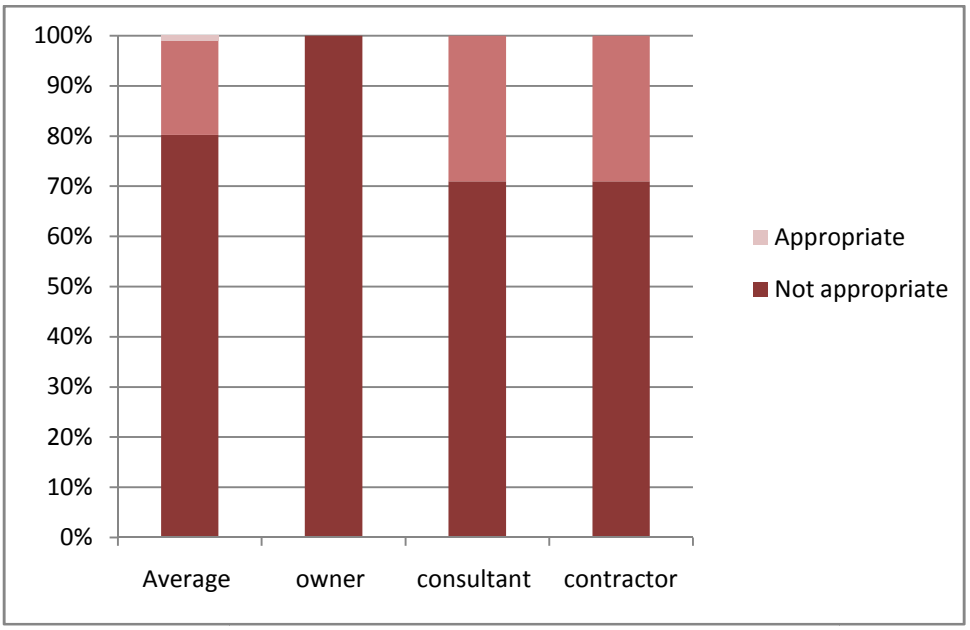

Figure 4.2: Progress of the projects Vs contract period

4.2.1.4 Reason that affect progress of the projects based on the schedule

The respondents of the survey believed that like the cause of delay mentioned above there were some reasons that affect the progress of the projects with respect to the schedule. The percentages were 37% of the total of all respondents responded design related issues, 26% poor contractors' capacity , 21% right of way related issues and 16 said variation order were the main reasons that affect the progress of the projects not commenced based on their schedule, show figure 4.3.

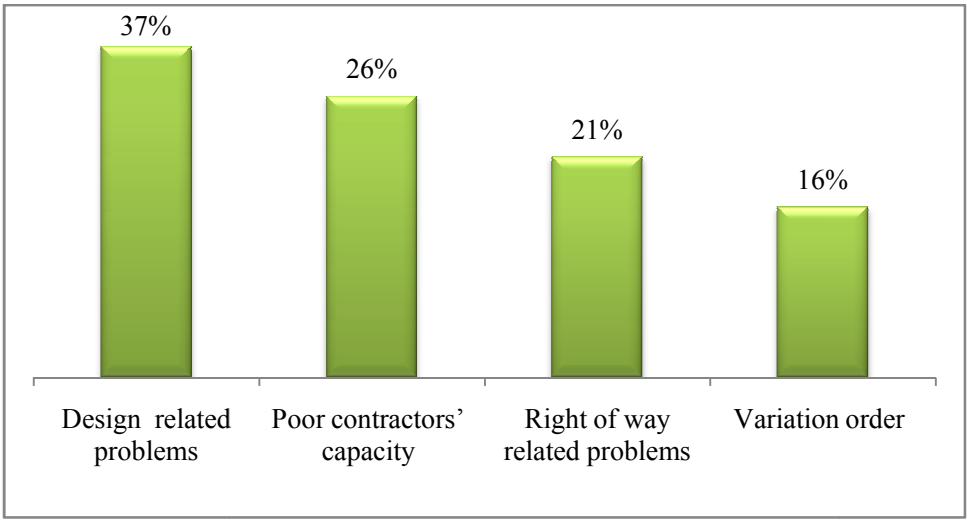

Figure 4.3: Reason that affects progress of projects

4.2.1.5 Engineering Time Estimation of Projects

68% of all the respondents (owners, consultants and contractors) agreed that the original engineering time duration estimation of the selected federal road projects mentioned in the contract agreement was enough to complete the projects. But the rest 32 % of all the respondents said that the original engineering time duration estimation of the selected federal road projects in the contract agreement was not enough to complete the projects. This was because of design change (modification), delay in approval of the modified design, variation order by the request of the owner and right of way problem related issues were the main problems respectively.

4.2.1.6 Extension of Time

100 % of all the respondents of owners, consultants and contractors agreed that there were extension of time during the construction of the selected federal road projects.

4.2.1.7 Main Causes of Extension of Time

Respondents of contractors, consultants, and owners responded that there were different causes of extension of time during construction of the road projects. The main causes are; 47% of the respondents reply design related problems, 21%, both variation order and right of way related problems, and the rest 11 % unexpected ground conditions , see figure 4.4.

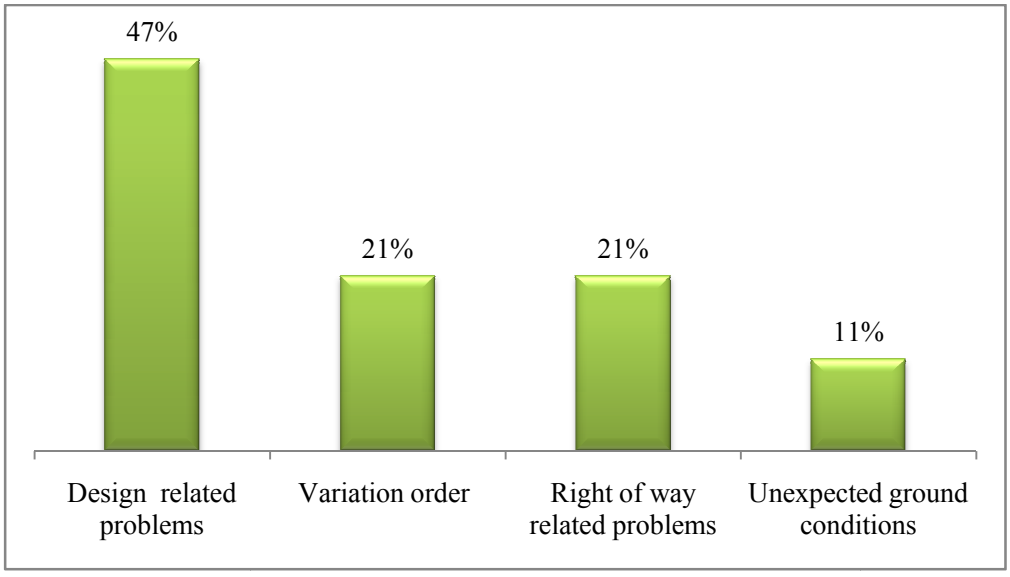

Figure 4.4: Main cause of extension of time

4.2.2 Cost Performance

4.2.2.1 Cost Overrun in Federal Road Projects

As indicated by the respondents, 86 % of the owners', 67% of the consultants' and 83 % of the contractors' respondents agreed that there is cost overrun during the construction of the selected federal road projects because of different reasons. Whereas the rest 14% the owner's, 33% of the consultants' and 17% of the contractors' respondents didn't agree with presence of cost overrun. Totally 79 % of all the respondents agreed, but 21% didn't agree with presence of cost overrun during the construction of the selected federal road projects.

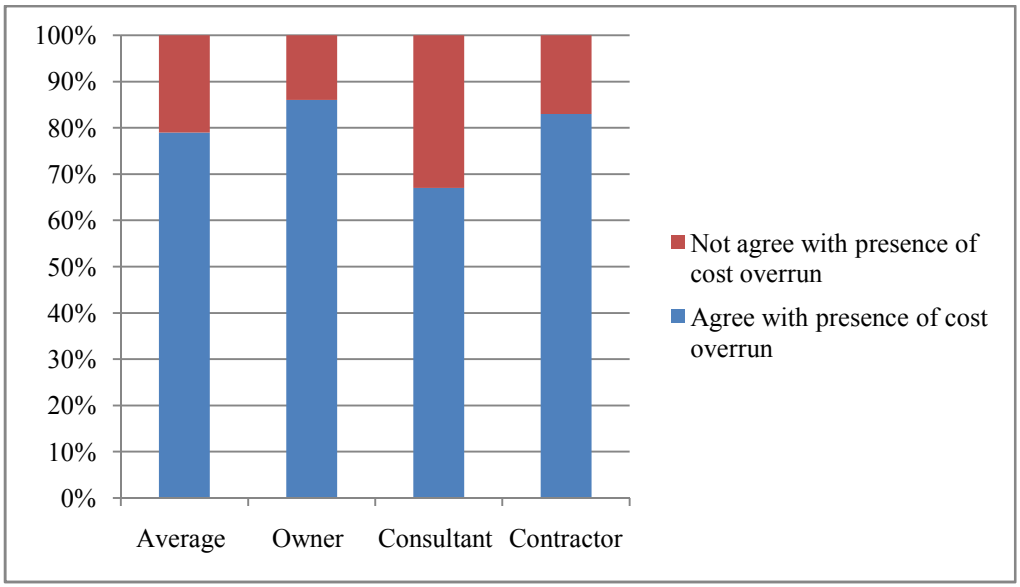

Figure 4.5: Respondents agreement on presence of cost overrun

4.2.2.2 Causes of Cost Overrun

Figure 4.6 shows that, 53 % all the respondents (contractors, consultants, and owners) concluded that the main causes of cost over run during the construction of the selected federal road projects are design change, 26% said variation order and the rest 21% said delay of projects.

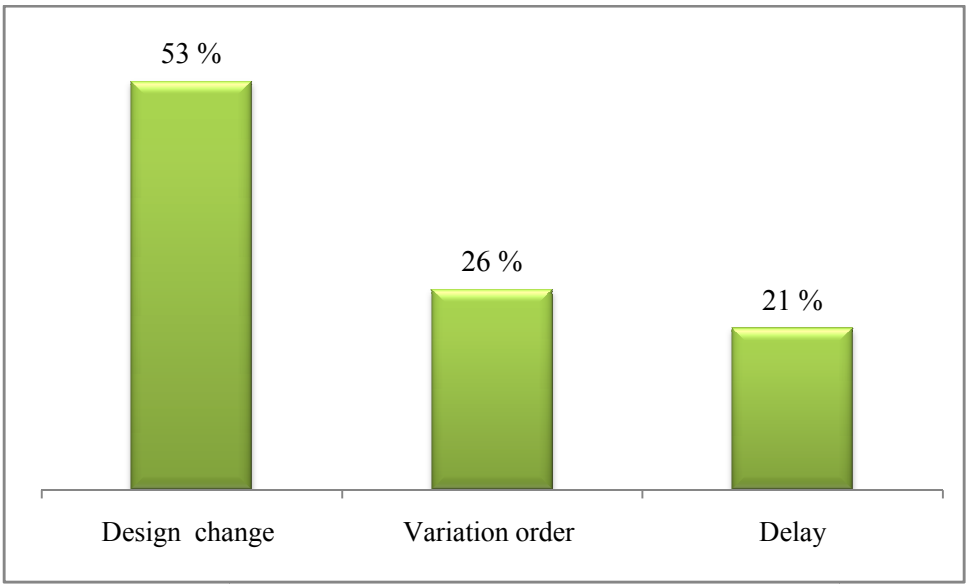

Figure 4.6: Main causes of cost overrun

4.2.2.3 Engineering Estimation Vs Actual Cost of Projects

According to the response of the respondents, 79% of all the owners, consultants and contractors conclude that the actual cost the selected federal road projects were more than the engineering estimation cost of the projects. This was because of the design change (modification), variation order and delay. On the other hand the rest 21% of the respondents said that the actual cost the selected federal road projects are not more than the estimated cost of the projects.

4.2.2.4 Variation

Similar to the cost overrun,86% of owners', 67% of the consultants' and 83% contractors' respondents agreed that there were a variation during the construction of the selected federal road projects. The main reasons that caused variations concluded by all respondents were; design change (modification) issues and incomplete quantity estimations. But 22% of the consultants' respondents didn't agree that there were a variation during the construction of the selected federal road projects.

4.2.3 Quality Performance

As indicated by the respondents, 86 % of the owners' and 67% of both the consultants' and contractors' respondents agreed that there were no as such any quality problems during the construction of the selected federal road projects. But the rest 14 % of the owners,'33% of both the consultants' and contractors' respondents agreed that there were quality problems. This was because of an ethical professional (contractors) and lack of experience but they were controlled by the consultants and project owners. Totally 73% of all the respondents agreed that no quality problems, but 27% of the respondents said there were quality problems during the construction of the selected federal road projects.

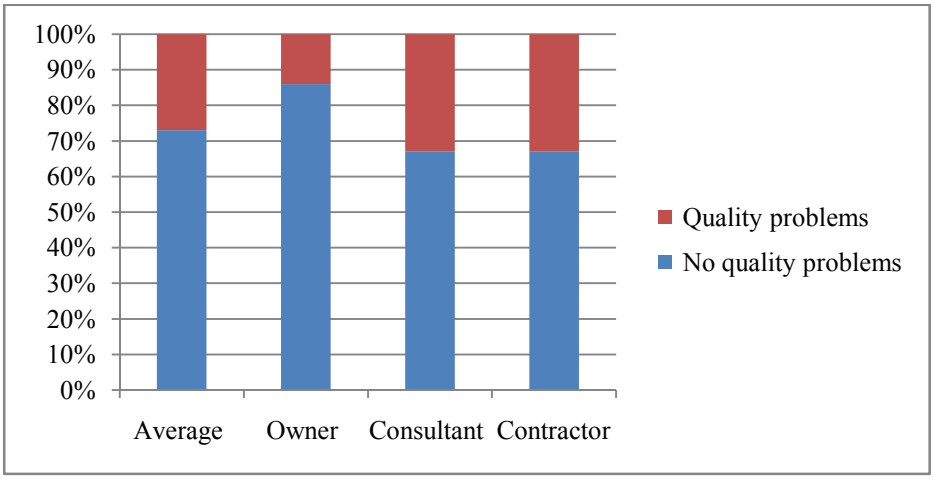

Figure 4.7: Respondents agreement on quality performance

4.3 Project Performance of Chinese Contractors

4.3.1 Time performance

4.3.1.1 Delay during the Construction of Selected Federal Road Projects

Similar to the case of domestic contractors, 100 % all the respondents (Contractors, Consultants, and Owners) agreed that there was a delay during the construction of the selected federal road projects.

4.3.1.2 Main Cause of Delay of the Selected Federal Road Projects

According to all respondents of Contractors, Consultants, and Owners there were different causes of delay during construction of the selected federal road projects. The main causes of delay were; 31% of the respondents reply design related problems, 25% both unexpected ground conditions and variation order, 13% right of way related problems, and the rest 6% said poor contractors' capacity, see figure 4.8.

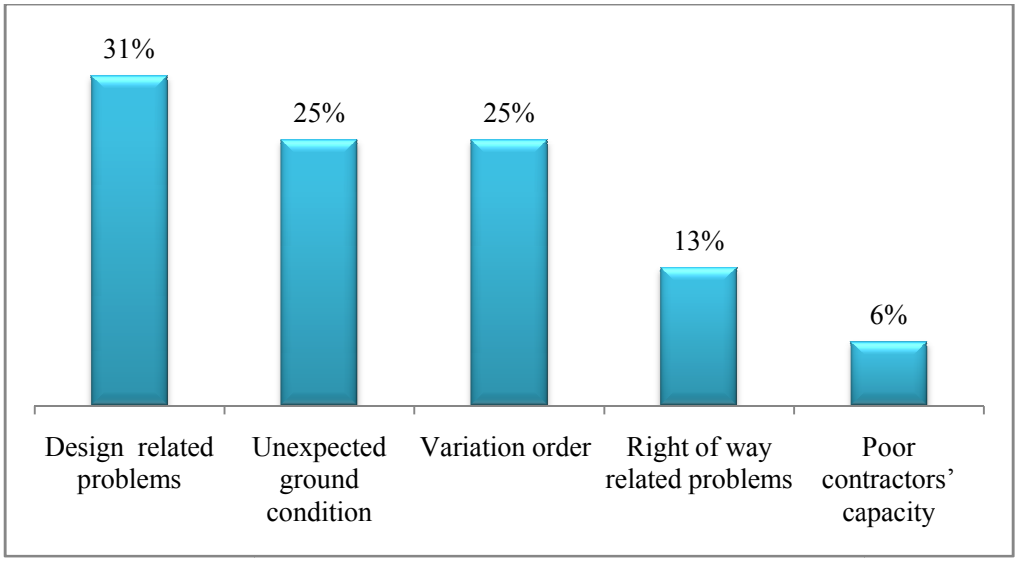

Figure 4.8: Main cause of delay of the selected federal road projects

4.3.1.3 Progress of the Projects versus Contract Period (Schedule)

Figure 4.9 shows that, on average 74% of all the respondents agreed that progress of the projects were not appropriate with regards to the contract period. But the rest 26 % of the respondents responded that the progress of the projects is appropriate with regards to the contract period.

On the other hand according to the responses of each respondent's, 83% of the owners', 80% of the consultants' and 60% of the contractors' respondents agreed that progress of the projects were not appropriate with regards to the contract period. But 17% of the owners', 20% of the consultants' and 40% of the contractors' respondents said that the progress of the projects was appropriate with regards to the contract period.

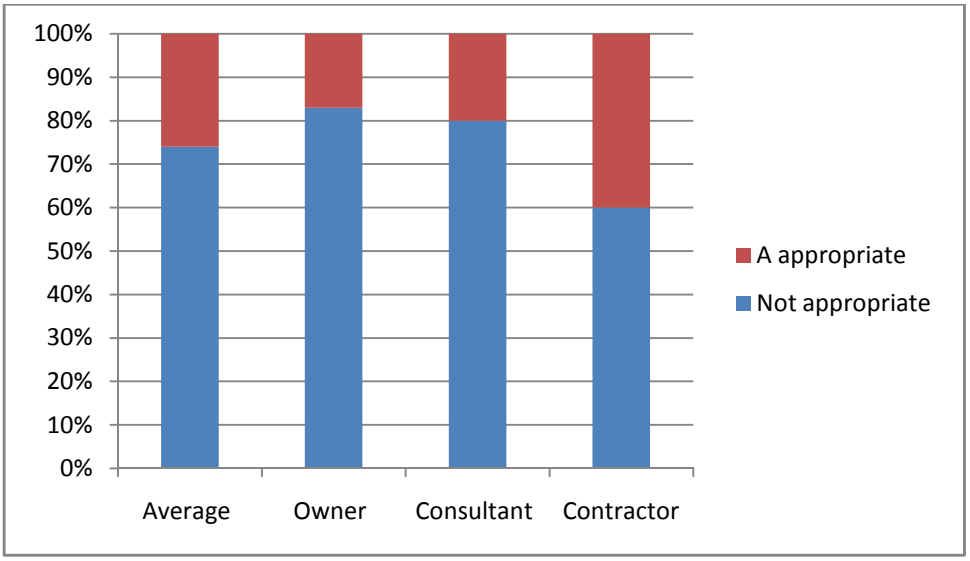

Figure 4.9: Progress of the projects Vs contract period

4.3.1.4 Reasons that Affect Progress of the Projects Based on the Schedule

The respondents of the survey believed that like the cause of delay mentioned above there were some reasons that affect the progress of the projects with regards to the schedule. The percentages showed 38% of the total respondents said design related issues, 25% of the respondents responded variation order, 19% of the respondents right of way related issues and 13% responded contractors' capacity related issues are the main reasons that affect the progress of the projects not commenced based on their schedule, see figure 4.10.

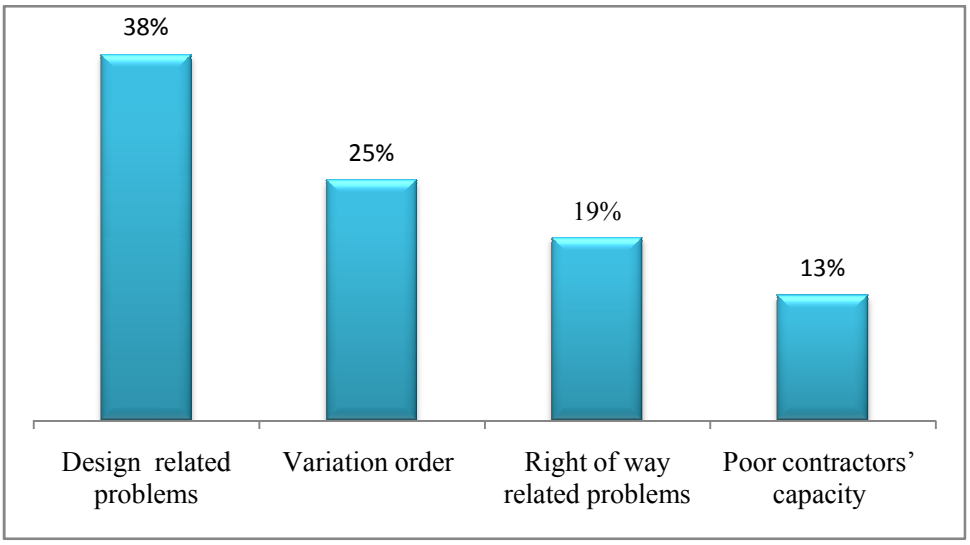

Figure4.10: Reason affects progress of projects

4.3.1.5 Engineering time Estimation of Projects

Similar to the above in the cases of domestic contractors according to the response of the respondents, 69% of all the respondents (owners, consultants and contractors) agreed that the original engineering time estimation of the selected federal road projects mentioned in the contract agreement was enough to complete the projects. But the rest 31 % of all the respondents said that the original engineering time estimation of the selected federal road projects in the contract agreement was not enough to complete the projects. This was because of design change (modification), delay in approval of the modified design, variation order by the request of the owner and right of way problem related issues were the main problems respectively.

4.3.1.6 Extension of Time

100 % of all the respondents of owners, consultants and contractors agreed that there is extension of time during the construction of the selected federal road projects.

4.3.1.7 Main Cause of Extension of time

All the contractors, consultants, and owners responded that there were different causes of time extension during construction of the selected federal road projects. The main causes of extension of time were; 31% of the respondents said design related issues, 25%, said both variation order and unexpected ground conditions and the rest 19% right of way related issues, see figure 4.11.

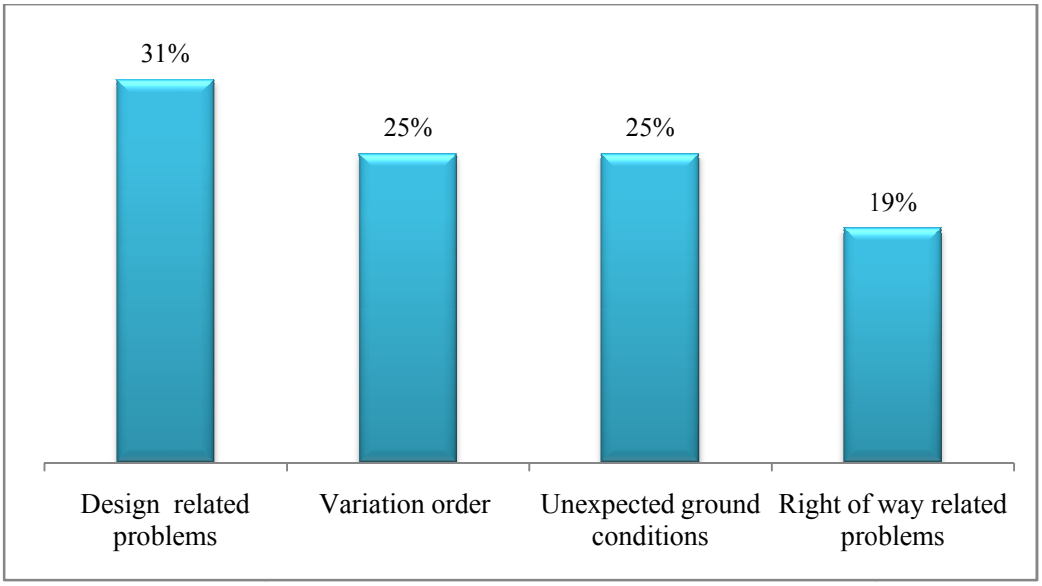

Figure 4.11: Main cause of time extension

4.3.2 Cost performance

4.3.2.1 Cost overrun in Selected Federal Road Projects

100 % of all the respondents of owners, consultants and contractors agreed that with presence of cost overrun in the construction of the selected federal road projects. This was because of different reasons. These different reasons would be summarized in the following for the three parties of the construction industry.

4.3.2.2 Causes of Cost Overrun

Figure 4.12 showed that, 44 % of all the respondents (contractors, consultants, and owners) concluded that the main causes of cost overrun during the construction of the selected federal road projects were design change, 32% responded variation order and the rest 24% responded delay of projects.

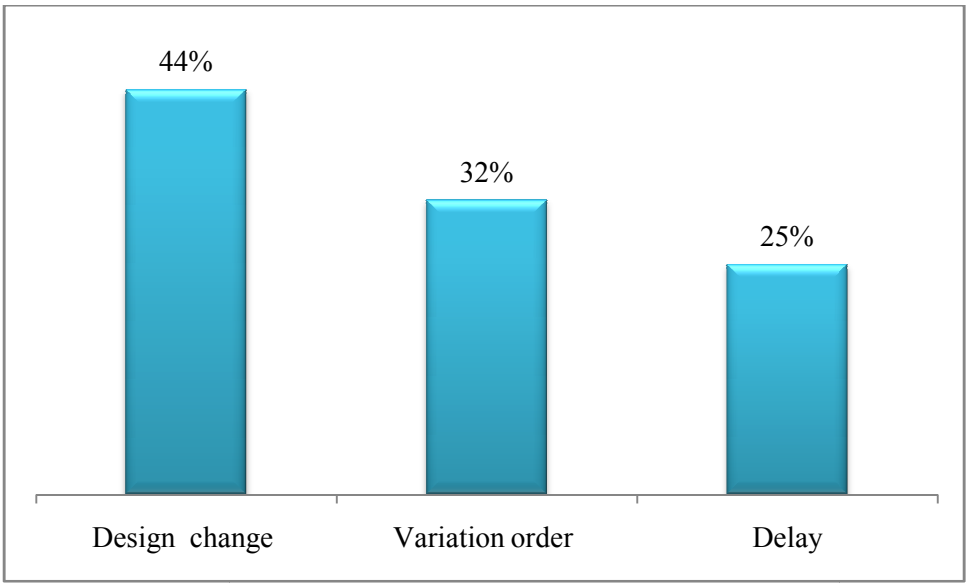

Figure 4.12: Causes of cost overrun of the selected federal road projects

4.3.2.3 Engineering Cost Estimation Vs Actual Cost of Projects

According to the response provide by the respondents, 100% of all the informants (owners, consultants and contractors) concluded that the actual cost of the selected federal road projects was more than the estimated cost of the projects. This was because of the design change (modification), variation order and delay of projects respectively.

4.3.2.4 Variation

All of the respondents' of owners', consultants' and contractors agreed that there is a variation during the construction of the selected federal road projects. The main reasons that causes variations were conclude by all respondents were; design change (modification) issues and incomplete quantity estimations.

4.3.3 Quality Performance

Results in figure 4.13 showed that 83 % of the owners' and 80% both the consultants' and contractors' of respondents agreed that there were no quality problems during the construction of the selected federal road projects. The rest 17 % of the owners' and 20% both the consultants 'and contractors' respondents responded that there were quality problems. Totally 81 % of all the respondents (owner, consultants and contractors) agreed that, no quality problems. But 19 % of the respondents said that there is a quality problem during the construction of the federal road projects.

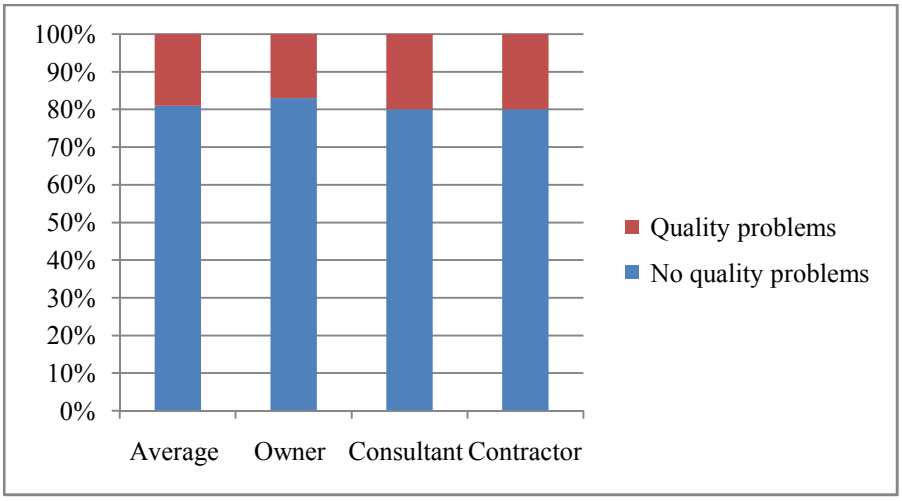

Figure 4.13: Respondents agreement of on quality problems

4.4 Comparison Between Domestic and Chinese Contractors

4.4.1 Related to Time Performance

In both the domestic and Chinese contractors, 100 % all the respondents (Contractors, Consultants, and Owners) agreed that there is delay during the construction of the selected federal road projects. Regarding to delay there is no difference between the two contractors rather this makes them similar.

As showed in the table below, design related problems and unexpected ground conditions had ranked in the first and second position respectively as the main causes of delay during construction of the selected federal road projects in both projects implemented by domestic and Chinese contactors.

Table 4.1: Main Causes of Delay in Domestic and Chinese Contractors

No.	Causes of delay	Percentage given by the respondents			
		Domestic	Rank	Chinese	Rank
1	Design related problems	32	1	31	1
2	Unexpected ground conditions	26	2	25	2
3	Right of way related problems	16	3	13	4
4	Variation order	16	4	25	2
5	Poor contractors' capacity	11	5	6	5

In the case of on-going projects, respondents concluded that; 81 % in domestic contractors and 74 % in Chinese contractors responded that the progress of the projects were not appropriate with regards to the contract period (schedule). But 19 % in domestic contractors and 26 % in Chinese contractors responded that the progresses of the projects were appropriate with regards to the contract period (schedule). 68% in domestic and 69% Chinese contractors, of all the respondents, (owners, consultants and contractors) agreed that the original engineering time estimation of the selected federal road projects mentioned in the contract agreement was enough to complete the projects.

However, the rest 32 % and 31 % respectively of all the respondents in both cases responded that the original engineering time estimation of the selected federal road projects in the contract agreement was not enough to complete the projects. This was because of design change (modification), delay in approval of the modified design, variation order by the request of the owner and right of way problem related issues were the main problems respectively

Like the case of delay, in both the domestic and Chinese contractors, 100 % of the respondents (Contractors, Consultants, and Owners) agreed that there was an extension of time during the construction of the selected federal road projects. This point is also makes both of the two contractors were similar. But there were differences in the amount of extension of time. The amount of extension of time on average in projects executed by domestics' contractors was 35%; where as in projects executed by Chinese was 31%.

In the case of the main cause of extension of time even though there is a difference in their amount in both contractors they were the same. The main causes of extension of time mentioned in both contractors were compared as follow:

Table 4.2: Main causes of extension of time in Domestic and Chinese Contractors

No.	Main causes	Percentage given by the respondents			
		Domestic	Rank	Chinese	Rank
1	Design related problems	47	1	31	1
2	Variation order	21	2	25	2
3	Right of way related problems	21	2	19	4
4	Unexpected ground conditions	17	4	25	2

In both contractors, design related problems and variation order have ranked in the first and second position respectively as main causes of extension of time. Right of way related problems is also ranked in the second in domestic contractors, while, in the fourth in Chinese contractors. Unexpected ground conditions had been ranked in the fourth position in domestic contractors, where as in the second position as main causes of extension of time in Chinese contractors.

4.4.2 Related to Cost Performance

In domestic contractors, 79% of the respondents agreed that, there was cost overrun during the construction of the selected federal road projects. On the other hand in the case of Chinese contractors, 100 % of the respondents of owners, consultants and contractors agreed that there was cost overrun in the construction of the selected federal road projects. This was because of different reasons. These different reasons would be summarized in table 4.3 below for the two contractors.

Table 4.3: Main causes of cost overrun in both contractors

No.	Main causes	Percentage given by the respondents			
		Domestic	Rank	Chinese	Rank
1	Design change	53	1	44	1
2	Variation order	26	2	32	2
3	Delay of projects	21	3	24	3

As the above table showed that, even though the amount of percentage given were vary, in both contractors the main causes were the same. They were also order as design change, variation order and delay of projects respectively. Due to these reasons 79% of the respondents, in domestic contractors and all of the respondents in Chinese contractors concluded that the actual cost the selected federal road projects were more than the estimated cost of the projects.

In the case of variation, 79% in domestic and 100 % of the respondents in Chinese contractors agreed that there was a variation during the construction of the selected federal road projects. The main reasons that cause variations concluded by all respondents were; design change (modification) issues and incomplete quantity estimations. To elaborate this let us see the amount of variation in all projects of both the contractors'. Average variation of the completed projects executed by domestic contractors' was the 25%; where as in projects constructed by Chinese was 3%. This showed there was big difference between the two contractors.

4.4.3 Related to Quality Performance

As indicated by the respondents in domestic contractors, 73% of all the respondents concluded that no quality problems, but 27% of them said that there were quality problems during the construction of the selected federal road projects. Whereas the respondents in Chinese contractors showed that, 81 % of all the respondents (owner, consultants and contractors) agreed that, no quality problems. But 19 % of the respondents said that there was a quality problem during the construction of the federal road projects. Under the two contractors there is a difference of 8% that means in case of road projects constructed by domestic contractors, the amount of problems were higher than that of Chinese contractors by this amount.

In both contractors, the key performance indicators are ranked as quality, cost and time respectively in their more prone to success. On the other hand their more prone to failure of the key performance indicators was the reverse of the above (time, cost and quality).

4.5 Key difference and best practices between Domestic and Chinese contractors

According to the respondents, the key differences between domestic and Chinese contractors would be summarized as follow. 40% of the entire respondent responded that resource capacity, 23% said time management, 20% said experience and 17 said commitment respectively.

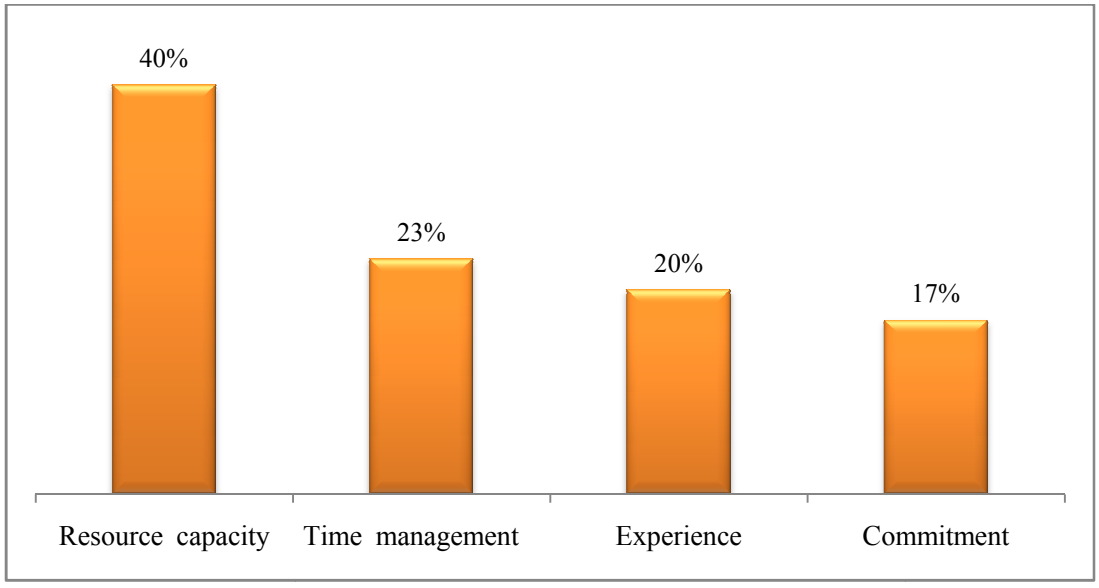

Figure 4.14: Key difference between domestic and Chinese contractors

Some of the respondents (contractors and owners) responded that, in addition to the above key difference, the other main difference between domestic and Chinese contractors was, Chinese contractors were effective in the criteria set by the World Bank (African Development Bank) sponsored to the projects. Chinese contractors have the capacity to cover the 10% of the total cost of the project on unconditional (block) bank guaranty, but domestic contractors didn't have the capacity to do so. On the other hand Chinese government also gave the guaranty or covered the unconditional (block) bank guaranty to contractors of the country.

According to the respondents, the best practices that domestic contractors learnt from Chinese Contractors were: 85% of the owners', 100 % of the consultants' and 73% of the contractors' respondents responded that there were best practices that domestic contractors learnt from Chinese. On the other hand, 15% of the owners' and 27 % of the contractor's responded that there were some best practices that Chinese contractors learnt from domestic contractors. 55% of owners', 100% of the consultants' and 64 % of the contractors' respondents responded that, project management system was the best practice that domestic contractors learn from Chinese contractors. But 30% of the owners' and 9% of the contractors' respondents responded commitment respectively. The owners' and contractors' responses concluded that the best practices Chinese contractors learnt from domestic contractors during construction of the selected federal road projects were: professional ethics, honesty and construction quality work.

CHAPTER FIVE

DISCUSSION

5.1 Project Performance of Domestic Contractors

5.1.1 Time performance

5.1.1.1 Delay During construction of federal road projects

As the result indicated in section 4.2.1.1; all the respondents of contractors, consultants and owners agreed that there was a delay during the construction of the selected federal road projects. The researcher would verify this result taking the completed projects as cases discussed in detail below:

Seret Village -Werei Bridge road project was found in Tigray regional state. The total length of project is 65Km with road class of link road. According to the project contract document, the project has contract period of 1080 calendar days (three years) and the contractual date of completion period was May 21, 2014. It has also an extension of time 26 calendar days; this extends the original contractual date of completion period to June 17, 2014.The delay equivalent to the amount of extension of time (26 calendar days) was due to the fault of the external factors (out of the contactor fault). External factors include; design related problems, unexpected ground conditions, right of way related problems and variation order.

Nehile–Abala road project was found in Afar regional state. The total length of project is 77Km with road class of link road. According to the project contract document and project report, the project has contract period of 820 calendar days (two years and three months) and the contractual date of completion period was April 25, 2013. It has also an extension of time 567 calendar days; this extends the original contractual date of completion period from April 25, 2013 to November 25, 2014. But the actual completed date of the project was April 25, 2015. From this the researcher observed that there was a delay of 150 calendar days by the fault of the contractor. That means 22.33% of the main causes of delay of this project were due to the internal factors.

The remaining delay equivalent to the amount of extension of time (567 calendar days) was due to the fault of the external factors (out of the contactor fault). This indicated that the amount of delay caused by external factors (out of the contactor fault) was larger than the delay caused by the contactor's fault. In other words 77.67% of the main causes of delay of this project were due to the external factors.

Dima–FiyelWeha road project was found in Tigray regional state. The total length of project is 87Km with road class of link road. As mentioned in the contract document and project report, the project has contract period of 1095 calendar days (three years) and the contractual date of completion period was August 30, 2014. Like the above case this projects had also an extension of time 365 calendar days; this extends the contractual date of completion period from August 30, 2014 to August 30, 2015. But the project was completed on February 30, 2015.

That means that the project was completed 180 calendar days (six months) earlier than the revised completion period. As compared to the original contractual date of completion period, the project has 180 calendar days (six months) of delay. But this delay was due to fault of the external factors, not due to the contractor's problem. On the other hand this indicates that, if external conditions were favorable, the contractor could complete the project earlier than the original contractual completion period. From this, the researcher concluded that under this project there were different obstacles that hindered the effective project implementation by the external factors. In general, this project had good time performance. It was also mentioned by the project owner as a model of good time performance of the domestic contractors.

Respondents were also asked to mention the different causes of delay during construction of the selected federal road projects. Accordingly, respondents mention different causes of delay. Among those the main causes of delay during construction of the selected federal road projects concluded by the respondents are: design related problems, unexpected ground conditions, right of way related problems, variation order and finally poor contractors' capacity respectively.

The researcher classified the above main causes of delay as internal and external causes. Internal causes are causes occurred by the contractors fault but external causes are other causes out of the contractors fault. Based on this classification the above main causes of delay during construction of the selected federal road projects are grouped as follow. Poor contractors' capacity which includes: Lack of resource, commitment problem, lack of experience, improper planning and implementation, and gab in project management skill are grouped under the internal causes. On the other hand design related problems, unexpected ground conditions, right of way related problems, and finally variation orders are grouped under the external causes. Design related problems include: faulty design, design change and/or modification and delay in approval of modified design. Unexpected ground conditions such as: adverse climate condition (rain), un foreseen site condition, changes in sub-soil conditions and actual site conditions may changed until construction begins (due to large gap between design and construction period). Right of way related problems which include: late site hand over after the contract award, delay of local administration/federal government decision, and untimely resolution of problems in regards to right of way case. Variation order like; new additional work order due to the public request, quantity increment because of faulty design and additional work due to design change and modification.

Therefore, from the above mention main causes of delay, the researcher concluded that, 64% of the main causes of delay were due to the problems of the project owner and/or consultants or designers. 25% due to unexpected ground conditions and/or natural hazards and the rest 11% of the main causes were due to the fault of the contractors. So the project owner and/or consultants or designers were the first accountable for the delay of the selected federal road projects. Unexpected conditions and/or natural hazards are the second causes but they were beyond the control of the construction firms. Finally, Contractors were the last accountable for the delay of the federal road projects.

Chan and Kumaraswamy (2008) conducted a survey to determine and evaluate the relative importance of the significant factors causing delays in Hong Kong construction projects. They analyzed and ranked main reasons for delays and classified them into two groups:

A. The role of the parties in the local construction industry (i.e. whether client, consultants or contractors) and

B. The type of projects.

Results indicated that five major causes of delays were: poor site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, client initiated variations and necessary variations of works. Therefore, all owners, consultants and contractors felt with this sensitive problem (delay) in their projects. This problem could be considered as an obstacle for time performance of construction projects.

5.1.1.2 Progress of projects VS Contract Period (Schedule)

The results showed that 81% of all the respondents agreed that progress of the projects were not appropriate with regards to the contract period. But the rest 19% of the respondents said that the progress of the projects was appropriate with regards to the contract period. The main arguments of the respondents especially the contractors was the progress of original contractually work was appropriate with the schedule. But the main problems that makes (seems) progress of the projects are not appropriate with regards to the contract period were the additional work by the local administration and/or the project owner.

The researcher verified these two different ideas using some undergoing projects. To elaborate the progress of the projects were appropriate with regards to the contract period. Menebegna–Lemlem Berha project, original contractual date of completion was December 21, 2013. But due to design change (shifting route of the proposed road), the date of completion period would be revised to June 30, 2015. The progress of the project was 90% until the data for this research was collected. This shows that, the progress of the project is good and it would be completed according to the revised schedule because there are above two months remaining to the dead lines of the contract. Mehal Meda–Km 72 original contractual date of completion was September 15, 2014. But due to design change, the date of completion period would be revised to March 15, 2015. The progress of the project was 68% until the data for this research was collected. This shows that, the progress of the project is good and it would be completed according to the revised schedule because there are above one year remaining to the dead lines of the contract.

To elaborate the progress of the projects are not appropriate with regards to the contract period. Mekele–Seret Village original contractual date of completion was April 17, 2014. Due to design change and additional work the date of completion period would be revised to Apirl 15, 2015. The progress of the project is 70% until the data for this research was collected. Consider the current project status and its revised completion period; the progress of the project is not appropriate with the contract schedule (contractual period).

Therefore, from the results of the respondents' and these different cases, the researcher concluded that most of the progresses of the projects were not in line with regards to the contract period (schedule) finally they exposed to delay. Since the aggregate sun of progress problems was delay, the main causes were also similar to that of delay. These were design related problems, unexpected ground conditions, poor contractors' capacity, right of way related problems and variation order respectively.

5.1.1.3 Engineering Time Estimation of Projects

The results indicated that most of all the respondents (owners, consultants and contractors) agreed that the original engineering time estimation of the selected federal road projects mentioned in the contract agreement was enough to complete the projects. But some of the respondents oppose this idea. This was because the arguments of those respondents were; due to the design change (modification), delay in approval of the modified design, variation order by the request of the owner and right of way problem related issues, the engineering time duration estimation of the selected federal road projects mentioned in the contract agreement was not enough to complete the projects.

5.1.1.4 Extension of Time

As all the respondents' of owners, consultants and contractors agreed that there was an extension of time during the construction of the selected federal road projects. The researcher also agreed with this idea, because as shown in table 5.1there was no any project executed without extension of time. In other words all the projects (7 of the projects) executed by the domestic contractors have extension of time starting from one month up to one and half years.

Table 5.1: Extension of Time in Projects of Domestic Contractors

No.	Project name	Contract period (Calendar days)	EOT (calendar days)	EOT in %	Project status
1	Seret Village -Werei Bridge	1080	26	2.41	Completed
2	Nehile -Abala	820	567	69.15	Completed
3	Dima -FiyelWeha	1095	365	33.33	Completed
4	Menebegna - LemlemBerha	1095	555	50.68	On-going (90%)
5	Otolo- Sawla	1095	90	8.22	On-going (80%)
6	Mekele - Seret Village	1080	360	33.33	On-going (70%)
7	Mehal Meda-Km72	1096	534	48.72	On-going (68%)

From the above 7 projects, the researcher selected three of the completed projects as an elaboration of the above conclusion about extension of time. These projects are Seret Village –Werei Bridge, Nehile–Abalaand Dima –FiyelWeha.

Seret Village -Werei Bridge road upgrading projects was a three years project with extension of time 26 calendar days. This was very small extension of time and it was completed without delay except this amount of time. The researcher also concluded that this project could be taken as a model of good time performance. Nehile–Abala road project was contract period of 820 calendar days (two years and three months) with time extension period of 567 calendar days (one year and six months). This indicated that, the original contract period and the amount extension of time were almost similar. The effect of this would caused the project to be delayed a minimum of equivalent to the amount of extension of time. So from this the researcher concluded that the time performance of this project was low.

The third final case from the completed road projects was the Dima–Fiyel Weha road project with contract period of 1095 calendar days (three years) and this project had also a time extension period of 365 calendar days (one year).Therefore, from this result the researcher concluded that there was no any road project free of extension of time .

In addition to the presence of extension of time respondents were also asked to mention the reason that caused extension of time. Accordingly, as shown in figure 4.4 showed that all the respondents of contractors, consultants, and owners, said that there were different causes of extension of time during construction of the selected federal road projects. The main causes of extension of time were design related problems, variation order, right of way related problems, and unexpected ground conditions order from first -forth respectively.

From these results the researcher concluded that like the causes of delay, 89% of these causes were grouped under the projects owner and /or designer. This was because design related problems and right of way related problems should solve earlier before tendering and the contract award. Similarly the variation due to the faulty design and quantity increment because design change and modification should also control earlier in the time of either feasibility study or during design period. That means all these causes were under the control of the project owner and/or designer.

On the other hand, 11% of these causes were grouped under unexpected ground conditions and /or natural hazards or acts of God which are impossible to control either by the project owner or contractors. Because unexpected ground conditions includes as: adverse climate condition (rain), change of the physical site condition due to flood(topographic change), un foreseen site condition and changes in sub-soil conditions from the sample taken during the feasibility study. Therefore, the sources of the main causes of extension of time were project owner and /or designer and natural hazards or act of God.

5.1.2 Cost Performance

5.1.2.1 Cost overrun of federal road projects

As indicated by the respondents, 79% of all the respondents agreed that, there was cost overrun during the construction of the selected federal road projects because of different reasons. But 21% didn't agree with the presence of cost overrun during the construction of the selected federal road projects. Like the case of delay discussed above, the researcher would be verified this result taking the completed three projects as cases discussed in detail below:

The Nehile–Abala road project has a total contractual cost of 272,704,620.78 birr. But the project was completed with additional cost of 165,760,590.92 birr (around 61 %). So this project has a cost overrun of equal to the amount of the 165,760,590.92 birr (more than half of the total cost of the project cost). The Dima–Fiyel Weha road project has total contractual cost of 777,078,942.38 birr. It was completed with additional cost of 14,667,997.10 birr (around 2%). From this it could be concluded that there was a cost overrun of equal to the amount of the 14,667,997.10 birr.

The above two cases showed that, there was a presence of cost overrun during the construction of the selected federal road projects. Even in under-going projects cost overrun was also common. Though the project progresses were between 60% -90%, the cost overrun also ranges from 2%- 47% from the original contractual cost. This amount might be increase as the projects were not completed. Respondents that were agreed with the presence of cost overrun during the construction of the selected federal road projects; were also asked to mention reasons and they mention different reasons. The main causes of cost overrun concluded by all the respondents (contractors, consultants, and owners.) were design change, scope change (increase in quantity), and variation order due to additional work and prolongation of the contract (delay) of projects respectively.

The above mention main causes of cost overrun were grouped under the problems of the project owner and/or designers. This is because, if the designs of the projects were correct, there was no any variation order. At the same time if there was no variation, there was no cost overrun. Therefore, to avoid/minimize the cost overrun in road projects the first and most things that project owner should focus on the accuracy of the design.

Because this was the root causes of cost overrun, delay and variation. In addition to this the other point that requires attention by the project owner was that to solve problems that causes project delay. Such as avoiding right of way related problems. As indicated in the results, 21% of all the respondents didn't agree with the presence of cost overrun during the construction of the selected federal road projects. The arguments of those respondents were the additional cost had equivalent tasks. Similar to the above case, the researcher was taken the third completed project to verify this result.

Seret Village –Werei Bridgeroad project has a total contractual cost of 460,257,521.26 birr. It was completed without any additional cost (cost overrun). Therefore, the researcher concluded that, one from the three selected federal road projects was free of cost over run.

Arditi, et al. (1985) carried out a survey in public projects in Turkey. The authors concluded that the main reason for cost overruns was the increase in materials' prices, mainly caused by the fast growth of Turkish inflation in those years. In addition, the increase in inflation also made it difficult for contractors to buy materials at official prices and in the same way, sell their products at its official price. This fact was considered as the second most important reason for cost overruns. Shortages in resources, changes in design specifications and financial problems were some of the factors which caused delays in projects. These delays were considered the fourth reason for cost overruns in public projects in Turkey. Finally, the authors concluded that the fifth reason for cost overruns was the underestimation of cost at the time of creating the budget of the project.

5.1.2.2 Engineering Estimation Vs Actual cost of projects

Results in the report showed that, most (79%) of all the informants (owners, consultants and contractors) concluded that the actual cost the selected federal road projects were more than the estimated cost of the projects. Those respondents were also asked to mention the main cause of this, and they mention different causes. Similar to the cause of the cost overrun, the main causes were design change (modification), variation order and delay of projects. On the other hand some (21%) of the respondents concluded that, the actual cost the selected federal road projects were not more than the estimated cost of the projects.

This was because the amount of work specified in the contract agreement was equivalent with the initial engineering cost estimation. But the main problems were the cost of the additional work due to different reasons which was not mentioned in the original contract agreement. From the two different results above, the researcher‘s opinion would be discussed as follow: Most of the respondents concluded that the actual cost the selected federal road projects were more than the estimated cost of the projects. But this was due to the design change (scope change), variation order and delay of the projects.

So if the cost of these effects would be add/include to the original engineering estimation cost of the projects, defiantly the final /actual cost of the projects would not exceed to the engineering estimation cost. The main reasons that the researcher observed over this conclusion was the respondents simply compare the original estimation cost of the projects with the final cost of the projects without considering the cost of the additional works due to different reasons. As discussed in the sub section 5.1.2.1, due to the additional cost of the projects the initial cost of the projects were increased by some amount of money.

On the other hand, some (21%) of the respondents concluded that, the actual cost the selected federal road projects were not more than the estimated cost of the projects. The researcher agreed with idea. This was because the amount of work specified in the contract agreement was equivalent with the initial engineering cost estimation. To elaborate these ideas consider the Seret Village -Werei Bridge road project. The project has an initial total contractual cost of 460,257,521.26 birr. The final cost of the project was the same to the initial cost. This is because there is no any variation/ additional work. Therefore, the actual cost the project was not more than the estimated cost of the project.

5.1.2.3 Variation

As all respondents agreed that there was a variation during the construction of the federal road projects. This is also elaborated as shown in table 5.2.

Table 5.2: Variation in projects of domestic contractors

No.	Project name	Contract price (ETB)	Variation in (ETB)	Variation in %	Project status
1	Seret Village -Werei Bridge	460,257,521.26	----	--	Completed
2	Nehile -Abala	272,704,620.78	165,760,590.92	60.78	Completed
3	Dima -FiyelWeha	777,078,942.38	14,667,997.10	1.89	Completed
4	Menebegna - LemlemBerha	1,192,072,064.49	554,788,702.17	46.54	On-going (90%)
5	Otolo- Sawla	453,990,619.00	136,197,185.7	30.00	On-going (80%)
6	Mekele - Seret Village	482,672,383.62	168,729,485.46	34.96	On-going (70%)
7	Mehal Meda-Km72	802,248,892.71	16,548,504.21	2.06	On-going (68%)

The main reasons that cause variations concluded by all respondents were; design change (modification) issues and incomplete quantity estimations. To elaborate this, the researcher took three of the completed road projects and constructed by the domestic contractors.

Nehile–Abala road project has 165,760,590.92 birr (around 61 %) of variation. This was too much amount of variation as compared to the amount of variation recommended in the general condition of contact (10%). Dima–FiyelWeha road project has 14,667,997.10 birr (around 2 %) of variation. This is relatively smaller than the above and it is reasonable, since it is also below amount of the contingency (10%) of projects most of the time considered during deciding the budget of projects.

On the other hand some of the respondents didn't agree with the presence of variation during the construction of the selected federal road projects. They mention roads like Seret Village -Werei Bridge project has no variation. This road project was an example of effective cost performance in the selected federal road projects. Even though one out of the seven projects was without variation, the other six projects have different amount of variation including on-going projects.

From the above results and discussion, the researcher concluded that 85% (6 out of 7) of the selected federal projects were exposed to variation. This is because of design change (faulty design), scope change and incomplete quantity estimations (specification problems). Only 15% (1 out of 7) project was not exposed to variation. Although each project may have unique characteristics, most of the problems that required variation orders are found to be common.

Getachew (2009) concluded the different reasons for variation orders in the road projects as: Errors in estimation of quantities,, inadequate subsurface investigation and interpretation inadequate/Inaccurate topographic survey data, lack of design details, change of alignment, poor specification, late implementation of design and additional works from local administration.

5.1.3 Quality Performance

A high percentage of the respondents believed that, there was no quality problem. As indicated in the results, 86 % of the owners' and67% of both the consultants' and contractors' respondents agreed that there was no as such any quality problem during the construction of the selected federal road projects. But the rest 14 % of the owners,' 33% of both the consultants' and contractors' respondents agreed that there was quality problems. This was because of unethical professional (contractors) and lack of experience but they were controlled by the consultants and project owners. Sometimes, if the costs of unit rate of the some quantities were low, contractors balance this by decreasing in the quality of the construction which was morally and professionally unethical.

Generally, a total 73% of all the respondents agreed that no quality problems, but 27% of the respondents responded that there are quality problems during the construction of the selected federal road projects. This means that, five out of the even projects were exposed to quality problems during construction and they were re-corrected according to the quality requirements of the design of the projects.

5.2 Project Performance of Chinese Contractors

5.2.1 Time performance

5.2.1.1 Delay during construction of selected federal road projects

Results of all the respondents of contractors, consultants and owners showed that there was a delay during the construction of the federal road projects. The researcher would verify this result taking the one completed project as cases discussed in detail below: Yabelo–Mega road project was found in SNNPR regional state. The total length of project is 97Km with road class of trunk road. According to the project contract document and project report, the project has contract period of 1080 calendar days (three years) and the contractual date of completion period was December 23, 2013. As the project has extension of time 95 calendar days, the revised date of completion period was March 28, 2014. But the actual completed date of the project was June 30, 2014. This shows that there was a delay of 90 calendar days (three months).

From this, the researcher concluded that the cause of this delay was the contractor. The remaining delay equivalent to the amount of extension of time (95 calendar days) taking the original contractual date of completion period as a bench mark, was due to the fault of the external factors. This indicated that the amount of delay caused by external factors (out of the contactor fault) is almost similar to the delay caused by the contactor's fault (95=90 calendar days). Even on projects which are undergoing, there are different amount of delay while the progresses of the projects are from 49% up to 88%. This indicates that they might be also delay more than the present because their progress was less than 90%; this showed there were more activities not completed.

Respondents were also asked to mention the different causes of delay during construction of the selected federal road projects. Accordingly, respondents mention different causes of delay. Among those the main causes of delay during construction of the selected federal road projects concluded by the respondents were: design related problems, unexpected ground conditions, variation order, and right of way related problems and finally poor contractors' capacity respectively see figure 4.8.

The researcher classified the above main causes of delay as internal and external causes. Internal causes were causes occurred by the contractors fault but external causes were causes occurred by any other causes out of the contractors fault. Based on this classification the above main causes of delay during construction of the selected federal road projects were grouped as follow. Poor contractors' capacity was grouped under the internal causes. On the other hand design related problems, unexpected ground conditions, right of way related problems, and finally variation orders were grouped under the external causes.

Therefore, from the above mention main causes of delay, the researcher concluded that, 69% of the main causes of delay were due to the problems of the project owner and/or consultants or designers. 25% due to unexpected ground conditions and /or natural hazards and the rest 6% of the main causes were due to the fault of the contractors. So the project owner and/or consultants or designers were the first accountable for the delay of the selected federal road projects. Contractors were also the next accountable for the delay of the federal road projects. But even though the unexpected ground conditions and /or natural hazards were the second main causes, they were out of the control of both parties but, they could be systematically minimized.

5.2.1.2 Progress of the projects versus Contract Period (Schedule)

The results in figure 4.9 indicated that most (74%) of all the respondents agreed that progress of the projects were not appropriate with regards to the contract period. The researcher verified these respondents result using some projects that the progresses of the projects were not appropriate with regards to the contract period.

Wolkite–Arekit road project was found in SNNPR regional state. The total length of project is 60Km with road class of trunk road. As indicated in the contract document and project report, the project had contract period of 912 calendar days (two years and six months) and the contractual date of completion period was April 09, 2014. Since the project had extension of time 352 calendar days, the original contractual date of completion period would be extend to March 26, 2015. But the project is still under on-going with progress status of 88% and it is expected to be complete on August 09, 2015.

So this shows; the progress of the projects is not appropriate with schedule of completion period and with a delay of 30 calendar days due to the contractors fault and 352 calendar days due to the other external factors, (causes out of the contractors) until the present progress. It is completed on the expected completion date (August, 09, 2015), the delay by the faults of the contractor increases to 133 calendar days, if not it might be more than this. This showed, the progress of the project is not appropriate with regards to the contract period (schedule).

Mekenajo – Ayraroad project original contractual date of completion was April 3, 2014. But due to the extension of time of 365 calendar days, the date of completion period would be extended to April 3, 2015. The progress of the project was 49% until the data for this research was collected. This showed that, even though the revised completion period was completed, the progress of the projects was less than 50%. So this showed that the progress of the project was not appropriate with regards to the contract period (even revised period). Since its progress was less than 50% this might requires another more than two years, unless there was no another extension of time.

Chinka–Dembidollo road project contractual date of completion was April 3, 2014. Revised completion was April 3, 2015(including extension of time). The progress of the project was55% until the data for this research was collected. This showed that, similar to the above case, even though the revised completion period was completed; the progress of the projects is less than 60%. So this shows that the progress of the project is not appropriate with regards to the contract period (even revised period). Unless there is another extension of time, the current progress of the project might require another may be more than a year.

The other final case was Ayra – Chinka with contractual date of completion was April 3, 2014 and including extension of time the revised completion was April 3, 2015. At the time data collection for this research (April 2015), the progress of the project was 65%. Similar to the above two cases even though the completion period of the project was completed; its progress was still very low. Therefore, from the three different cases above the researcher concluded that the progresses of the road projects were not appropriate either with original or revised completion period of the projects.

On the other hand, 26% of the respondents responded that the progress of the projects were appropriate with regards to the contract period. The argument they mention were original work can completed based on the contract period, but due to the different reasons the progress of the projects were highly affected. These were like additional work by the local administration and the project owner, design change/modification and right of way problems affected the progress of the projects not going on their contractual agreement.

Abi Adi– Fireweyni contractual date of completion was February 22, 2015. Adding the extension of time, the revised date of completion period was extended to October 17, 2015. At the time data collection for this research (April, 2015), the progress of the project was70%. This showed that, the progress of the project was good and it would be completed according to the revised schedule because there were above eight months remaining to the dead lines of the completion period of the contract.

Therefore, from the results of the respondents' and different cases, the researcher concluded that most (4/5) of the progresses of the surveyed projects were not in line with regard to the contract period (schedule) provided that the there was no any other extension of time. Finally they might expose to delay. Since the aggregate result of progress problems was delay.

The respondents of the survey believed that like the cause of delay mention above there were some reasons that affect the progress of the projects with regards to the schedule. As mention in the results, there were different causes that affect the progress of project not on going with the contract period of construction of the selected federal road projects. The main causes are design related problems, right of way related problems, variation order and finally poor contractors' capacity respectively were the main reasons that affect the progress of the projects not commenced based on their schedule.

5.2.1.3 Engineering Time Estimation of Projects

The results showed that most of all the respondents (owners, consultants and contractors) agreed that the original engineering time estimation of the selected federal road projects mentioned in the contract agreement was enough to complete the original scope projects in practical. But some of the respondents concluded that time duration estimation of the selected federal road projects mentioned in the contract agreement was not enough to complete the projects. Because of design change (modification), delay in approval of the modified design, variation order by the request of the owner and right of way problem related issues were the main problems respectively.

The researcher opinion on the above results was design change (modification), delay in approval of the modified design and variation order had their own time given by the consultants and/ or project owner. Considering the only the initial estimation of time without taking in to account the time duration of the additional work, definitely the time was not enough. But to compare the original time estimation with that of the final completion time of the project, it was necessary to add all the time add in the extension of time with their scope of work to the original work estimation. Therefore, from this it could be conclude that, as majority of the respondents concluded that the original engineering time duration estimation of the selected federal road projects mentioned in the contract agreement was enough to complete the original scope projects in practical. But if there are additional works, since they need another additional time the original engineering time duration estimation of the projects mentioned in the contract agreement was not enough to complete.

5.2.1.4 Extension of Time

As pointed out in the result, all the respondents' of owners, consultants and contractors agreed that there was extension of time during the construction of the selected federal road projects. The researcher also agreed with this idea, because as shown in table 5.3 there is no any project without extension of time. In other words all the projects (6 of them) executed by the Chinese contractors had extension of time starting from three months up to one year.

Table 5.3: Extension of time in projects executed by Chinese contractors

No.	Project name	Contract period (Cal. days)	EOT (cal. days)	EOT in %	Project status
1	Yabelo-Mega	1080	95	8.80	Completed
2	Wolkite-Arekit	912	352	38.60	On-going (88%)
3	Abi Adi _ Fireweyni	1080	235	21.76	On-going (70%)
4	Ayra - Chinka	910	360	39.56	On-going (65%)
5	Chinka- Dembidollo	910	330	36.26	On-going (55%)
6	Mekenajo - Ayra	910	365	40.11	On-going (49%)

From the 6 projects, the researcher selects the completed project (Yabelo-Mega) as an elaboration of the above conclusion about extension of time. Yabelo-Mega project was a contract period of 1080 calendar days (three years) project with time extension of 95 calendar days. This is very small extension of time. The other cases from the on-going projects were projects of Mekenajo – Ayra, Ayra – Chinka and Chinka- Dembidollo (Mekenajo-Dembidollo Contract: 1-3) and Wolkite-Arekit had extension of time each one year. But the progresses of these projects were Mekenajo – Ayra (49 %), Ayra – Chinka(65%) ,Chinka- Dembidollo (55%) and Wolkite-Arekit (88%) respectively. Therefore, from this result, the researcher concluded that no road project was completed without extension of time.

In addition to the presence of extension of time respondents were also asked to the mention the reason that causes extension of time. Accordingly, as shown in figure 4.11, all the contractors, consultants, and owners, responded that there were different causes of extension of time during construction of the selected federal road projects. The main causes of extension of time were design related problems; like faulty design, design change and modification, delay in approval of modified design. Variation order: such as additional work order due to the public request, quantity increment because of faulty design, additional work due to design change and modification. Unexpected ground conditions: such as adverse climate condition (rain), shortage of construction materials like cements un foreseen site condition, and actual site conditions may changes until construction begins. Right of way related problems; like late site hand over, problems of identified boundary of the rout of the road.

From these results the researcher concluded that like the cases of delay, majority (75%) of these causes were grouped under the projects owner and /or designer. This is because design related issues and right of way related cases should solve earlier before tendering and the contract award. Similarly the variation due to the faulty design and quantity increment because design change and modification also solve in the time of either feasibility study or during design period. That means all these causes are under the control of the project owner and/or designer.

On the other hand, some (25%) of these causes were grouped under unexpected ground conditions and /or natural hazards or act of God which are impossible to control either by the project owner or contractors. This was because of these were adverse climate condition (rain), topographic change, etc. Therefore, the sources of the main causes of extension of time were project owner and /or designer and unexpected ground conditions and /or natural hazards or act of God respectively.

5.2.2 Cost Performance

5.2.2.1 Cost overrun of the selected Federal Road Projects

As indicated by the respondents, all the respondents agreed that, there was cost overrun during the construction of the federal road projects because of different reasons. To elaborate this, the researcher took the completed road project (Yabelo-Mega) executed by the Chinese contractors. Yabelo-Megaproject was a total contractual cost 770,007,996.78 birr. But the project was completed with additional cost of 23,000,000.00 birr (around 3%). So this project has a cost overrun of equal to the amount of the 23,000,000.00 birr.

Similar to those completed projects, the undergoing projects were also exposed to a cost overrun of ranging from 1-5% until the date of this data collection time (April, 2015). But since the progresses of these projects were ranging from 49% -88% (not completed), there might be additional cost on the remaining amount of work. Therefore; the researcher concluded that, even though the amount of cost overrun as compare to that of domestic was relatively low (1-5%) or less than 10%, there is no road projects was implemented without any cost overrun; weather executed by domestic or Chinese/foreign contractors.

The respondents were also asked to mention causes cost overrun during the construction of the federal road projects, and they mention different reasons. The main causes of cost overrun concluded by all the respondents (contractors, consultants, and owners.) were design change, variation order due to additional work and prolongation of the contract (delay) of projects respectively. Likewise, the main cause of the cost overrun of the completed project that was executed by Chinese contractor, it was not far from this reason. Yabelo-Mega road project, the main causes of cost over run were: improper design, delay of the project, inflation and lack of construction materials with reasonable cost.

The above case showed that, there was a presence of cost overrun during the construction of the selected federal road projects. Even in undergoing projects cost overrun was also common. Though the project progresses were between 49% - 88%, the cost overrun also ranges from 0.75% - 4.78% from the original contractual cost. This amount might be also increase as the projects were not completed. The main causes of cost overrun were grouped under the problems of the project owner and/or designers. This is because, if the designs of the projects were correct, there was no any variation order. At the same time if there was no variation, there was no cost overrun. Therefore, to avoid/minimize the cost overrun in road projects the first and most things that project owner should focus on the accuracy of the design. Because design related problems were the root causes of cost overrun, delay and variation. In addition to this the other point that required attention by the project owner was that to solve problems that causes to the prolongation of the contract project. Such as avoiding right of way related problems.

5.2.2.2 Engineering Estimation Vs actual cost of projects

Results in the report showed that, all of the respondents (owners, consultants and contractors) concluded that the actual cost of the selected federal road projects were more than the estimated cost of the projects. As respondents were also asked to mention the main cause of this, and they mention different causes. Similar to the cause of the cost overrun, the main causes were design change (modification), variation order and delay of projects.

The researcher‘s opinion would be discussed as follow: all of the respondents concluded that the actual cost the selected federal road projects were more than the estimated cost of the projects. But this was due to the design change (scope change), variation order and delay of the projects.

So if the cost of these effects would be add/include to the original engineering estimation cost of the projects, defiantly the final /actual cost of the projects will not exceed to the engineering estimation cost. Similar to the cases in domestic contractors, the main problem that the researcher observes over this conclusion was the respondents simply compare the original estimation cost of the projects with the final cost of the projects without considering the cost of the additional works due to different reasons. As discussed above, due to the additional cost of the projects the initial cost of the projects were increased by some amount of money.

5.2.2.3 Variation

Respondents agreed that there was a variation during the construction of the selected federal road projects. To elaborate this, the researcher took the completed road project that was executed by the Chinese contractors.

Table 5.4: Variation in projects of Chinese contractors

No.	Project name	Contract price (ETB)	Variation in (ETB)	Variation in %	Project status
1	Yabelo-Mega	770,007,996.78	23,000,000.00	2.99	Completed
2	Wolkite-Arekit	717,440,576.41	34,319,187.70	4.78	On-going (88%)
3	Abi Adi _ Fireweyni	874,321,916.68	27,431,687.03	3.14	On-going (70%)
4	Ayra - Chinka	669,000,000.00	5,000,000.00	0.75	On-going (65%)
5	Chinka- Dembidollo	648,000,000.00	29,000,000.00	4.48	On-going (55%)
6	Mekenajo - Ayra	633,000,000.00	18,000,000.00	2.84	On-going (49%)

Yabelo-Megaroad project has 23,000,000.00 birr (around 3 %) of variation. The researcher concluded that, the amount of variation in projects executed by Chinese contractors was less than the amount of variation in projects constructed by domestic contractors. In addition to this it was also reasonable as compared with the amount of contingency allocated for projects most of the time 10% of the project cost. Respondents were also requested to mention the main causes of variation and they stated different reasons. The main reasons that caused variations concluded by all respondents were; design change (modification) issues and incomplete quantity estimations.

Likewise, the main causes of variation of the above completed project, for the cases of this project (Yabelo-Mega), the main causes were: improper design (increase in quantity), delay of the project, inflation, and lack of construction materials with reasonable cost. From the above results and discussion, the researcher concluded that all (six) of the selected federal projects which were executed by the Chinese contractors are exposed to variation. This was because of design change (faulty design), scope change and incomplete quantity estimations (specification problems).

5.2.3 Quality performance

Like in the cases of domestic contractors, a high percentage of the respondents believed that, there was no quality problem. As indicated in the results, 83% of the owners' and 80% of both the consultants' and contractors' respondents agreed that there were no any quality problems during the construction of the federal road projects. But the rest 17 % of the owners,' 20% of both the consultants' and contractors' respondents agreed that there was quality problems. This was because of the Chinese contractors didn't worry about the long run function of the projects; they simply think about their profit which was unethical attitude.

Generally, a total 81% of all the respondents agreed that no quality problems, but 19% of the respondents said there were quality problems during the construction of the selected federal road projects. This means that, one out of the six projects was exposed to quality problems during construction of the road projects, but they were re-corrected according to the quality requirements of the design of the projects.

5.3 Comparison between Domestic and Chinese Contractors

5.3.1 Related to Time performance

In both the domestic and Chinese contractors, all the respondents of contractors, consultants, and owners agreed that there was a delay during the construction of the selected federal road projects.

Table 5.5: Delay of completed projects in Domestic and Chinese Contractors

Contractors' category	Project name	Fault of delay in (cal.d) due to		Total delay in (Cal. days)
		contractor's	Other factors	
Domestic	Seret Village -Werei Bridge	------	26	26
	Nehile -Abala	163	567	730
	Dima - FiyelWeha	-----	180	180
Chinese	Yabelo-Mega	90	95	180

As the above table showed that, in projects of Seret Village -Werei Bridge and Dima - Fiyel Weha; 100% of the delay was caused due to the fault of the external factors. External factors include; design related problems, unexpected ground conditions, right of way related problems and variation order. But Nehile–Abala road project 77.67% of the delay was caused due to external factors and the rest 22.33% was due to the fault of the contractor (internal factors). Internal factors include; lack of resources, commitment problems, lack of experience and improper planning and implementation. In Yabelo-Megaroad project 51.35% of the delay was caused due to external factors and the rest 48.65% was due to the fault of the contractor (internal factors).

Generally, in completed projects executed by domestic contractors, 82.59% of the causes of delay were due to the external factors but 17.41% was due to contractors fault (internal). In the case of Chinese contractor the cause of delay was shared to both the internal and external factors with the amount of almost fifty –fifty (48.65% and 51.35%) respectively.

From the results and discussion, the researcher like the respondents concluded that there was no any completed road projects without delay. Even though the amount and causes of delay varies, it was a common in the entire project whether they were completed or under progress. The researcher concluded that projects constructed by both contractors (domestic and Chinese) were mainly caused by design related problems and unexpected ground conditions. In the cases of Chinese contractors, variation order was also equally cases as unexpected ground conditions. Right of way related problems were ranked in the third in domestic, while it was in the fourth position in Chinese. These were from the problems of project owner and/or designer and act of God. As poor contractors' capacity position was in the fourth place in case of Domestic, it was in the fifth position in Chinese. This showed that the effect of delay due to domestic contractors was somewhat greater than the Chinese by 4%. This effect was due to the contractors fault. So this indicated that the role of contractor fault in the delay of project was also common in both contractors.

In the case of on-going projects, respondents concluded that; 81% in domestic contractors and 74% in Chinese contractors said that the progress of the projects was not appropriate with regards to the contract period (schedule). But 19% in domestic contractors and 26% in Chinese contractors said that the progresses of the projects were appropriate with regards to the contract period (schedule). From this result, even though the amount of percentage varies, in both projects under the implementation of either by domestic or Chinese contractors, the progresses of the projects were not on the right truck as compared with the contract period.

In both domestic and Chinese contractors, the same amount of respondents, (owners, consultants and contractors) agreed that the original engineering time duration estimation of the selected federal road projects mentioned in the contract agreement was enough to complete the projects. But the rest 32% of all the respondents in both cases said that the original engineering time estimation of the selected federal road projects in the contract agreement was not enough to complete the projects. This was because of design change (modification), delay in approval of the modified design, variation order by the request of the owner and right of way problem related issues were the main problems respectively. Due to these and other reasons obviously, there is extension of time during the construction of the selected federal road projects constructed by Chinese and domestic contractors.

Table 5.6: Amount of extension of time in Domestic and Chinese Contractors

No.	Project name	Contractor	Contract period (Calendar days)	EOT (Calendar days)	EOT in %	Project status
1	Seret Village -Werei Bridge		1080	26	2.41	Completed
2	Nehile –Abala	Domestic	820	567	69.15	Completed
3	Dima -FiyelWeha		1095	365	33.33	Completed
4	Menebegna - LemlemBerha		1095	555	50.68	On-going (90%)
5	Otolo- Sawla		1095	90	8.22	On-going (80%)
6	Mekele - Seret Village		1080	360	33.33	On-going (70%)
7	Mehal Meda-Km72		1096	534	48.72	On-going (68%)
8	Yabelo-Mega	Chinese	1080	95	8.80	Completed
9	Wolkite-Arekit		912	352	38.60	On-going (88%)
10	Abi Adi _ Fireweyni		1080	235	21.76	On-going (70%)
11	Ayra - Chinka		910	360	39.56	On-going (65%)
12	Chinka- Dembidollo		910	330	36.26	On-going (55%)
13	Mekenajo - Ayra		910	365	40.11	On-going (49%)

As shown in table 5.6, the amount of extension of time on average in projects constructed by domestics' contractors was 35%, where as in projects constructed by Chinese was 31%. There is a difference of only 4% between the two contractors' projects. But this difference was not due to the contractors' performance; rather it was related with the attention given to foreign / Chinese constrictors. That means priority was given in solving any problems related to the projects and other investment policy of the country. In the case of the main cause of extension of time even though there was a difference in their amount in both contractors they were the same. The main causes of extension of time mention in both contractors were compared as follow:

In both contractors, design related problems and variation order have ranked in the first and second position respectively as main causes of extension of time. Right of way related problems and unexpected ground conditions have been ranked in the second and fourth position in domestic contractors whereas the reverse (fourth and second) position as main causes of extension of time in Chinese contractors.

From this result the researcher concluded that, right of way related problems were early solved in Chinese contractor than in domestic, whereas the act of God was common for both contractors' projects. This was because of they were out of the human beings control (might be beyond the project owners capacity to solve them), such as adverse climatic condition like, rain or flood. But they might be decrease/ minimize their effects through different composited mechanisms. Likewise if there was shortages of materials such as cement the project owner import and provided to Chinese contractors only, this also created a difference between the two contractors.

In general, the time performance of both domestic and Chinese contractors was low. Because the average delays of projects (including on-going projects) were 35% and 31% in both domestic and Chinese contractors respectively. This amount was almost similar even though there was an average difference of 4% between the two contractors' projects. This made, both domestic and Chinese contractors had low time performance.

5.3.2 Related to Cost performance

In both projects executed either by domestic or Chinese contractors there was cost overrun during the construction of the selected federal road projects.

This was because of different reasons. These different reasons would be summarized below for two contractors taking the completed projects. Even though the amounts of percentage given are varying, in both contractors the main causes were the same. They were also ranked as design change, variation order and delay of projects respectively. Due to these reasons respondents, concluded that in both contractors the actual cost the selected federal road projects were more than the estimated cost of the projects. From this the researcher concluded that, like the case of time performance, the main source of poor cost performance was due to the project owner and/or designer. This was due to almost all of the main causes were created by the problems of these parties. But there was also some contribution by the contractors especially in the case of delay, if it was due to the contractors' fault.

In the case of variation, respondents in domestic and Chinese contractors agreed that there was a variation during the construction of the selected federal road projects. The main reasons that caused variations concluded by all respondents were; design change (modification) issues and incomplete quantity estimations. To elaborate this result, the researcher took all cases mentioned below.

Table 5.7: Amount of variation in Domestic and Chinese Contractors

No	Project name	Contractor	Contract price (ETB)	Variation in (ETB)	Variation in %	Project status
1	Seret Village -Werei Bridge		460,257,521.26	----	--	Completed
2	Nehile –Abala	Domestic	272,704,620.78	165,760,590.92	60.78	Completed
3	Dima -FiyelWeha		777,078,942.38	14,667,997.10	1.89	Completed
4	Menebegna - LemlemBerha		1,192,072,064.49	554,788,702.17	46.54	On-going (90%)
5	Otolo- Sawla		453,990,619.00	136,197,185.7	30.00	On-going (80%)
6	Mekele - Seret Village		482,672,383.62	168,729,485.46	34.96	On-going (70%)
7	Mehal Meda-Km72		802,248,892.71	16,548,504.21	2.06	On-going (68%)
8	Yabelo-Mega	Chinese	770,007,996.78	23,000,000.00	2.99	Completed
9	Wolkite-Arekit		717,440,576.41	34,319,187.70	4.78	On-going (88%)
10	Abi Adi _ Fireweyni		874,321,916.68	27,431,687.03	3.14	On-going (70%)
11	Ayra – Chinka		669,000,000.00	5,000,000.00	0.75	On-going (65%)
12	Chinka- Dembidollo		648,000,000.00	29,000,000.00	4.48	On-going (55%)
13	Mekenajo - Ayra		633,000,000.00	18,000,000.00	2.84	On-going (49%)

From amount of variation in all projects of both the contractors', the average variation of the projects constructed by domestic contractors' was the 25.2%; where as in projects constructed by Chinese was 3.2%. This showed there was an average difference of 22% between the two variations. This was very big difference as compare to the case of time difference. But in case of projects constructed by domestic contractors, there was one project completed without any variation i.e Seret Village -Werei Bridge project. The other two completed projects had a variation of: Nehile–Abala road project had 165,760,590.92 birr (around 61 %) and Dima–FiyelWeha road project had 14,667,997.10 birr (around 2 %) of variation. Even on the undergoing projects there was also a variation of ranges from 2% -47% while, the progress of the projects were from 68% -90% there might be some more additional variation until the completion period. From the above results and discussion, the researcher concluded that, 6 out of the 7 projects (86%) constructed by domestic contractors are exposed to variation. This is because of design change (faulty design), scope change and incomplete quantity estimations (specification problems). But only 1 out of the 7 projects (15%) was not exposed to variation.

On the other hand, in case of projects constructed by Chinese contractors, there was no any project completed without any variation. Yabelo-Mega road project has 23,000,000.00 birr (around 3%) of variation. Even on the other on-going projects there was also a variation ranges from 0.75% -5% ,but the progress of the projects were from 49% - 88% , there might be also some more additional variation until the completion period. The main reasons were the same with the domestic contractors.

The researcher concluded that, 6 (100%) of the selected federal projects which were constructed by the Chinese contractors were exposed to variation. This was because of design change (faulty design), scope change and incomplete quantity estimations (specification problems).

In general, even though one exceptional project was completed without any variation (cost overrun), taking into consideration the average amount of variation /cost overrun, in both cases Chinese contractors were relatively better than domestic in cost performance. The cost overrun under the completed project was 2.99% which was less than the amount of 10% contingency. But in the case of domestic contractors, one of the complete projects was with cost overrun of around 61% which was more than half of the total cost of the projects. So this showed the cost performance in domestic contractors was relatively lower than Chinese contractors.

5.3.3 Related to Quality performance

As indicated by the respondents in domestic contractors, 73% of all the respondents concluded that no quality problems, but 27% of them said that there was a quality problem during the construction of the selected federal road projects. Whereas the respondents in Chinese contractors showed that, 81% of all the respondents (owner, consultants and contractors) agreed that, no quality problems. But 19% of the respondents said that there was a quality problem during the construction of the selected federal road projects. Under the two contractors there was a difference of 8% that means in case of road projects constructed by domestic contractors, the amount of problems were higher than that of Chinese contractors by this amount.

From these results, the researcher concluded that; even though the amount of the percentages of the respondents was varying, in both contractors this key performance indicator was relatively moderate as compare to the other two KPI (time and cost). In both contractors, from the tree key performance indicators (time, cost and quality) quality performance was ranked in the first position as more prone to success. But cost and time were ranked in the second and third position respectively. In other words, time was ranked in the first position as more prone to failure. But cost and quality were ranked in the second and third position respectively, in their more prone to failure during the construction of the selected federal road projects.

In general, in both domestic and Chinese contractors, performance of the key performance indicators (time, cost and quality) was highly affected though different reasons. However, the major reasons can be grouped into the following four categories:

- Problems related to ERA,
- Problems related to consultants and /or designers,
- Problems related to Unexpected ground conditions and /or natural hazards, and
- Problems related to contractors.

The causes were summarized in figure 5.1.

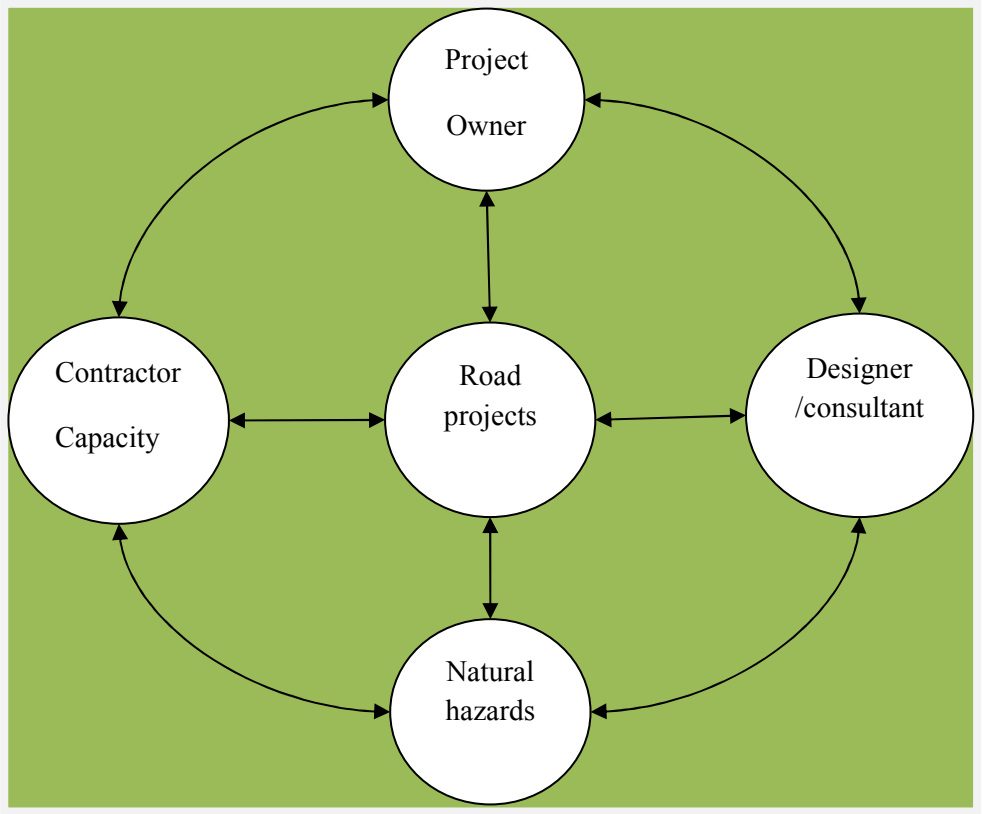

Figure 5.1: Causal relationships for low performances of both contractors

5.4 Key Difference and Best Practices Between Domestic and Chinese contractors

As mentioned in section 4.5, the key difference concluded by the respondents between Chinese and domestic contractors were: resource capacity, time management, experience and commitment respectively. This means that according to the respondents, Chinese contractors had relatively better in the above different items. In addition to this ,some of the respondents (from contractors and owners) said that, the other main key difference between Domestic and Chinese contractors was, Chinese contractors were effective (full fill) the criteria set by the World Bank (African development bank) to financial sponsor the projects. In other words, Chinese contractors had the capacity to cover the 10% of the total cost of the project which was requested by the project sponsor on unconditional (block) bank guaranty, but domestic contractors didn't have the capacity to do so. On the other hand Chinese government covered the unconditional (block) bank guaranty to contractors. Most of the projects sponsored by the World Bank/ African development bank were constructed by the foreign/Chinese contractors. The main reason was that the criteria set by the fund raiser were full filled by the foreign/Chinese contractors not by the domestic contractors.

The researcher agreed partially and completely on above concluded by the respondents. In cases of resource capacity, experience and commitment, the researcher agreed completely while in the case of time management, the researcher agreed partially. This was because if the Chinese contractors were good in time management, the projects constructed by Chinese contractors should not have a delay by the fault of the contractors. So these showed as time management was not consider as a key difference. Rather some of the domestic contractors like Sur Construction, Gemshu Beyene Construction etc, were better than Chinese contractors in time management. Because they completed the projects without delay due to the fault of contractors and even six months earlier than the revised completion period of the project. This showed that, the time management skill of some domestic contractors were better than the Chinese contractors.

In the case of resource capacity like, financial, equipment, definitely the Chinese contractors were better than the domestic contractors. That was why 83% (5 out 6 projects) constructed by the Chinese contractors were financially sponsored by foreign fund (IDA and ADB). Only 17% (1 out of the 6 projects) was financial sponsored by the Government of Federal Democratic Republic of Ethiopia. On the other hand all the projects (7of them) constructed/under constructions by the domestic contractors are financial sponsored by the Government of Federal Democratic Republic of Ethiopia.

Therefore, the researcher concluded that, even though Chinese contractors were financially strong and had an experience; their time performances were low and they did not as such differ from most domestic contractors. Time performances of some contractors like Sur Construction and Gemshu Beyene Construction are better than Chinese contractors. So Chinese contractors should take this as a best practice and learned from the exceptional contractors.

Table 5.8: Summary of key differences between Domestic and Chinese Contractors

Domestic Contractors	Chinese Contractors
Technically failed in ICB	Technically successful in ICB
Limited resource capacity	Have resource capacity
Less committed	More committed
Some contractors were effective in time performance	most contractors were not effective in time performance
Relatively not good in cost performance	Relatively good in cost performance
No more attention given by owner	Have positive attention given by owner

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This chapter aimed to see into 'what was asked?', 'what were the Objectives?' and 'what the findings were, and make sense out of their relationships. Accordingly, the conclusions and recommendations were presented corresponding to the objectives of the research.

The project performance of domestic contractors would be summarized as follow, with regards to the key performance indicators.

Time performance: The overall time performance of the domestic contractors' in selected federal road projects was low. This was due to different internal and external factors. The main causes of low time performance were: design related problems, unexpected ground conditions, right of way related problems, poor contractors' capacity and finally variation order respectively. Majority of these causes of low performances were strongly associated with the project owner and consultants /designer. Next to this the rest were related with natural hazards and fault of the contractors. In other words, the project owner and designers and/ or consultants were the first accountable for the low time performance of the selected federal road projects. Next, contractors were also accountable for the delay of the federal road projects. Besides, it was found that out of 7 projects expected to completed in the RSDP-IV, only 3 were completed. But the rest projects were found substantially (> 65 %) progressing.

Cost performance: It was also found that most of the projects were exposed to cost overrun during the construction of the federal road projects. With the root causes of design related problems, variation order and delay respectively; projects were rated for their lowest cost performances. The average cost overrun of the completed projects was found 20.89%.

Quality performance: as point out by the participants of the study, most of the projects have under going with the required quality standards. This was relatively considered as good performance over the other two key performance indicators.

The project performance of Chinese contractors' would be summarized as follow, with regards to the key performance indicators.

Time performance: like the case of domestic contactors, the overall time performance of the Chinese contractors' in federal road projects was low. This was due to similar reason mentioned above in domestic contractors. In addition, it was found that out of 6 projects expected to complete in the RSDP-IV, only 1was completed. But the rest projects were found substantially 49%-88% progressing. Therefore, from the above mention main causes of delay, the researcher concludes that, 69% of the main causes of delay were due to the problems of the project owner and/or consultants or designers. 25% due to natural hazards and the rest 6% of the main causes were due to the fault of the contractors. So the project owner and/or consultants or designers were the first accountable for the delay of the federal road projects. Contractors were also the next accountable for the delay of the federal road projects.

Cost performance: All of the projects were exposed to cost overrun during the construction of the federal road projects. Due to the main causes of design related problems, variation order and delay respectively. Cost overrun of the completed projects was found 2.99%.This was somewhat relatively makes the cost performances moderate.

Quality performance: as indicated by the respondents, most of the projects of have undergoing through the required quality. There were some projects which exposed to quality problems but, they are re-correcting immediately.

The comparative evaluation of the performance between domestic and Chinese contractors related to the key performance indicators were presented as follow. In general, the time performance of both domestic and Chinese contractors was low. Because the average delays of projects (including on-going projects) are 35% and 31% in both domestic and Chinese contractors respectively. This amount was almost similar even though there was an average difference of 4% between the two contractors' projects.

Related to cost performance, even though one exceptional project was completed without any cost overrun, taking into consideration the average amount of variation /cost overrun, Chinese contractors were relatively better than domestic in cost performance.

The cost overrun under the completed project was 2.99% which was less than the amount of 10% contingency. But in the case of domestic contractors, the average cost overrun of the complete projects was 20.89% which was double of the amount of 10% contingency. So this makes the cost performance in domestic contractors was relatively lower than Chinese contractors. In the case of quality performance, most of both of the domestic and Chinese contractors were completed their project with the specified quality requirements. But there are some contractors that their quality work was less than the required quality.

The key difference and best practice in project performance between domestic and Chinese contractors were summarized as; the key differences were: generally, Chinese contractors had resource capacity (financial and equipment), experience and commitment. The first and most key difference between domestic and Chinese contractor was, Chinese contractors technically successful in the international competitive bidding (ICB), projects. But domestic contractors didn't full fill the criteria required by the project financial donor. On the other hand, the best practice those Chinese contractors learn from some domestic was the effective execution of projects especially completing projects before and on the specified completion time (time performances).

Generally, in both the domestic and Chinese contractors there was low performance during the construction of the federal road projects due to internal and external factors.

6.2 Recommendations

This study revealed that there was low performance during the construction of the federal road projects. Thus, based on the findings of the analysis; the researcher forwarded the following recommendation as an improvement interventions to be under taken by each party involved in construction projects including; the government, owners, consultants, and contractors.

6.2.1 The Government

1. The government should take part in giving a training of capacity building to the main parties of the construction industry like contractor, consultant and owner.
2. The government should support to domestic contractors, like the Chinese /foreign contractor, in introducing the spare parts/ machinery from abroad; it should be tree of tax,
3. The government should also introduce different machinery and give to domestic contractors either through rental fee (lease) or sell with partially payment and complete through long time.

6.2.2 The Owner/ERA

1. For the effective performance of the federal road implementation the first and the most that the project owner should give an emphasis on the accuracy of design of the proposed road projects,
2. The owner should clear up everything before invites to tender of for construction, with the designer, local administration, and community and other stake holders,
3. The owner should make as much as possible the time between the design and the implementation period should be short. This is because if the time between the design and implementation period was long, the proposed rout may be changed for another purpose, like a town was established not a free space.
4. The owner(ERA) should equally treat to both domestic and Chinese contractors in all aspects,
5. The owner should solve the external factors that affect the project performance like; give on time decision or decreases more procedural on decision making.

6.2.3 The Consultants/designers

1. The designers / consultants should also take proper data from the real situation not only from map and design accurately by taking a detailed cross section, otherwise simply design by taking the ERA map was very difficult this was because sometimes the design and practical ground didn't much and create a problem in the implementation.
2. Consultant should also revise the design based on the practical situation and approve immediately, so that the contractor can implement the project based on the time schedule,

6.2.4 The Contractors

6.2.4.1 Domestic Contractors

1. The domestic contractors should visit the proposed site (route) and observe in detail before they start to determining the cost of each quantity (unit rate cost),
2. The domestic contractors should create a joint venture with Chinese contractors, so as to participate in ICB and learn best practices like; project management systems, experience and commitment,

6.2.4.2 Chinese Contractors

1. Chinese contractors should learn best practices from some domestic contractors, like an effective execution of projects especially completing projects before and on the specified completion time (time performances),
2. Chinese contractors should also visit to the proposed site (route) and observed in detail before determining the unit rate cost of each quantity,
3. Chinese contractors should also create a joint venture with domestic contractors during the construction of the federal road projects,

6.3 Area of further studies

The researcher point out further studies on two major issues:

1. Evaluation of project performance in Design-Build (D-B) project delivery system,
2. Comparative evaluation of project performance between Domestic and Chinese contractors in regards to health and safety during construction of federal road projects.

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Appendix A: Questionnaire Survey

Introduction

This questionnaire survey was prepared to obtain information from key informants. The information is required for the academic research entitled *"**Comparative Evaluation of Project Performance Between Domestic and Chinese Contractors in Selected Federal Road Projects in Ethiopia**",* which is being conducted as partial fulfillment of MSc in construction technology and management in Addis Ababa University; Addis Ababa Institute of Technology, School of Civil and Environmental Engineering.

All information provided in this survey will be treated with strict confidentiality and allowed to serve only for this academic research only.

Thank you, in advance for your co-operation and participating in the research

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E-Mail Tsegayh40@yahoo.com
Mobile: 09 13 67 26 65/09 13 68 11 79

A1. Guide line for desk study

Brief information of the projects:

Project: _____

Road Class:_____

Procurement Process:_____

Employer: Ethiopia Road Authority (ERA)

Consultant: _____

Contractor: _____

Financial resource: _____

Contract Period: _____

Date of Signing of Contract: _____

Date of Commencement: _____

Mobilization Period: _____

Contractual Date of Completion: _____

Contract Amount: _____

Project location: _____

Project status up to now: _____

Total length of project in Km:_____

Time Extension period (if any) _____

Variation amount (if any):_____

A2. Questionnaires for project Owner

Direction: Please provide the requested information on the space provided

Title or Position(s) of respondent in the organization: _____

Profession: _____

1. From your experience, which contractors (Chinese or Domestic) do you think that have completed the projects based on their schedule? _____
2. What do you think the main reason for the above question?

_____

3. Is there any delay during the construction of the federal road projects?

   □ yes □ No ; If yes what is the main reason

   _____

4. Is there any **cost overrun** during the construction of the federal road projects?

   □ yes □ No ; If yes what is the main reason

---

5. Which of the key project performance criteria are often more prone to success?

   □ Cost □ Time □ Quality; if others, please specify

6. Which of the key project performance criteria are often more prone to failure?

   □ Cost □ Time □ Quality; if others, please specify

7. How do you compare the project performance of the domestic and Chinese contractors in the Ethiopian federal road projects with regards to the key project performance indicators (Time, Cost and Quality)?_____
8. What are the key differences in road project performance between Domestic and Chinese Contractors?

_____

9. What are the best practices that domestic contractors learn from Chinese? or Chinese contractors learn from domestic?

_____

10. Any other points (comment**)** that you want to say about the project performance of the Ethiopian federal road projects?

_____

A3. Questionnaires for project contractors

Direction: Please provide the requested information on the space provided

Title or Position(s) of respondent in the organization: _____

Profession: _____

1. Do you think that you have already finished /the progress of the project was appropriate with regards to the Contract Period? □ Yes □ No; If yes, what are the procedures that you follow?

_____

_____

If no what is the main reason?

_____

2. Do you think that the engineering time estimation of the project is enough to complete the project in the practical?

   □ Yes □ No If no, what are the main reasons?

_____

3. Do you think that the engineering cost of the project is enough to complete the project in the practical?

   □ Yes □ No If no, what are the main reasons?

_____

_____

4. Do you think that your company was performed based on the work schedule of the project?

   □ Yes □ No If no, what are the main reasons or problems?

_____

5. Did the actual cost of projects be more than the estimated cost?

   □ Yes □ No; If yes, what are the reasons for the increment?

_____

6. Is there any time extension?

   □ Yes □ No If yes, what are the main reasons?

_____

7. Is there any variation? □ Yes □ No If yes, what is the main reason?

_____

8. Have you ever face any quality problems or is there any opportunity to demolish and reconstruct? □ Yes □ No If yes, what are the main problems?

   _____

   _____

9. Which of the key project performance criteria are often more prone to success in your organizations? □ Cost □ Time □ Quality; if others, please specify_____
10. Which of the key project performance criteria are often more prone to failure in your organizations? □ Cost □ Time □ Quality; if others, please specify_____
11. How do you compare the project performance of the domestic and Chinese contractors in the Ethiopian federal road projects with regards to the key project performance indicators (Time, Cost and Quality)?

    _____

    _____

12. From your experience which contractors (Chinese or domestic) contractor do you think that have completed the projects based on their schedule?_____

What do you think the main reason for the above question?

_____

13. What are the key differences in road project performance between Domestic and Chinese Contractors?

_____

_____

14. In your opinion, what are the best practices that domestic contractors learn from Chinese? or Chinese contractors learn from domestic?

_____

_____

15. Any other points (comment) that you want to say about the project performance of the Ethiopian federal road projects?

    _____

    _____

    _____-

A4. Questionnaires for project Consultants

Direction: Please provide the requested information on the space provided

Title or Position(s) of respondent in the organization: _____

Profession: _____

1. How do evaluate the project performance of the contractors with regards to time, cost, & quality?

_____

2. Have you face any design change? □ Yes □ No: If yes, what is the main reason?

_____

3. From your experience, which contractors (Chinese or Domestic) do you think that have completed the projects based on their schedule? _____

What do you think the main reason for the above question?

_____

4. Is there any delay during the construction of the federal road projects?
   □ yes □ No ; If yes what is the main reason

   _____

5. Is there any **cost overrun** during the construction of the federal road projects?
   □ yes □ No ; If yes what is the main reason

---

6. Which of the key project performance criteria are often more prone to success?
   □ Cost □ Time □ Quality; if others, please specify
7. Which of the key project performance criteria are often more prone to failure?
   □ Cost □ Time □ Quality; if others, please specify
8. Do you think that the contractor has already finished /the progress of the project was appropriate with regards to the Contract Period? □ Yes □ No; If yes, what are the procedures that the contractor follow? _____-

If no what is the main reason?_____

9. Do you think that the engineering time estimation of the project is enough to complete the project in the practical?
   □ Yes □ No If no, what are the main reasons?

_____

10. Do you think that the engineering estimation cost of the project is enough to complete the project in the practical? □ Yes □ No If no, what are the main reasons?

_____

11. Did the actual cost of projects be more than the estimated cost?
□ Yes □ No; If yes, what are the reasons for the increment?

_____

12. Is there any time extension?
□ Yes □ No If yes, what are the main reasons?

_____

13. Is there any variation? □ Yes □ No If yes, what is the main reason?

_____

14. How do you compare the project performance of the domestic and Chinese contractors in the Ethiopian federal road projects with regards to the key project performance indicators (Time, Cost and Quality)?

_____

_____

15. From your experience which contractors (Chinese or domestic) contractor do you think that have completed the projects based on their schedule?_____

What do you think the main reason for the above question?

_____

_____

16. What are the key differences in road project performance between Domestic and Chinese Contractors?

_____

17. In your opinion, what are the best practices that domestic contractors learn from Chinese? or Chinese contractors learn from domestic?

_____

18. Any other points (comment**)** that you want to say about the project performance of the Ethiopian federal road projects?

_____

Appendix B: Projects information executed by domestic contactors

Criteria	List of the projects						
Project Name	Seret Village -Werei Bridge	Nehile –Abala	Dima- FiyelWeha	Menebegna - LemlemBerha	Otolo- Sawla	Mekele - Seret Village	MehalMeda-Km 72
Road Class	Link Road	Link Road	Link Road	Link Road	Link Road	Link Road	Link Road
Procurement Process	NCB	NCB	NCB	NCB	NCB	NCB	NCB
Employer	ERA	ERA	ERA	ERA	ERA	ERA	ERA
Consultant	Construction Design Share Company	C-Tech Engineering PLC	Core consulting Engineering	Engineer Zewdie Eskindr Consulting plc	Robust consulting and Engineering services PLC	NET Consult Consulting Engineers and Architectures PLC	Engineer Zewdie Eskindr consulting plc
Contractor	SUR Construction	MACRO General Contractor and Trading Plc	Gemshu Beyene Construction Plc	SUR Construction	FAL Trading General Contractor	Ministry of National Defense, Construction Enterprise	Sunshine Construction PLC
Financial resource	FDRE	FDRE	FDRE	FDRE	FDRE	FDRE	FDRE
Contract Period ca.d	1080	820	1095	1095	1095	1080	1096
Contract Signing period	29, march 2011	Dec. 22, 2010	August 12, 2011	August 3, 2010	Aug. 11, 2011	March 29, 2011	June 27, 2011
Commencement period	26, April 2011	January 26, 2011	August 31, 2011	December 22, 2010	September 07, 2011	April 18, 2011	September 15, 2011

Mobilization Period in calendar days	90	35	90	90	90	90	90
Contractual Completion Date	May 21, 2014	April 25, 2013	August 30, 2014	Dec. 21, 2013	Sep. 06, 2014	April 17, 2014	Sep. 15, 2014
Contract Cost (ETB)	460,257,521.26	272,704,620.78	777,078,942.38	1,192,072,064.49	453,990,619.00	482,672,383.62	802,248,892.71
Project location	Tigray	Afar	Tigray	Oromia	SNNPR	Tigray	Amhara
Project status	Completed	Completed	Completed	90%	80%	70%	68%
Total length in Km	65	77	87	64	51	71	72
EOT in calendar day	26	567	365	555	90	360	534
Variation in (ETB)	non	165,760,590.92	14,667,997.10	554,788,702.17	136,197,185.7	168,729,485.46	16,548,504.21

Appendix C: Projects information executed by Chinese contactors

Criteria	List of the projects					
Project Name	Yabelo-Mega	Wolkite-Arekit	AbiAdi_ Fireweyni	Ayra - Chinka	Chinka-Dembidollo	Mekenajo - Ayra
Road Class	Trunk Road	Link Road	Link Road	Link Road	Link Road	Link Road
Procurement Process	ICB	ICB	ICB	ICB	ICB	ICB
Employer	ERA	ERA	ERA	ERA	ERA	ERA
Consultant	Renardet Consulting Engineers	Comptran Engineering and planning associates IV Beza Consulting Engineering	NET Consult Consulting Engineers and Architectures PLC	Renardet in sub consulting with UNICONE	Lea in sub-consulting with UNICONE	Sheladia in sub-consulting with Hitcon
Contractor	China Tiesiju China Engineering Group	China Gezhouba Group Company Ltd. (CGGC)	China Railway No3 Engineering Group Co ltd	China Int. Water & Electric Corp	China Hyway Group	China Hyway Group
Financial resource	IDB and FDRE	IDB	FDRE	IDA	IDA	IDA
Contract Period ca.d	1080	912	1080	810	910	910
Contract Signing period	November 26, 2010	June 03, 2011	February 7, 2012	June 3, 2011	June 3, 2011	June 3, 2011
Commencement period	December 22, 2010	October 07, 2011	February 23, 2012	January 3, 2011	January 3, 2011	October 7, 2011

Mobilization Period in calendar days	120	90	90	90	90	90
Contractual Completion Date	December 23, 2013	April 09, 2014	February 22, 2015	April 3 2014	April 3, 2014	April 3, 2014
Contract Cost (ETB)	770,007,996.78	717,440,576.41	874,321,916.68	669,000,000.00	648,000,000.00	633,000,000.00
Project location	SNNPR	SNNPR	Tigary	Oromia	Oromia	Oromia
Project status	Completed	88%	70%	65%	55%	49%
Total length in Km	97	60	101	65	63	63
EOT in calendar day	95	352	235	360	330	365
Variation in (ETB)	23,000,000.00	34,319,187.70	27,431,687.03	5,000,000.00	29,000,000.00	18,000,000.00

Appendix D: List of the selected projects

1. Mekele - Abi Adi - Adwa Road Upgrading Projects,Lot II : Seret Village -Werei Bridge
2. Nehile -Abala
3. Maytsebry-Dima-FiyelWeha-AbiAdi-Hawzen-Fereweyni,Cont2:Dima(Km75.6) FiyelWeha(Km162.2)
4. Gedo FinchaLemlemBerha Contract 2 Menebegna - LemlemBerha
5. Arbaminch - Kemba - SawlaLot3 Otolo- Sawla (~50.8Km)
6. Mekele - Abi Adi - Adwa Road Upgrading Projects,Lot I : Mekele - Seret Village
7. MehalMeda-Alemketema Road Project Contract 1: MehalMeda-Km 72
8. Ageremariam –Mega,Contract 2: Yabelo-Mega
9. Wolkite-Hossana road upgrading project, contract 1, Wolkite-Arekit (APL-IV)
10. Mekenajo-Dembidollo Contract: 2 Ayra - Chinka
11. Maytsebry-Dima-FiyelWeha-AbiAdi-Hawzen-Fereweyni,Cont4:AbiAdi(Km262.0)_ Fireweyni(Km362.9)
12. Mekenajo-Dembidollo Contract: 3 Chinka- Dembidollo
13. Mekenajo-Dembidollo Contract: 1 Mekenajo - Ayra

Appendix E: List of the selected three parties of construction

E1. Client

Ethiopian Road Authority: Engineering Procurement Services, Planning Department, North South East, Central and West Region,

E2. Consultants

1. Construction Design Share Company
2. C-Tech Engineering PLC
3. Core consulting Engineering
4. Engineer Zewdie Eskindr Consulting plc(for two projects)
5. Robust consulting and Engineering services PLC
6. NET Consult Consulting Engineers and Architectures PLC (for two projects)
7. Renardent Consulting Engineers
8. Comptran Engineering and planning associates joint venture Beza Consulting Engineering
9. Renardet in sub consulting with UNICONE
10. Lea in sub-consulting with UNICONE
11. Sheladia in sub-consulting with Hitcon

E3. Contractors

1. SUR Construction (for two projects)
2. MACRO General Contractor and Trading Plc
3. Gemshu Beyene Construction Plc
4. FAL Trading General Contractor
5. Ministry of National Defense Construction Enterprise
6. Sunshine Construction PLC
7. China Tiesiju China Engineering Group
8. China Gezhouba Group Company Ltd. (CGGC)
9. China Railway No3 Engineering Group Co ltd
10. China Int. Water & Electric Corp.
11. China Hyway Group (for two projects)