

**EVALUATION of PERFORMANCE CHALLENGES for CONTRACTORS in
ROAD CONSTRUCTION PROJECTS in CASE of WEST ARSI ZONE ROAD
PROJECTS**



Mahmud Abubaker Haji

A Thesis Submitted to the department of Civil Engineering for the Partial Fulfillment of
The Requirement for The Degree of Masters

(Specialization in Construction Engineering and Management)

School of Civil Engineering and Architecture

Office of Graduate Studies

Adama Science and Technology University

June, 2022
Adama, Ethiopia

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DECLARATION

I hereby declare that this Master Thesis entitled “Evaluation of Performance Challenges for Contractors in Road Construction Projects” Case of West Arsi Zone Road projects is my original work. That is, it has not been submitted for the award of any academic degree, diploma or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation.

Mahmud Abubaker Haji

23/06/2022

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Signature

Date

RECOMMENDATION

I/we, the advisor(s) of this thesis, hereby certify that I/we have read the revised version of the thesis entitled **“Evaluation of performance challenges for contractors in road construction projects” case of West Arsi Zone road projects** prepared under my/our guidance by **Mahmud Abubaker Haji** submitted in partial fulfillment of the requirements for the degree of Master’s of Science in **Construction Engineering and Management**. Therefore, I/we recommend the submission of revised version of the thesis to the department following the applicable procedures.

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APPROVAL SHEET

I/we, the advisors of the thesis entitled “**Evaluation of Performance Challenges for Contractors in Road Construction Projects**” **Case of West Arsi Zone Road projects** and developed by Mahmud Abubaker Haji, hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

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APPROVAL OF BOARD OF REVIEWERS

We, the undersigned, members of the Board of Examiners of the thesis by **Mahmud Abubaker Haji** have read and evaluated the thesis entitled “**Evaluation of Performance Challenges for Contractors in Road Construction Projects**” and examined the candidate during open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of Master of Science in **Construction Engineering and Management**.

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ABSTRACT

In the road construction sector, several performance problems and target deviations of construction projects are observed. Properly measuring performance by integrating the necessary measures and methods can aid to identify the performance problems and take corrective action. This study was conducted to identify the performance challenges for contractors in road construction projects for the case of west Arsi zone. A desk study, questionnaire survey, case study, and literature review were employed to collect primary and secondary data. For this purpose, 78 different challenges were identified and categorized into eight (8) major group factors, during the literature review and analyzed by relative importance index and correlation analysis using the MS-excel.

Based on the data collected from the samples and questionnaire analyzed, the identified challenges were examined by construction stakeholders. Accordingly the results shows that the major performance challenges that most frequently occurs were cost with RII (0.78), time with RII(0.74) ,client satisfaction(0.72) and quality(0.71). The critical factors that affect performance of contractors in road construction project have been cost, quality and time. From the analysis and discussions made the top three key performance indicators with combined RII were cost (0.82), time (0.80) and quality (0.76) and it's hoped that these findings were guide efforts to improve the performance of the construction industry in the future. The case study was conducted on selected road projects as control values to assess how many of the projects were affected by the identified challenges using archival documents and discussion with participants on the project site. In this research study the top five remedial measures for project performance challenges are: meets technical Specification and competent and capable of client's representative, commitment to projects, proper project planning and scheduling, proper emphasis on past experience, comprehensive contract documentation and community involvement, complete and accurate project feasibility study respectively. The result reveals that, from four projects selected for case study, one project were in critical condition that needed immediate attention and intervention. Stakeholders are recommended to develop application of health and safety factors and awareness of workers on the advantages and usage of safety equipment's and minimize waste rate through project implementation in order to improve cost performance.

Key Words: - Challenges, Key performance indicators, Impact ranking, Road construction project

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LIST OF ABBREVIATIONS

AEC:	Architectural Engineering and Construction
CSA:	Central Statistical Agency
ERA:	Ethiopian Road Authority
GC:	General Contractor
ISO:	International Standard of Organization
MDG:	Millennium Development Goals
MS:	Microsoft
NIST:	National Institute of Standards and Technology
ORA:	Oromia Road Authority
RII:	Relative important index
UK: -	United Kingdom
US: -	United State

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Road infrastructure is the backbone of economic development of any country. A good road network facilitates trade and cooperation. It also provides access to markets in addressing socio-economic challenges by providing access to employment opportunities (World Bank 2014).

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, rail ways, hydropower stations 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 (Opuch ,2016).

Construction industry has complexity in its nature because the criteria for success are in fact much wider, incorporating the performance of the stakeholders, evaluating their contributions and understanding their expectations. A stakeholder is an individual or group, inside or outside the construction project, which has a stake in, or can influence, the construction performance. Construction projects potentially can have different sets of stakeholders as: clients, consultants, contractors, suppliers, regulatory bodies, end-users and the communities. Successful construction project performance is achieved, when stakeholders meet their requirements, individually and collectively. However, it becomes difficult to complete projects in the allocated cost, time and quality (Biruk siyoum, 2019).

Construction industry in Ethiopia suffers from many problems and complex issues in performance. Performance is related to many topics and factors such as time, cost, quality, client satisfaction; productivity and safety. In the selected Zones there are many construction projects such as roads, buildings and water supply projects which are executing by small and medium scale local contractors. These construction projects have problems in their performance. As a result of many factors which affect the successful completion of the project, especially time, cost and quality of the projects.

Evaluation of Performance Challenges for Contractors in Road Construction Projects

Nowadays there has been a large scale investment in the Ethiopian construction industry. Ethiopian government and private sectors have been investing widely for the development of infrastructures. This industry has many participants that play a major role in the functioning which contractors take the main part. Among these parties, contractors have a greater role to play in the development and execution of works in the construction industry.

According to the directives for registration of contractors obtained from Ministry of Urban Development and Construction, GC (General Contractors) are contractors who are qualified to undertake a variety of construction work such as building, roads railways bridges, airports, dams and water work. RC (Road Contractors are contractors qualified to undertake construction of roads and other related Civil Engineering works. If portion of the project work that requires specialization exceeds 15 percent of the total project cost, that part is to be subcontracted out to the appropriate specialized contractor (Eshetu Fanta, 2019).

Road construction challenges are examined to be one of most repeatedly problem in the construction industry. Most of the road construction challenges are continuous and there are recently new added challenges occurring in the industry due to new technology and other influences. “The challenges on roads construction are experienced on infrastructure which already incorporate, existing roads and the new infrastructure that is mushrooming which needs to take traffic into consideration. Therefore it is vital to take roads challenges into consideration for better future modernizes quality roads in Ethiopia. Many projects experience comprehensive challenges as results of exceeding initial scheduled time and cost estimates due to change of scope, procurement system. Stakeholders have positive and negative impact on road construction projects and hence, they contribute to the success or failure of the projects (Mashwama, etal, 2018).

In the Ethiopian construction industry, contractors have many challenges on their progress and performance while on the other hand opportunities that lead them for success as well. Such comparatively small contractors stay and function actively while others stay in the industry and do not function actively and are dominated then forced to leave eventually due to different reasons. Since the contribution of each contractor is vital for feeding the constructional industry of a country, contractors need to understand what challenges they are going to face, factors affecting their progress and how to overcome them in order to be successfully integrated(Biruk Seyoum,2019). Therefore, this research tries to address the

reasons behind these issues and factors that affect the progressive activity of contractors on the road construction projects and challenges to their performance in West Arsi zone.

1.2 Statement of the Problem

In Ethiopia, construction industry plays an important role in socio-economic development of the country. Road construction project passes a number of processes starting from initiation to completion. Most of the road projects in West Arsi Zone is not completed in their planned time and does not give expected service for the society due to several reasons and one of the main reasons is the Performance challenges of contractors.

Contractors are main participants that have a major role and involvement in the development of construction industry and country's economy as well. Contractors have many challenges on their progress and performance while on the other hand opportunities that lead contractors for success as well. Contractors do face many and more challenges that prohibit their progress and performance. Due to these factors, contractors execute works, perform and behave in way that one is different from the other. Some stays dormant for a long period of time while others function actively. The varying progress and status gives a clue that there could be some reasons for them to behave in such ways (Biruk, 2019).

Therefore, it is very important to identify and study these reasons, challenges and factors whether they arise from external or internal conditions in order to perform and progress steadily. The reason for this research needs to be conducted is to identify the performance of road contractors and to enable problems overcome and make the progress while being active participants of the construction industry in required performance. This research is also help to understand what the concerned stakeholders should do to overcome performance challenges and improve overall performance of road construction projects in West Arsi Zone.

The responsibility of achieving success in the implementation of a construction project largely depends on the contractors' performance. Delays in project completion and poor performance in the construction industry has been experienced and has led to failure in achieving effective time and cost performance (Aftab, 2012).

Thus, this study tried to identify various performance challenges facing road contractors in the construction process in order to draw up lessons for future efforts to develop, empower and promote them.

1.3 Objectives of the Study

1.3.1 General Objective

- The general objective of this study was to identify the performance challenges for contractors in road construction projects for the case of west Arsi zone

1.3.2 Specific Objectives

- To identify the current major performance measurements of contractors in road construction projects in West Arsi Zone.
- To determine the key performance indicators of contractors in West Arsi Zone road construction projects.
- To recommend remedial measures for contractors performance challenges on road construction projects in West Arsi Zone.

1.4 Research Questions

- What are the current major performance challenges of contractors that occurred frequently in West Arsi Zone road projects?
- What are the main key performance challenges of contractors in West Arsi Zone?
- What are the remedial measures to be recommending for improving performance challenges of contractors on road construction projects in West Arsi Zone?

1.5 Significance of the Study

This study is important for the following reasons;

- The output of this study could contribute to the understanding of the critical performance challenges contractors are facing that inhibit their performance on projects in the road sector in Arsi zone and other country Zone.
- To have a better understanding on how road contractors could effectively perform road project within required time ,cost and high quality in road construction process.
- It benefit the different stakeholders involving in construction projects in general and particularly for road construction projects, related to project performance, and helps all

the Stake Holders to know the causes and effects of performance problems in construction projects and to take remedial measures to prevent the occurrence of the problems.

- The contractors to get the solutions for their performance challenges, client to know the main performance challenges of contractors and work on improvement, public get access to road early at planned time.
- The study may be useful for construction supervision consultants who may comprehend how their services affect performance of contractors in the road sector and, serves as a benchmark for further studies.
- The study can be merged with others done in other nations for comparison of factors affecting performance of contractors in the road sector in order to facilitate worldwide exploration on strategy to improve performance of contractor.

1.6 Scope and Limitations of the Study

The scope of this study is mainly focus on road contractors of Grade 1 (GC and RC) were expected to participate in road construction projects administered by ERA.

This study was limited on road construction projects of the past six years but if the study covered say ten or fifteen years, the research would identify more performance challenges of road contractors that limit them from participating in construction of large road projects. Also due to different constraints such as finance, time and labor, the study is limited both in scope and depth.

The study is further limited to investigating the extent to which the following factors are influencing the performance of contractors on road construction projects: namely cost, time, quality, client satisfaction, Regular and End user satisfaction, Innovation and Learning, health and safety and productivity.

Due to limitation of resources, budgets and time the study was limited to selected contractors in road construction sector in Ethiopia although there are many contractors involved in other infrastructural projects in the country.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews past literature on factors affecting the performance in the construction sector with particular focus on factors affecting the performance of road contractors in Arsi Zone. Literature review involves the systematic identification, location and analysis of documents containing information related to the research problem. This chapter provides the review of literature on Performance challenges of the contractors. It includes the theories to be used as well as the key concepts of the study and their interrelationships.

2.2 History of Road Construction

Road transport is one of the most common modes of transport. Roads in the form of track ways, human path ways, etc. were used even from the pre-historic times. Since then many experiments were going on to make the riding safe and comfort. Thus road construction became an inseparable part of many civilizations and empires (Buys et al., 2010). The history of road construction gives us an idea about the roads of ancient times. Roads in Rome were constructed in a large scale and it radiated in many directions helping them in military operations. Thus they are considered to be pioneers in road construction.

According to Rivera providing accessibility and mobility is the primary function of roads. Currently, developing countries around the world are prioritizing the improvement and linking of their road networks. When allocating their national budget road projects are being listed as the primary focus, given that a good road network contributes to the development of the economy and national growth. Goods and services cannot be delivered without adequate transportation infrastructure. Therefore, to serve the immediate needs of stakeholders' road projects should be completed in accordance with the schedule (Rivera et al. , 2020).

2.2.1 Ancient Roads.

The first mode of transport was by foot. These human path ways would have been developed for specific purposes leading to camp sites, food, streams for drinking water. The next major mode of transport was the use of animals for transporting both human beings and materials. The invention of wheel in Mesopotamian civilization led to the development of animal drawn vehicles. Then it became necessary that the road surface

should be capable of carrying greater loads. Thus roads with harder surfaces emerged. To provide adequate strength to carry the wheels, the new ways tended to follow the sunny drier side of a path. These have led to the development of foot-paths. After the invention of wheel, animal drawn vehicles were developed and the need for hard surface road emerged. Traces of such hard roads were obtained from various ancient civilization dated as old as 3500 BC. The earliest authentic record of road was found from Assyrian empire constructed about 1900 BC (Forbes et al., 1993).

2.2.2 Modern Roads

The modern roads follow macadam's construction method. Use of bituminous concrete and cement concrete are the most important developments. Various advanced and cost-effective construction technologies are used. Developments of new equipment help in the faster construction of roads. Many easily and locally available materials are tested in the laboratories and then implemented on roads for making economical and durable pavements. Scope of transportation system has developed very largely. Population of the country is increasing day to day. The life style of people began to change. The need for travel to various places at faster speeds also increased. This increasing demand led to the emergence of other modes of transportation like railways and travel by air. While the above development in public transport sector was taking place, the development in private transport was at a much faster rate mainly because of its advantages like accessibility, privacy, convenience and comfort. This led to the increase in vehicular traffic especially in private transport network. Thus road space available was becoming insufficient to meet the growing demand of traffic and congestion started. In addition, chances for accidents also increased. This has led to the increased attention towards control of vehicles so that the transport infrastructure was optimally used (Eshetu Fanta, 2019).

With the advancement of better roads and efficient control, more and more investments were made in the road sector especially after the world wars. These were large projects requiring large investments. For optimization of funds, one should know the travel pattern and travel behavior. This has led to the emergence of transportation planning and demand managements (Christopher McFaddn, 2017).

For many people it is still unclear the distinction between criteria and factors. The Oxford Advanced Learner's dictionary describes the criterion as "a standard or principle by which

something is judged, or with the help of which a decision is made” while a factor is explained as a fact or situation which influences the result of something.

Performance means carrying out a task, the progress of which can be measured and compared using a set of stated requirements. Therefore, performance factor is a fact or situation which influences a progress of work which can be measured and compared using a set of stated requirements.

Performance can be considered as an evaluation of how well individuals, groups of individuals or organizations have done in pursuit of a specific objective (Ankrah and Proverbs, 2005). These objectives vary significantly, but from an industry or organizational perspective, they generally revolve around satisfying the key stakeholders such as customers, employees, shareholders, the various suppliers, government and society as a whole. Mullins (1993) described performance as relating to such factors as increasing profitability, improved service delivery or obtaining the best results in important areas of organizational activities. In construction, because of the numerous participants contribute towards the achievement of project objectives, performance has been defined in one sense as a participant's (client, consultant or contractor) contribution to the execution of the task required to complete the project

According to Kingsley (2010), performance indicators specify the measurable evidence necessary to prove that a planned effort has achieved the desired result. In other words, when indicators can be measured with some degree of precision and without ambiguity they are called measures. However, when it is not possible to obtain a precise measurement they are usually referred to as performance indicators.

The key performance indicators are identified by Hobday (2000) as an applicable indication of project and/or company levels. In some cases the company indicator is the average value of that company's project indicators and stated that the owner satisfaction for performance can be defined as the gap between what the owner expects and the level of performance they believe is being delivered by the contractors.

2.3 The Concept of Performance

Performance measurement is described as the method of evaluating previous activities to ascertain present performance. Contractor performance is defined as a factor of time,

sustainable development, quality and construction cost, the idea being that the attainment of one facet of performance must not be at the cost of another (Hong and Proverbs, 2003).

For instance, the National Institute of Standards and Technology (NIST, 2009) defines performance as “outputs and outcomes from processes, products and services that allow assessment and comparison relative to set goals, standards, past results, and other specifications”. For a long time, performance assessment has remained a problem for the construction industry. Various concepts and measures have been experimented to assess and measure performance of projects.

Alarcon (1994) observed that most of these measures inhibit their assessment to preferred standards such as, time, cost or output. Contractors are required to evaluate performance and upgrade strategies to gain competitive advantage. To lift competitiveness, construction firms have to utilize performance evaluation mechanisms to ensure sustainable performance.

Rose (1995) observed that performance measurement is the expression of progress. Expansion in business cannot be achieved if its performance is not evaluated (Baldwin *et al.*, 2001). Poor performance, shown by substandard quality of work and low production, is widespread in construction projects. Other challenges linked with inadequate performance include poor work ethic and miscommunication among stakeholders, late completion, cost increase, very high accident occurrences, and lack of consideration of ecological issues (Alinaitwe *et al.*, 2013).

2.4 Problem of Performance in Construction Industry

The failure of any construction project is mainly related to the problems and failure in performance. Moreover, there are many reasons and factors which attribute to such problem. (Shaban, 2008) stated that the construction industry performance problems in developing economies can be classified in three layers: problems of shortages or inadequacies in industry infrastructure (mainly supply of resources), problems caused by clients and consultants and problems caused by contractor incompetence/inadequacies.

The subject of performance measurement or assessment has become a matter of concern to several countries at different levels of socio-economic development which have realized the need to improve the performance of their construction industry (Kingsley, 2010). (Navon, 2005) identified in various forms as low productivity, delays, cost overrun, poor,

and quality and so on. Poor project performance has been noted as the bane of construction industries of several countries, particularly, developing countries.

X Ling et al., (2007) remarked that architectural, engineering and construction (AEC) firms may face difficulties managing construction projects performance in China because they are unfamiliar with this new operating environment. International construction projects performance is affected by more complex and dynamic factors than domestic projects frequently being exposed to serious external uncertainties such as political, economic, social, and cultural risks, as well as internal risks from within the project.

2.5 Contractors Related Factors and Project Performance

Contracts cause mutually contractual and legal commitments on partners that are hard to modify based on fiscal exchanges (Thomas & Ellis, 2007). The client employs the services of a construction firm to execute a contract in order to deliver a project on agreed timeline. (Kulatunga et al., 2005) propose that contractors have to gauge their performance to get a reasonable market share. Concerning the factors in performance of contractor, noted that increase in cost make a major monetary risk for clients and construction firms. The connection between employers and their consultants“ calls for an evaluation process that is price-based, as (Tao and Kumaraswamy, 2012) noted. Even then, the least offer frequently results to challenges such as substandard quality, cost increase, including lateness.

Clients and owners also influence project performance. In construction, the requirement to improve is necessary since clients need better value from their projects, and contractors require good profits to guarantee their long-term future. In this investigation, contractors, consultants, and owners agreed on the most important factors affecting contractor .First among these important performance factors are contractors“ financial difficulties, shortage of manpower, and too many change orders. These outcomes agree with the results of research conducted in a three-year study of contractor performance in Japan, the UK, and the USA by (Xiao and Proverbs, 2003).

In developing countries several researches have also been carried out concerning contractor performance, for example, a study in Ghana found widespread failures in meeting performance milestones in the construction sector. In several occasions, contractors were held responsible for poor performances and criticized for having limited technical expertise in the use of necessary organization techniques. Small and large contractors in

Ghana find it difficult to access funds (Badu et al., 2012). Pending bills for executed tasks is extensive and is the chief reason of incomplete projects (Adams, 2008).

2.6 Factors Affecting Road Construction Project Performance

Mashwama conducted study to investigate the challenges faced by stakeholders in the road construction projects in the Gauteng province of South Africa. Adopted quantitative research and a well-structured questionnaire was distributed to different construction companies in Gauteng Province, which were registered with various approved councils construction professionals and contractors such as civil engineers, project managers, directors, quantity surveyors, construction managers and resident engineers. The findings revealed that Community unrest and land proclamation were the highest ranked factors that pose a major challenge in the road construction, time, financial constraints, cash flow, lack of proper panning, resources, delivery of material, plant and equipment, shortage of skilled laborers, lack of equipment, lack of materials, performance guarantees, project duration/period, cost overruns were the major challenges facing the stakeholders (Mashwama et al., 2018).

Initial subcontractor selection and document preparation problem, poor performance of the subcontractor and cooperation problems are the significant determinants of subcontracting performance on cost and quality dimensions (Hailu, 2018).

Alhomidan also conducted study to identify the factors causing cost overrun in road construction projects in Saudi Arabia from contractors' viewpoint. The risk map of 41 factors considered in a survey indicates that the most severe factors affecting cost overrun in road construction projects are: internal administrative problems, payments delay, poor communication between construction parties, and delays in decision making. The results shows that most of the critical factors are managerial factors that could be controlled and minimized by improving the managerial skills of the construction teams by conducting proper trainings and workshops.(Alhomidan, 2013)

The research done to identify the factors affecting road construction projects performance in Uganda through review of literature and the findings have revealed that poor project planning and poor management of the implementation have remained the major factors affecting paved road project performance. The solution to the road construction project performance problem will not only help in the tackling of Uganda National Development Plan of strengthening the country's underdeveloped physical infrastructure, but will also

help in dealing with the Millennium Development Goals (MDGs) 1, 7 and 8 of: eradication of extreme poverty, ensuring environmental sustainability and developing a global partnership for development respectively. The academicians, policy makers, construction parties and all other stakeholders will benefit from this information with consequences of better road networks that will spur social-economic transformation and development across Uganda, Africa and globally (Roads, 2010).

Oguya studied the factors affecting performance of road construction projects in arid and semi-arid areas in Kenya and focuses on the Isiolo – Moyale (A 2) and Garissa Modogashe (C 81) road projects. It sought to establish whether Contractor's Competency, Construction parties' Financial Management, Construction Resources, and Conflicts affect performance of road construction projects in arid and semi-arid areas in Kenya and concluded that there is a positive correlation between Contractor's Competency, Construction parties' Financial Management, Timely availability of Construction Resources, and Conflicts towards the realization of increased performance of road construction projects in arid areas in Kenya. The study also found that the independent variables explain 82.7% of variance of the dependent variable performance of road construction in arid and semi-arid areas in Kenya. And also found that the contractor's competency variable will lead to the greatest change in performance followed by the conflict variable, construction parties' financial management variable and timely availability of construction resources (Oguya, 2016).

2.6.1 Factor Affecting Construction Cost Performance in Road Project

Cost performance has been identified as general problems in the construction industry in worldwide. The factors affecting cost performance are: 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. Cost overruns are more common in infrastructure projects especially, more common in road construction activities. The impacts of cost overruns are very high in developing countries compared to developed countries. In fact 100% of projects are suffered by cost overruns in developing countries (Rajakumar, 2016).

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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' most significant factors causing Performance Challenges on Contractors.

According to Harris and McCaffer (2005), the contractor's working capital or finance is the resource he requires to smooth the progress of implementation of the construction work on site. It is made up of money at hand, bank credit, overdraft, credit purchases, and work-in-progress and invoiced amount. Working capital also includes resources needed to grease the daily business of the construction firm. The portion of the clause addressing cost or time adjustments for 'differing site conditions' provide. If such conditions do differ in material and thus cause an increase/decrease in the Contractor's cost or time required for performance of the work, an equitable adjustment would be made pursuant to the General Condition titled "Changes". No claim of the contractor under this clause will be allowed unless the contractor has given the required notice.

Completing road projects within the specified budget agreed on the contract has been a chronic problem for the most of the projects in our country. Some of the causes of cost overruns in road construction projects can be avoided and controlled by the parties involved in the contract. However, some of them are beyond the control of the parties to the contract because virtually all projects are planned under the context of uncertainties.

Factors influencing cost in the road construction projects includes:

- Political interference during project implementation
- Profit rate of project
- Material and equipment cost
- Project labour cost
- Project overtime cost
- Cost of rework
- Cost of variation orders
- Waste rate of materials
- Escalation of material prices
- Differentiation of currency prices
- Cash flow problem of the project
- Incomplete drawing

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- Government policy
- Sudden change in taxation by the Government

2.6.1.1 List of other factors, which are usually ignored according to Biyadgign Tagesse (2017),

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

2.6.2 Factors Affecting Construction Time Performance in Road Project

➤ Causes of time overrun (delay)

Time overruns (delays) can be divided into three categories:

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

The predominant factors influencing time overruns/delays are design changes, poor labor productivity, inadequate planning and resource shortages. This Table illustrates the variables of delay and cost controls, which studied by (Kaming, 1997) in Indonesia.

Table2. 1: Variables influencing time, and/or cost control (Kaming et al., 1997)

Variables of delays and cost controls
Environment restriction
Experience of project location
Accurate prediction of equipment production rate
Equipment availability
Experience of local regulation
Weather conditions

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Variables of time controls
Build ability
Labour productivity
Level of planning
Material availability
Accuracy of materials estimate
Accurate prediction of craftsmen production rate
Skilled labour availability
Locational restriction of the project
Variables of cost controls
Inflation of material cost
Accurate quantity take-off
Experience of project type

In construction projects, there are two main types of causes causing delays in construction projects which are external causes and internal causes. The internal cause of delay includes the causes coming about from four parties involved in the project. These parties comprise the owner, designers, contractors, and consultants. However, other delays, which do not strike from the four mentioned parties, are based on external factors, for instance, delays caused by government, public and society problems, suppliers or natural conditions such as weather (Alaghbari et al., 2007) and (Hughes et al., 2017).

- 1) External causes; and
- 2) Internal causes.

Internal causes of delay include the causes arising from four parties involved in the project. These parties include the owner, designers, contractors, and consultants. Other delays, which do not arise from these four parties, are based on external causes for example from the government, materials suppliers, or the weather. (Alaghbari, 2007) mentioned the possible following factors causing delays in construction projects. A number of researchers have categorized the factors that causing delays in the four categories, those are:

➤ **Contractor's Responsibility**

The factors that related to contractor's responsibility are:

delay in delivery of materials to site; shortage of materials on site; construction mistakes and defective work; poor skills and experience of labour; shortage of site labour; low

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productivity of labour; financial problems; coordination problems with others; lack of subcontractor's skills; lack of site contractor's staff; poor site management; and equipment's and tool shortage on site.

➤ **Consultant's Responsibility**

The factors that related to consultant's responsibility are; absence of consultant's site staff; lack of experience on the part of the consultant; lack of experience on the part of the consultant's site staff; (managerial and supervisory personnel); delayed and slow supervision in making decisions; incomplete documents; and slowness in giving instructions.

➤ **Owner's Responsibility**

The factors that related to owner's responsibility are; lack of working knowledge; slowness in making decisions; lack of coordination with contractors; contract modifications (replacement and addition of new work to the project and change in specifications); and financial problems (delayed payments, financial difficulties, and economic problems

➤ **External factors**

The factors that related to external factors are:

Lack of materials on the market; lack of equipment and tools on the market; poor weather conditions; poor site conditions (location, ground, etc.); poor economic conditions (currency, inflation rate, etc.); changes in laws and regulations; transportation delays and external work due to public agencies like roads, utilities and public services (Alghbari et al.,2007). They Classified factors that cause time overrun into eight groups (owner, contractor, consultant, material, labour and equipment, contract, contractual relationships and external factors).This table illustrated the factors that cause time overruns.

Table2. 2: Factors that influencing time overrun (Alwi, 2002)

Category	Factor
Owner	Finance and payments of completed work.
	Owner interference.
	Slow decision-making by owners.
	Unrealistic imposed contract duration.
Contractor	Subcontractors.
	Site management.
	Construction methods.

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	Improper planning.
	Mistakes during construction.
	Inadequate contractor experience.
Consultant	Contract management.
	Preparation and approval of drawings.
	Quality assurance/control.
	Waiting time for approval of tests and inspections.
Material	Quality of material.
	Shortage in material.
Labour and Equipment	Labor supply.
	Labor productivity.
	Equipment availability and failure.
Contract	Change orders.
	Mistakes and discrepancies in contract documents.
Contractual Relationship	Major disputes and negotiations.
	Inappropriate overall organizational structure linking
	Lack of communication between the parties.
External factors	Weather condition
	Regulatory changes and building Code
	Unforeseen ground conditions

2.6.2.1 Critical Factors that Affect Time on Road Construction Projects

- Poor project management assistance
- Unforeseen ground conditions
- Low speed of decision making
- Project complexity
- Effective communication
- Financial constraints
- Average delay in claim approval
- Average delay in payments from owners to contractors
- Too many change orders from owner
- Site preparation time
- Unavailability of resources

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- Changes in technology after agreement
- Time needed to implement variation orders
- Weather due to heavy rain and flooding
- Political problem happened suddenly

2.6.3 Factors Affecting the Quality of Road construction projects

The quality of a project was commonly defined as meeting technical specifications (Khosravi and Afshari, 2011). Quality performance can be measured by looking into the nonconformance report (NCR) in the ISO 9000 certified organization. Moreover, quality performance can be determined by taking clients' satisfaction into consideration. The quality performance of a construction project at the site-level includes the quality of the constructed facility as well as the quality of services. A mix of product and service quality dimensions would therefore be very instrumental to the achievement of site-level quality performance (Idrus and Sodangi, 2010). Quality performance indicators as shown in the Table 2.3 below:

Table 2.3: Quality performance indicators (Cheung et al., 2004)

Category	Performance Indicators
Inspections	✓ Number of Site Inspection Conducted
Non- Compliance Records	✓ Number of Non Compliance Records Received ✓ Number of Non Compliance Records Closed ✓ Total Number of Non Compliance Records Rectified ✓ Average Time to close out Non- compliance Records
Work Rejection	✓ Due to Workmanship ✓ Due to Lateness
Survey (samples) Rejection	✓ Due to Workmanship ✓ Due to Lateness

2.6.3.1 Critical Factors that Affect Quality of Road Construction Projects

1. Inflation in prices of construction resources
2. Conformance to specification
3. Unavailability of competent staff
4. Quality of equipment or machineries and raw materials
5. Quality assessment system in organization

6. Quality training or meeting
7. Incomplete drawing
8. Incomplete technical specification
9. Test performed on material of road projects

2.6.4 Factors Affecting Client Satisfaction

Client Satisfaction factors include leadership skills for project manager, number of disputes between owner and project parties, speed and reliability of service to owner, number of rework incidents, information coordination between owner and project parties.

2.6.4.1 Critical Factors Affecting Performance of Client Satisfaction (Biyadgign Tagesse, 2017)

1. Poor workmanship and incompetence workers
2. Number of disputes between owner and project parties
3. Speed and reliability of service to owner
4. Additional work by the client during project implementation
5. Information coordination between owner and project parties
6. Leadership skills for project manager
7. Number of rework incidents
8. Preparation of drawings and other contract documents by the client

2.6.5 Factors Affecting Health and Safety Performance of construction projects

Health and safety programs are concerned with guiding the organizations management on plans of action and how the safety objectives can be met, protecting employees and other people affected by what the organization or company procedures and does against the hazards, either from their employment or their links with the company, helping to eradicate or minimize accident occurrence and production cost brought about by accident and declaring the intent of the management to protect employees and how to realize the intents . The safety performance is traditionally measured by using statistic data of injury and fatality. The main intention in measuring safety and health performance is providing information on the progress and current situation of site activities to control safety and health risks (Tiong et al, 2014).

The measurement of safety is mainly focused on the construction period as most accidents are happened during this stage. Similarly, Markovic et al, (2011) mentioned Health and

Safety Performance indicators in terms of: Reportable Accidents (including fatalities), Reportable Accidents (non-fatal), Lost Time Accidents and Fatalities. Kimanzi et al, (2015) noted Organizations must measure safety in order to find areas of weakness, and then implement actions aimed at raising safety levels While, the ultimate safety goal of a business should thus be to provide a productive and safe working environment for all employees. They also identified twenty one relevant safety performance management and measurement indicators within the paint manufacturing industry. Such as: Fire safety, Waste disposal, Space utilization, Plant Air quality, Spillage management, Safety gear, General health of workers, Worker skill, Warehousing/ material handling Function, Risk response, Communication, Noise exposure, Maintenance function, Accident and incident rates, General cleanliness of premises, Worker commitment and integrity, Level of lighting, Cost of accidents, Management input, Book Keeping and Water Supply.

2.6.5.1 Critical Factors Affecting Health and Safety Performance of Road construction projects

1. Reportable accidents rate in project
2. Application of health and safety factors in organization
3. Assurance rate of project
4. Easiness to reach to the site (location of project)
5. Wastes around the site
6. Climate condition and Air quality
7. Noise level

2.6.6. Factors Affecting Regular and Customer Satisfaction Performance

It has been evidently observed that Customer satisfaction has been a long lasting tool for success of the organization/organization. Customer satisfaction is one of the most important tasks in any project (Khan and Khoso, 2014). Companies use customer satisfaction more and more as a criterion when assessing the quality of products and services. Customer satisfaction affects the future cash flows, enhances profitability and increases profits, thus also having strategic implications. In construction, customer satisfaction could be determined by the extent to which a physical facility (product) and a construction process (service) meet and/or exceed a customer's expectations (Rahman and Alzubi ,2015) develop a conceptual model stating main elements that need to be considered in assessing client.

2.6.6.1 Regulatory and Community Satisfaction Factors

- Economic stability
- Environmental protection and mitigation costs
- Cost of compliance to regulators requirements
- Number of non-compliance events
- Site condition problems
- Quality and availability of regulator documentation
- Formation of Dispute Resolution Board

2.6.7 Factors Affecting Innovation and Learning of Construction Projects

- Research, Innovation and improvement
- Learning from own experience and past history
- Learning from best practice and experience of others
- Review of failures and solving them
- Work in group
- Training the human resources in the skills demanded by the project
- Enhancing training & education
- Technology Adaptability

2.6.8 Factors Affecting Productivity

Productivity is a commonly used measure of performance at the industry level, in the construction industry Acceptable productivity is measured solely on the basis of time spent with respect to the overall scheduled duration .It is commonly understood to be directly affected by the labor force. In this, worker time-keeping is significant (Sezer, 2016).

2.6.8.1 Factors Affecting Productivity Performance of Construction projects

1. Project size and complexity
2. Management-labour relationship
3. Absenteeism rate through project (late start and early exists)
4. Number of new projects per year
5. Sequencing of work according to schedule
6. Local cultural characteristics
7. Non-working holidays
8. Local climate conditions

9. Poor workmanship Resulting Defective Work and Rework

10. Low Labor productivity

2.7 Factors for successful Construction Project Performance

Many researchers identified different performance factors that are predominantly found to be affecting construction projects. This performance factors may result a huge impact on the construction projects and improper functioning of construction companies. Project Delay, poor quality, cost overrun and other target deviations of construction projects are a result of poor performance of the construction sector to set and align to an effective strategy. The performance factors are causes for performance problems which can be occurred either by negligence of obligation by the stakeholders or by external situations. For instance, in the road construction sector, Coordination between stakeholders in Ethiopia are causing construction delays, citizen dissatisfactions, safety issues, and issues raised by lack of review of contractors and other support companies (Fesseha, 2016).

Saraf identified performance factors that might determine construction as: improper planning, improper designing, lack of decision making, improper communication, poor site management, insufficient construction methods, quality assurance, quality and shortage of material, shortage of labor and technical personnel, availability of equipment and failure, unforeseen site condition, attitude of site personnel towards work ,weather condition, finance and payment of completed work, major disputes and negotiation , productivity, construction mistakes and defective work and client's satisfaction(Saraf,2016).

Project success depends upon how well the personnel can work effectively to accomplish objectives within scope, cost, quality and other constraints. Project Managers and Engineers are entrusted with the task of integrating the disciplinary and the inter-organizational efforts under changing environment for successful accomplishment of the specified objectives (Kaviya and Hema, 2015).

Similarly, main factors of project success as: Compliance with the planned budget, time frame and performance Criteria, Clearly defined goals and directions, Accurate schedule and plan, Timely and comprehensive control, Adequate use of project management techniques, Adequate use of technical skills, Competent project team members, Clearly defined roles and responsibilities, Synergy of the team, Experience and expertise of the project manager, Adequate risk management, Ability to handle unexpected problems, Communication and consultation with stakeholders, Provision of timely data to key

players, Client acceptance of the results, Stakeholders satisfaction, Owner involvement within the project, sponsor involvement within the project and top management support (Beleiu and Nistor, 2013).

2.8 Remedial Measures to Minimize the Project Performance Challenges

The following are factors that can be applied (in Vietnam) as a method of minimizing of construction delays as follows according to Biyadgign Tagesse (2017):

- Competent project manager;
- Multidisciplinary/competent project team;
- Availability of resources;
- Commitment to projects;
- Frequent progress meeting;
- Accurate initial cost estimates;
- Accurate initial time estimates
- Awarding bids to the right/experience consultant and contractor;
- Proper emphasis on past experience;
- Community involvement;
- Systematic control mechanism;
- Comprehensive contract documentation;
- Effective strategic planning;
- Clear information and communication channels;
- Use up to date technology utilization
- Research & development
- Meets technical Specification
- Absence of any legal claims & proceedings
- Pleasant Environment

2.9 Research Gap

There is a vast amount of literature on factors influencing performance of contractors in many developing countries. Based on the above surveyed studies, there was no study which focused on performance challenges of contractors on road construction projects undertaken to complete in the required schedule without affecting road performance. The studies that have been made on performance challenges of contractors mostly focus on the contribution, challenges and factors that affect their performance on road construction

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projects. The literatures on challenges that contractors' face internationally is reviewed. But the challenges on their functionality, progress and overall presence as a firm have not been studied in the context of Ethiopia particularly around Arsi Zone. Therefore, what affect the functionality, progress, quality, cost, Time, Client Satisfaction, Health and Safety, Productivity, best performance and overall presence and activity of contractors in West Arsi zone are about to assessed on this research paper.

CHAPTER THREE

RESEARCH MATERIALS AND METHODOLOGY

3.1 Introduction

This chapter discusses the line approach of the study. The first aspect deals with the method, population and sample of the study and the second part provides the tools and techniques employed in the research. It also presents the procedure of the study. The whole plan of the study is discussed in detail under this chapter. Administration of tools and scoring procedure are reported systematically. All these were used in order to achieve the research objectives.

3.2 Study Location

The study was conducted in West Arsi Zone, Oromia regional state, the southern part of the Arsi zone. This zone is named after a subgroup of the Oromo, who inhabit it and the administrative center of this zone is Shashamane. Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), this zone has a total population of 1,964,038 of whom 973,743 are men and 990,295 women. 272, 084 or 13.85% of population are urban inhabitants. Its geographical coordinates are between 7°17'North latitude and 38°39'16''East longitude.

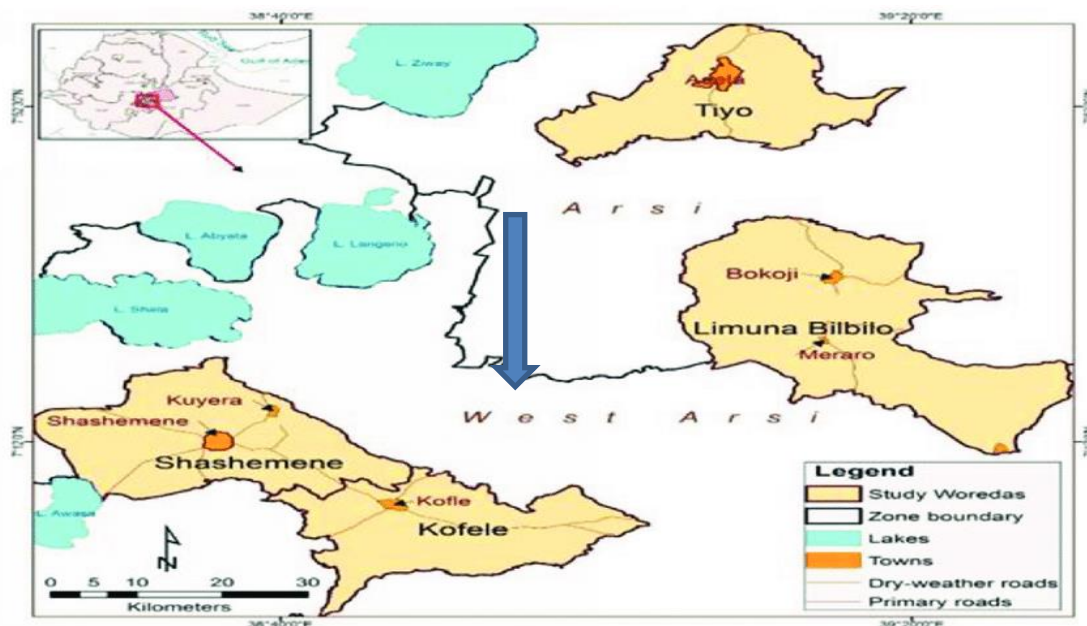


Figure 3.1: Map of the study area (Arsi and West Arsi zones)

Sources: Oromia Finance and Economic Development Bureau (2011).

3.3 Research Design

West Arsi Zone of Oromia Regional state has 12 Woredas where different construction projects have been undertaken for social benefit and economic development in the region. Using Purposive sampling techniques, Road construction project performed in all Woredas were identified for investigation. Identification and categorization of the challenges on road construction projects were identified using a literature review, desk study, and interview with construction stakeholders (clients' representatives, contractors, and consultant Engineers) in the Zone. Performance evaluation challenges on road construction project performance were identified under eight groups of factors. The questionnaire was developed to evaluate the frequency of identified problems with the five-point scale of ordinal measures i.e. Likert scale. A total of 43 questionnaires were distributed to construction professionals working on specific road projects in all places, and 34 questionnaires were returned from 43 distributed questionnaires. Using this research design, this study focused on acquisition of quantitative and qualitative data from different professional people involved in the road construction sector. The overall research process is:-

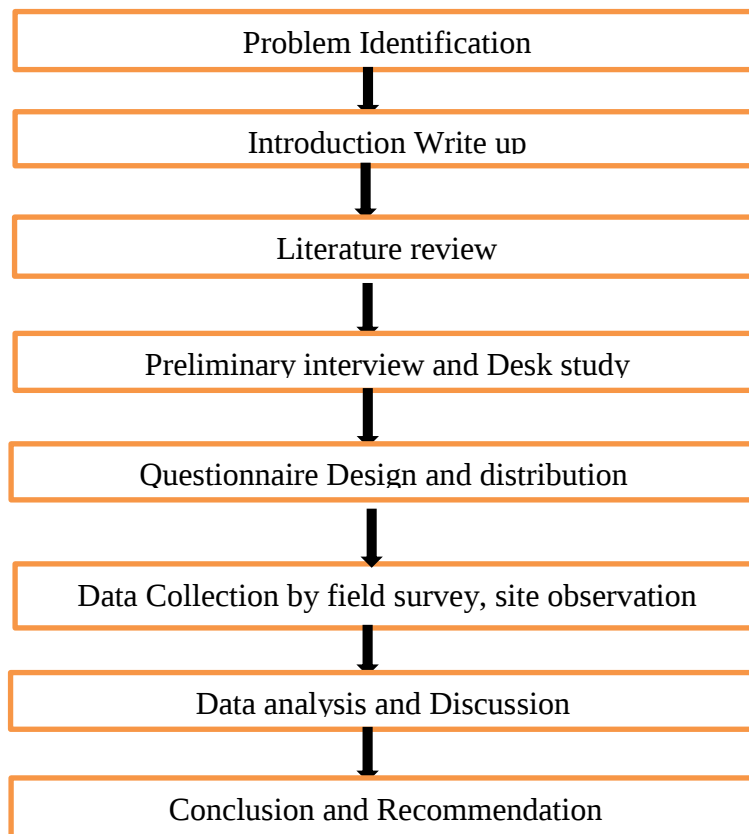


Figure 3.2: Thesis work flow

3.4 Sources of Data

To achieve the intended objective and to answer the research questions of the study, different sources of data will be used. As a primary data, questionnaire, semi-structured interview and site observation sources were used. To collect secondary data literatures, archival documents will be used. To improve the validity of study findings, the combination of qualitative and quantitative methods adopted to study observational. Study questionnaire survey has both open ended and closed ended questionnaires. The respondents' documents were collected using questionnaires from contractor, client representatives and consultants. Archival documents were mostly from completed project contract document, monthly reports, correspondence letters, consultancy completion reports and payment certificates were investigated thorough which were very important in identifying the current problems related performance failure on Road construction projects.

3.5 Population of the Study

The target population of this study were the road contractors in Arsi Zone, while the study population were government representatives from road authorities (ERA, and ORA), but as their response on questionnaire the targeted group were Woreda Roads Authority, Zone administration, Zonal Construction Authorities, the contractors (General Contractors and Road Contractors) and consultants (Supervising engineers), participating in road construction. The technique was applied so as to obtain a representative sample when the population does not constitute a homogeneous group. The populations used in this research were professionals participated ongoing road construction projects in Arsi Zone Road Construction projects, which started from 2015 but not suspended due to different reasons and those projects had a registered consultants and contractors.

The target populations in this study are professionals directly involved in the road construction and Zonal administration authority employees assigned to the road construction. The total number of contractors, consultant and Road authority employees made up the target population of 43 professionals as shown in Table 3.1 below:

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Table 3.1: Target Population for the Study

Population Category	Frequency	Percentage
Contractors	21	48.84%
Consultant	13	30.23%
Client Representatives	9	20.93%
Total	43	100%

3.6 Sample Size and Sampling Procedure

Sampling is selecting a given number of subjects from a defined population as representative of that population. From the target population of construction professionals involved in road construction projects and registered with zonal road authority and handled by Zonal Road Administration in Arsi Zone.

The sampling procedure describes the list of all population units from which the sample was selected. It is impossible to access every member of a population being studied. A researcher is required to select an appropriate and adequate number of participants from a research target population.

3.6.1. Sampling Technique

The purpose of sampling is used for data collection. Systematic random sampling technique was used for selecting the projects. The questionnaires were distributed for contractors at their offices and sites, for consultants at their project office and for the owners the questionnaires were distributed at the offices.

3.6.2. Determination of the Sample Size

The target groups in this study were west Arsi zone construction projects and their participants that are owners, contractors and consultants. The table 3.2 illustrates the number of respondents:

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Table 3.2: Sampling size of respondents in table form

Cluster	Stratified Sample Returned	Percentage
Road Contractors	18	52.93%
Consulting Engineers	9	26.47%
Owners	7	20.6
Total	34	100%

3.7 Data Collection Methods

After approval of the proposal by Adama Science and Technology University to collect data, the researcher starts to collect information from different Authority found in Arsi Zone. Using the authorization letter from the University the researcher started the process of data collection after seeking permission from relevant road authorities and owners of construction and consultancy firms involved in the research. A research assistant was engaged to assist in data collection. To clearly understand the research instruments, the assistant was trained on the intention of the study and moral values of research. Both primary and secondary data were employed to conduct this research. primary data collected through questionnaire, site observation and field survey to supplement the secondary data for the analysis of the qualitative part of the study, while secondary data gathered through review of working document, books, international journal and reviewing different documents of participants including monthly, fourth quarter and annual performance reports were collected to provide the explanatory analysis of the research questions.

The questionnaires to the respondents were administered face to face and via email. Telephone and email address including physical address of the respondents were obtained. Deliveries were carried out and followed up with reminders and personal collection was done by the researcher and the assistant. A few questionnaires were received through email.

3.8 Data Collection Tools

The instruments to be used in this study were questionnaires. Primary data was collected by the use of questionnaires. The questionnaire were divided into six sections: Section A

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which seeks to establish personal details of the respondent; Section B which contained Performance related problems on Road construction projects; Section C which contained factors affecting the performance of road construction projects; Section D which contained Key Performance Indicators' of road construction projects, Section E which contained remedial measures for project performance challenges and lastly Section F which contained Contractors Performance on road construction. The structured questions will be used in an effort to conserve time and money as well as to facilitate in easier analysis as they are in immediate usable form.

3.8.1 Questionnaire Administration

A Total of 43 questionnaires were distributed for 9 owner's representatives, 21 Road contractors and 13 consultant representatives. These questionnaires were filled by Road contractors, Consultant engineers, Road Authority engineers and others in different companies. 34 questionnaires were returned from 43 distributed questionnaires as follows: 7 (78%) from owners' representatives, 18 (86%) from contractors and 9 (69%) from consultants or Supervising Engineers as respondents. Figure 3.3 shows details of the responsiveness of the questionnaire.

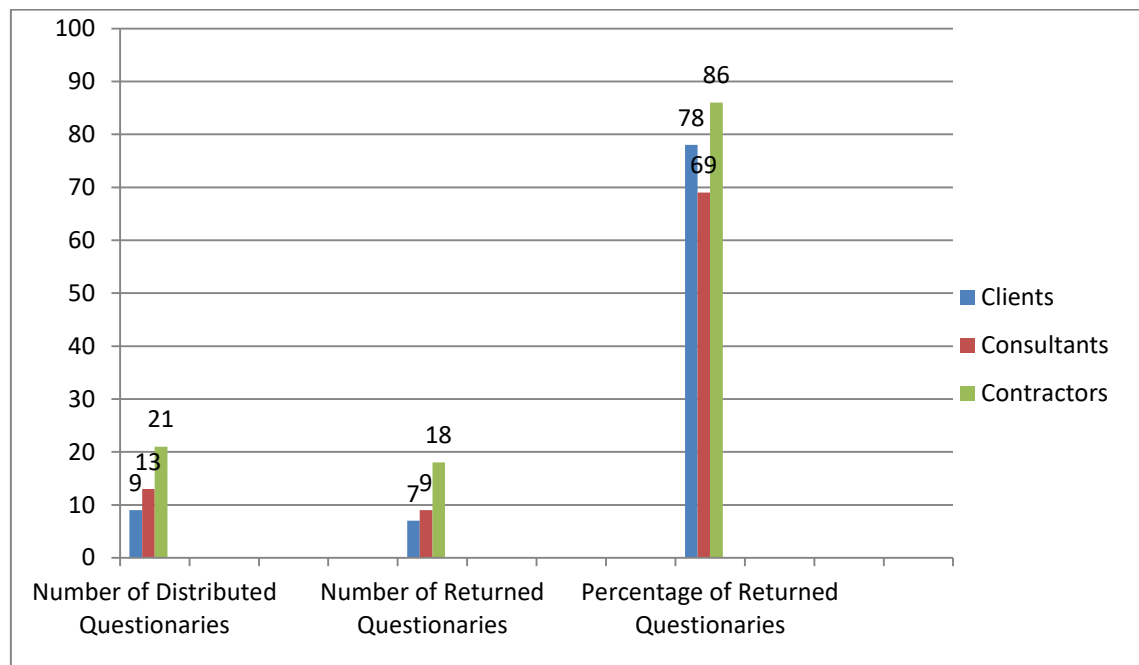


Figure 3.3: The responsiveness rate of the questionnaire

3.8.2 Validity of the Research Instruments

Validity is the degree to which the sample of the test item represent the content that is designed to measure. Creswell (2003) notes that validity is considering if one can draw consequential and valuable inference from scores on the instrument. The research adopted content validity which refers to the extent to which a measuring instrument provides adequate coverage of the topic under study. The study used both face and content validity to ascertain the validity of the questionnaires. To ensure content validity, the instruments were reviewed by the research supervisor hence enabling the content to address the purpose and avoided ambiguity. This ensured that all respondents understood the content on the questionnaire. The researcher sought assistance from supervisor in the university to ascertain content validity of the data collected.

3.8.3 Reliability of Research Instruments

Reliability analysis was subsequently done using Cronbach's Alpha which measured the internal consistency by establishing if certain item within a scale measures the same construct. Testing for reliability is important as it refers to the consistency across the parts of a measuring instrument (Huck, 2007). A scale is said to have high internal consistency reliability if the items of a scale "hang together" and measure the same construct (Huck, 2007, Robinson, 2009). The most commonly used internal consistency measure is the Cronbach Alpha coefficient. It is viewed as the most appropriate measure of reliability when making use of Likert scales (Whitley, 2002, Robinson, 2009). No absolute rules exist for internal consistencies, however most agree on a minimum internal consistency coefficient of .70 (Whitley, 2002, Robinson, 2009).

For an exploratory or pilot study, it is suggested that reliability should be equal to or above 0.60 (Straub et al., 2004). Hinton et al. (2004) have suggested four cut-off points for reliability, which includes excellent reliability (0.90 and above), high reliability (0.70-0.90), moderate reliability (0.50-0.70) and low reliability (0.50 and below) (Hinton et al., 2004). Although reliability is important for study, it is not sufficient unless combined with validity. In other words, for a test to be reliable, it also needs to be valid (Wilson, 2010).

Cronbach's Alpha was computed as follow according to Kothari, C. R. (2007):

$$\alpha = k/k-1*[1-\sum (S^2)/ \sum S^2_{sum})] \text{ Where;}$$

α = Cronbach's Alpha

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k =Number of Response items

$\sum S^2$ =Variance of individuals Items summed up

$\sum S^2_{sum}$ = Variance of summed up scores

The findings were as shown in table 3.3 describes how different values of Cronbach's Alpha are usually interpreted in research data discussion.

Table 3.3: Reliability Analysis of different variable values of Alpha

Performance challenges	No of Items	Cronbach's Alpha	Discussion
Cost	14	0.917	Excellent
Time	15	0.892	High reliability
Quality	9	0.904	Excellent
Client Performance	8	0.781	High reliability
Health and Safety	7	0.840	High reliability
Regulatory and Community Satisfaction	7	0.782	High reliability
Innovation And Learning	9	0.764	High reliability
Productivity	10	0.732	High reliability

The findings showed that all the eight variables were reliable as their reliability values exceeded the prescribed threshold of 0.7 Kothari, C. R. (2007). Therefore, these values indicate that the research instrument used was reliable that needed no amendments.

3.9 Data Measurement

In order to select the appropriate method of analysis, the level of measurement must be understood. For each type of performance challenges, there is/are an appropriate method/s that can be applied and not others. In this research, ordinal scales were used. Ordinal scales as shown in the Appendix questionnaire tables are a ranking or a rating data that normally uses integers in ascending or descending order. The numbers assigned (1, 2, 3, 4, 5) do not indicate that the interval between scales are equal, nor do they indicate absolute quantities. They are merely numerical labels based on Likert scale.

3.10 Data Analysis Methods

Data was collected, edited and coded. This was done to ensure consistency and uniformity in the processing of the data. Quantitative data was presented in tables and explanation

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presented in prose. Since the study was trying to identify challenges facing Performance of contractors when doing road construction projects, Microsoft excel were used in aiding the analysis and presentation of the findings of the research. The percentages and frequencies were used in the analysis and the results were presented in tables. The statistical tool used to run the analysis was descriptive statistics and the Relative Important Index (RII) was used to rank the identified variables and used to determine the rank of performance problems, the factors that affect project performance and key performance indicators in road construction projects. To provide a degree of importance for each delay cause, an importance index was calculated, in a manner similar to that in Assaf et al. (1995), as shown in Eq. 3.1

$$\text{Relative Importance of Index (RII)} = \frac{1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5}{5(n_1 + n_2 + n_3 + n_4 + n_5)} \quad \text{equation 3.1}$$

Where, n_1 = number of respondents who answered very low,
 n_2 = number of respondents who answered low,

n_3 = number of respondents who answered moderate,

n_4 = number of respondents who answered high, and

n_5 = number of respondents who answered very high.

The RII values have a range of 0 to 1 (0 not inclusive). In comparing two factors, the factor which scores greater value of RII is more important than the other corresponding factor which scores low value of RII.

I used Spearman Rank's Correlation Coefficient method to measure the relationship between variables because it's often used to evaluate relationships involving ordinal values. Spearman Rank's Correlation Coefficient method, which values varies between -1 and +1, was used to know owners, consultants and contractors perceptions of project performance related problems, factors that affect project performance and the key performance indicators in West Arsi Zone on Road construction Projects. The Spearman's Rank Correlation Coefficient is computed as using equation 3.2. Spearman rank correlation coefficient was calculated according to the following formula (Assaf and Al-Hejji 2006;

$$\text{Rho (Pcal)} = \frac{1-6*(\sum di^2)}{N*(N^2-1)} \quad \text{equation 3.2}$$

Where;

Rho =is Spearman's Rank Correlation Coefficient,

d_i = is the difference in ranking between each pair of factors given by the respondents,
 N = is the number of factors (Variables).

- A correlation coefficient of +1 means perfect positive correlation.
- A correlation coefficient close to 0 means no correlation.
- A correlation coefficient of -1 means perfect negative correlation

3.11. Ethical Consideration

Since, ethics is norms or standards to conduct right and wrong my research was conducted some of ethical considerations such as ensuring quality, safety and integrity, informed consent, confidentiality and anonymity of respondents on this research was expected to contribute the knowledge on how to mitigate the performance challenges facing contractors on road construction projects and was ensure that utmost confidentiality was maintained about the respondents and participants in study voluntarily and it was do no harm in any way.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSIONS

4.1 Introduction

This chapter discusses the interpretation and presentation of the data collected by means of questionnaires. The study aimed to identify and find the major performance challenges of contractors on road construction projects in West Arsi Zone. At this stage the data were examined and described in relation to the objectives of the study.

Frequency distribution and tables were used to organize data, to give meaning to the response rates and the statistical tool used to run the analysis was descriptive statistics and the Relative Important Index (RII). The data was then presented through frequency tables and analyzed by the programme MS-excel and I used Spearman Rank's Correlation Coefficient method because it's often used to evaluate relationships involving ordinal values.

4.2 Analysis of Questionnaire and Interview Response

The study generated 43 questionnaires which were administered to various categories of respondents and the results analyzed. Out of the 43 questionnaires distributed, 34 were returned giving a return rate. The questionnaire return rate results are shown in Table 4.1.

Table 4.1: Response rate of the study

Participants	Questionnaire Distributed	Questionnaire Returned	Response Rate in (%)
Contractors	21	18	86%
Owners	9	7	78%
Consultants	13	9	69%
Total	43	34	79%

From the combined result shown on table 4.1, a sample size of 43 respondents was the study target from which 34 filled in and returned the questionnaires with a rate response of 79%. This rate was acceptable to make conclusions for the study as it was considered representative. According to Gay (2001) in a questionnaire survey research, a response rate of 10% - 40% is acceptable for data analysis. The shortfall in the required sample size

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implies that, conclusions in the study may be considered as perception of the respondents only.

From the summarized table above, it can be said that enough questionnaire were returned to analyze the data and infer in this study since a rate of response of 79% is over 40% and exceptional when compared to the rate described above.

4.3 The Characteristics of Respondents

The characteristics of respondents observed in this study include gender, work position, age, educational qualifications, working experience, number of employees, and experience of the respondent. The review of these characteristics might give some insights as to why the answers of the respondents vary. Sample sizes of 34 respondents were taken and the following are their characteristics. The responses from the respondents are summarized in table 4.2.

Table 4.2: Respondents Profile

1	Position in the Firm	Contractor	18	52.94
		Client	4	11.76
		Consultant	9	26.47
		Technical Auditor	3	8.83
2	Organization Type	Zonal Administration	17	50
		Consultancy firm	6	17.65
		Contractors	11	32.35
3	Age of Respondent	20-29 Years	2	5.9
		30-39Years	8	23.35
		40-49 Years	13	38.24
		Above 50 Years	11	32.35
4	Experience	Less than 5 Years	2	5.9
		5-10 Years	8	23.55
		10-15Years	7	20.59
		15-20 Years	11	32.35
		Above 20 Years	6	17.65
	Level of Education	Diploma	1	2.94
		Bachelor's Degree	22	64.71

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5		Masters	11	32.35
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From the study results as shown in table 4.2 respondents profile on number one (1) as indicated on column number one above, the respondents were requested to indicate the position they worked in the firm. From the research findings, it was that noted that 52.94% worked as contractors, 11.76% worked as client firm, 26.47% worked as consultants, and while 8.83% of the technical auditor respondents worked with government ministry. This implies that all respondents worked with various organizations which are engaged in road construction playing various roles which place them in a position of being capable of providing very reliable information in this research study.

The respondents were asked to state their age bracket as above table 4.2 column three shows the study results, it was noted that 5.9 % of respondents were aged between 20-29 years, 23.35% were aged between 30 to 39 years, and 38.24% were aged between 40 to 49 years, whereas 32.35% were aged over 50 years. This indicates that respondents were fairly spread in relation to age.

As determined in above table 4.2 column number four (4) the respondents were requested to indicate their experience in years that they were involved in construction industry; thus from the study it was noted that 17.65% were involved in construction projects for more than 20 years, 32.35% were involved for a period of 15-20 years, 20.59% have been involved in construction projects for a period of 10-15years, 23.55% were involved in road construction projects for a period of 5 to 10 years ,whereas 5.9% of the respondents were involved in construction projects for less than 5 years. This result implies that most respondents were involved in road construction projects for a significant time length which enable them to give reliable information to this study.

From the research findings as indicated on column number five (5) in the table 4.2, the study noted that 64.71% held bachelor's degree, 32.35% of the respondents indicated to hold master's degree, 2.94% of the respondents indicated to hold diploma certificate, while 0% held PhD. This result shows that respondents were educated thus able to respond to research questions easily. It also indicates that the road construction industry is run by very well educated professionals.

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4.4 Project Performance Related Challenges from Respondents Response

The results of this part of study provides an indication of the participants' and combined relative importance index (RII) and rank of performance related problems in West Arsi Zone road construction projects and correlation coefficients between the respondents.

Table 4.3 and figure 4.1 shows summary of the participants', combined RII of performance problems and correlations between the respondents respectively.

Table 4.3: The Project Performance Related challenges with combined RII and Ranks

No.	Performance related challenges	Clients		Consultants		Contractors		Combined RII
		RII	Rank	RII	Rank	RII	Rank	
1	Cost	0.77	1	0.76	2	0.82	1	0.78
2	Time	0.72	3	0.73	4	0.78	2	0.74
3	Quality	0.69	4	0.71	6	0.73	4	0.71
4	Client Satisfaction	0.74	2	0.80	1	0.62	7	0.72
5	Health and Safety	0.60	6	0.62	8	0.63	6	0.62
6	Regulatory and Community Satisfaction	0.67	5	0.72	5	0.70	5	0.70
7	Innovation and Training	0.53	8	0.63	7	0.57	8	0.58
8	Productivity	0.57	7	0.74	3	0.76	3	0.69

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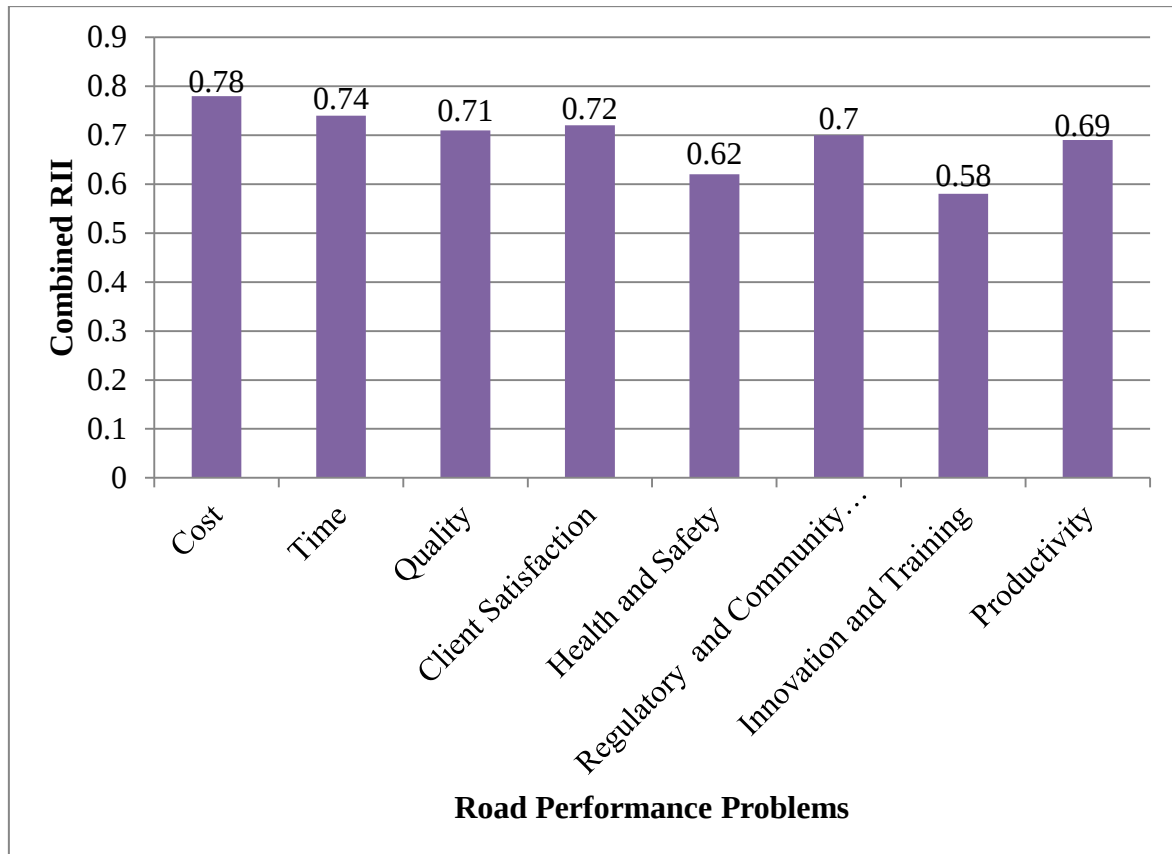


Figure 4.1: Combined RII and Rank of road project Performance problems

From the combined result shown on figure 4.1 above, the major performance problems which have been occurs on the road projects are cost and time with RII of 0.78 and 0.74 respectively. These is due to escalation of material prices, differentiation of currency prices, material and equipment cost , variation orders from owner, shortage of construction materials on the market, Time needed to implement variation orders, Average delay in payments from owners to contractor, Site preparation time and sudden change in taxation by the Government through countries.

Following to cost and time; Client satisfaction (0.72), quality (0.71), Regulatory and community satisfaction (0.70), productivity (0.69), are the second current major performance problems on road construction progress. The reasons for these are quality training or meeting for labor, Quality of equipment or machineries and raw materials, Additional work by the client during project implementation, Quality and availability of regulator documentation, poor supervision, quality of equipment's, delay on during project execution.

The least, but the important performance problems have been health and safety (0.62) and innovation and Training (0.58). The problems related to health and safety performance are

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assurance rate of project, application of health and safety factors in organization, wastes around the site which interrupt the movements of peoples near the site, health and safety application and awareness of labor about the advantage of the use of safety equipment's and there have not been first aid medication services on the project site.

Related to innovation and training performance; the problems are there is lack of technology adaptability, learning from best practice and experience of others, review of failures and solving them, skill training and education for the labors demanded by them, there are modern equipment's and technologies are available on the project, however they have not been operated by a well experienced person on the site.

From the research findings in the West Arsi zone the major and top performance problems which occur on the road projects are cost, time, client satisfaction, quality, regulatory and community satisfaction, productivity and health and safety. Almost there are fewer occurrences of innovation and training problems. This implies that there is no any practice related to innovation and learning, this means there is no skill training demanded labors.

Table 4.4: Spearman's correlation coefficient of project performance problems

Respondents	Spearman's correlation coefficient	Relations of the Respondents
Client Vs. Consultants	0.67	Moderate
Client Vs. Contractors	0.51	Moderate
Contractors Vs. Consultants	0.40	Weak

As shown on the table 4.4, the spearman correlation coefficient indicates that there is moderate relation between the responses of clients vs. consultants and Clients vs. Contractors, and weak relations between contractors and consultants.

The moderate relation between owner and consultant indicates that they have almost the same attitudes and perceptions towards the performance problems on time, regulatory and Community Satisfaction and client satisfactions. This is because of most of consultants are the representatives to owners and act as the clients. But they should act as fair both owners and contractors.

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The weak relation between contractors and consultants implies that contractors have too different attitudes with the consultants on the client satisfaction as we see from their responses' and the contractor was the only challenged party due to the occurrence of the problems.

4.5 The Current Major Performance Challenges on Road Projects

The results of this research finding provides an indication of the participants' and combined relative importance index (RII) with ranking of factors affecting the performance of road construction and shows the correlation coefficients between respondents of each participants respectively.

There are eight main groups that affect the performance of road construction projects on the successful completion of the project. The factors were identified from the literatures reviews that affect the performance of construction projects and each are sub-grouped in to the main eight groups' factors. The critical factors are discussed below. Also discussions are made by the correlations between the respondents.

4.5.1 Road project Performance Problem Related to Cost

Fourteen factors were identified from literature reviews that affect the performance of cost in road construction projects. Based on the combined relative important index and ranked the critical ones on the selected road construction projects are discussed. Table 4.5 and figure 4.2 show the results of participants by combined RII and the rank of factors affecting cost performance respectively.

Table 4.5: Participants RII and rank of cost related factors

Cost Factors Description	Client		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Political interference during project implementation	0.49	8	0.42	13	0.56	12
Profit rate of project	0.6	6	0.64	9	0.41	14
Material and equipment cost	0.83	3	0.84	2	0.84	1
Project labour cost	0.71	5	0.78	5	0.73	7
Project overtime cost	0.57	7	0.73	7	0.63	9
Cost of rework	0.46	9	0.71	8	0.69	8
Cost of variation orders	0.77	4	0.8	4	0.77	6

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Waste rate of materials	0.6	6	0.71	8	0.57	11
Escalation of material prices	0.89	1	0.87	1	0.83	2
Differentiation of currency prices	0.86	2	0.82	3	0.81	3
Cash flow problem of the project	0.57	7	0.76	6	0.8	4
Incomplete drawing	0.37	10	0.47	12	0.50	13
Government policy	0.71	5	0.53	10	0.60	10
Sudden change in taxation by the Government	0.57	7	0.51	11	0.79	5

From the above table the combined relative important index and the factors rank is shown and then the critical and top ranked factors of cost performance are shown by using MS-excel as seen on below figure 4.2.

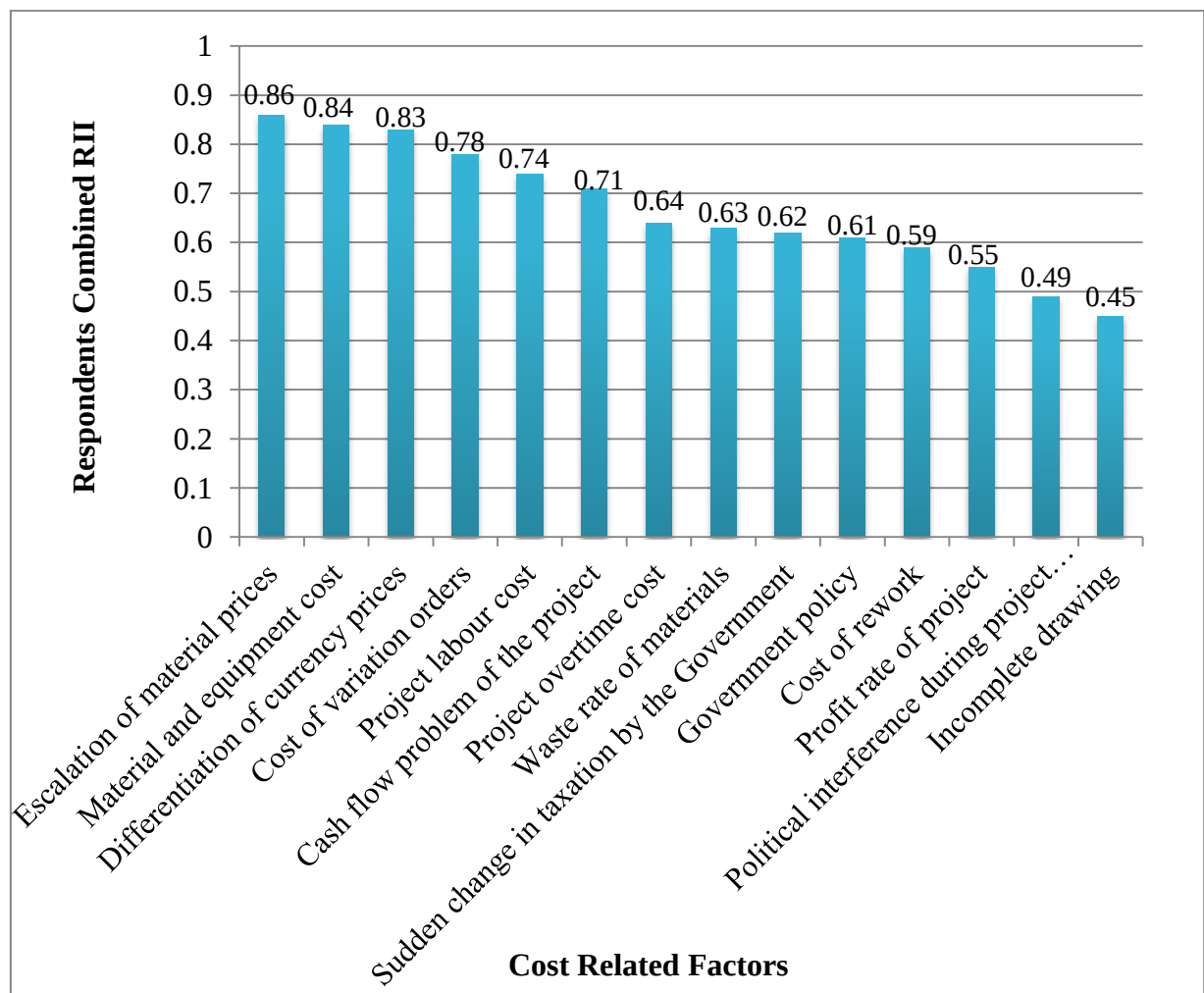


Figure 4.2: Combined RII and rank of cost Related factors

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Based on the combined relative important index and rank as shown on figure 4.2 above, the critical and top ranked factors of cost performance are discussed below in detail.

Escalation of material prices (0.86), material and equipment costs (0.84) and differentiation of currency prices on materials (0.83) became the main factors of cost performance. This is because of all the mentioned main factors of road performance are affects the liquidity of projects and cost performance of projects currently. The cost of construction materials are increases from time to time because of a limited suppliers, factories, shortage of raw materials , lack of currency exchange and cost of transportation from foreign countries. Differentiation of currency prices are affects profit rate of the project and cost performance. Contractors have been suffered from differentiation of currency prices because of economical and political situation of the country.

Cost of variation orders (0.78), Project labour cost (0.74), Cash flow problem of the project (0.71) became the critical factors next to escalation of material prices, material and equipment costs and differentiation of currency prices on materials. Cost of Variations orders from owners related to design change, increase of labor cost from day to day due to increase in life need standards affects the cost performance of project because project labor costs are one of the main inputs for project cost and Cash flow problem of the projects are leads to the increments of project cost. Cash flow are also affects the project budget and project cost performance, because cash flow can give an important evaluation for the cost performance at any stage of project. This is due to problem of assumptions during planning stage.

Table 4.6: Spearman's correlation coefficient of cost related factors

Respondents	Spearman's correlation coefficient	Relations of the Respondents
Client Vs. Consultants	0.81	Strong
Client Vs. Contractors	0.62	Moderate
Contractors Vs. Consultants	0.80	Strong

According to table 4.6 above, the spearman correlation coefficient indicates that the client has moderate relations with the responses of contractors and strong relations with consultant and there is also the strong relation between the responses of contractors and

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consultants on the factors affecting cost of road construction performance. The reason for strong relations between the client and consultant is both participants give attention for the project cost because consultant is the advisor of clients on the project and if project is affected by the change of cost he may be responsible for cost overrun and they have the same attitude on project labour cost, project overtime cost, cost of variation orders, escalation of construction material prices and nearly the same ideas on cash flow problem of the project, material and equipment cost, differentiation of currency prices and cost of rework.

But the moderate relation between client and contractor on the cost of project implies that the role of controlling the project cost besides of the client is by the consultant.

Whereas for the strong relation between the responses of contractor and consultant is that they have similar awareness's on differentiation of currency prices, government policy, cost of rework and almost nearly the same ideas on political interference during project implementation, material and equipment cost, escalation of material prices and incomplete drawing which factors greatly affects the project of cost since consultant is besides of client.

4.5.2 Road Project Performance Related to Time Factors

Fifteen factors were identified from literature reviews that affect the performance of time in road construction projects. Based on the combined relative important index and ranked the critical ones on the selected road construction projects are discussed. Table 4.7 and figure 4.3 show the results of participants by combined RII and the rank of factors affecting time performance respectively.

Table 4.7: Participants RII and rank of Time related factors

Time Factors Description	Client		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Poor project management assistance	0.43	13	0.47	10	0.51	12
Unforeseen ground conditions	0.6	8	0.49	9	0.41	14
Low speed of decision making	0.57	9	0.73	4	0.53	11
Project complexity	0.77	3	0.56	6	0.73	5
Effective communication	0.54	10	0.53	7	0.63	7
Financial constraints	0.69	5	0.64	5	0.6	9

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Average delay in claim approval	0.63	7	0.8	3	0.68	6
Average delay in payments from owners to contractors	0.71	4	0.71	5	0.83	2
Too many change orders from owner	0.66	6	0.42	11	0.57	10
Site preparation time	0.71	4	0.82	2	0.81	3
Unavailability of resources	0.83	1	0.84	1	0.84	1
Changes in technology after agreement	0.47	11	0.56	6	0.5	13
Time needed to implement variation orders	0.80	2	0.82	2	0.80	4
Weather due to heavy rain and flooding	0.57	9	0.51	8	0.51	12
Political problem happened suddenly	0.46	12	0.49	9	0.62	8

From the above table the combined relative important index and the factors rank is shown and then the critical and top ranked factors of time performance are shown by using MS-excel as seen on below figure 4.3.

Figure 4.3 below are shows the results of participants and combined RII and the rank of factors affecting time performance respectively.

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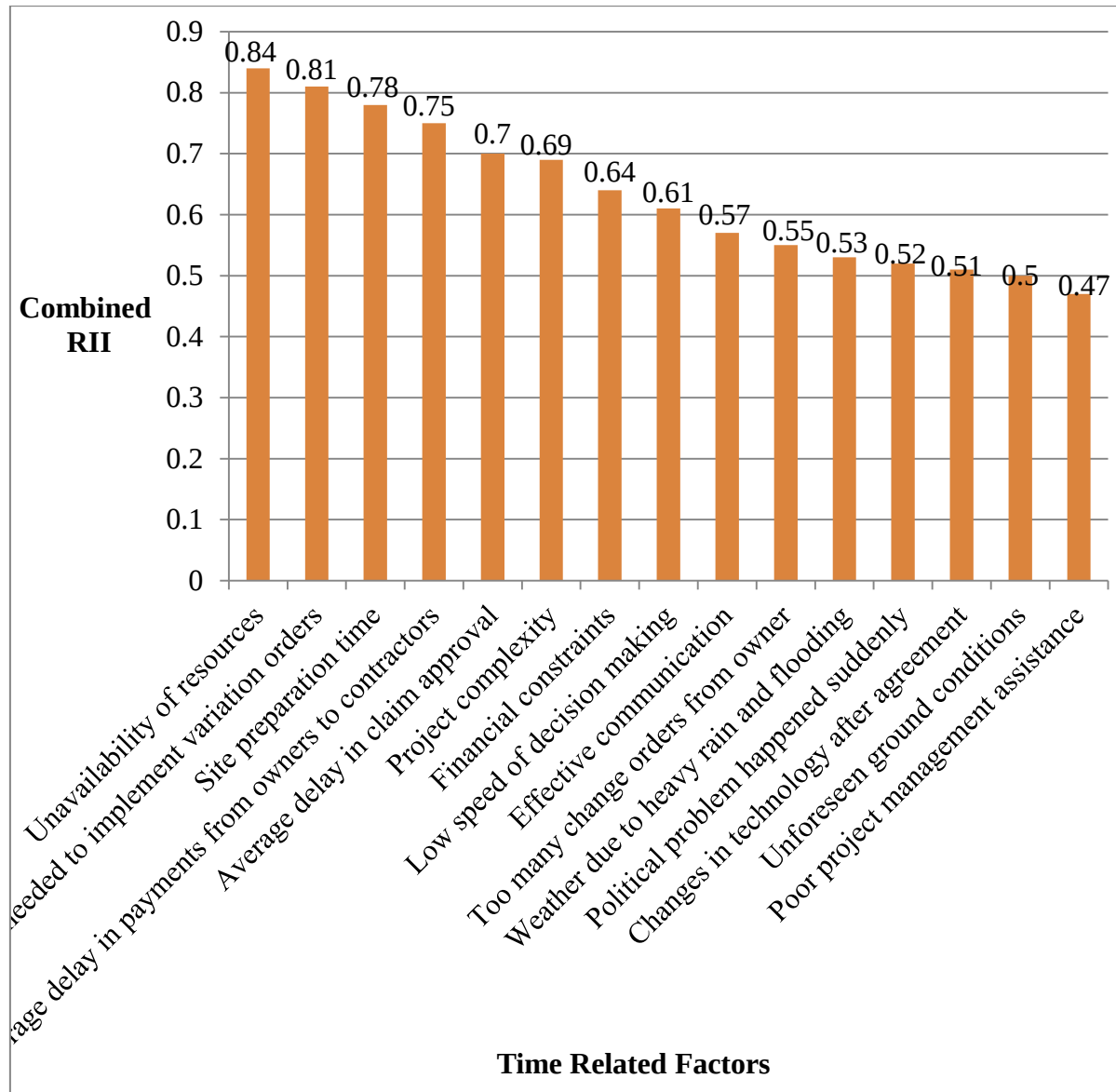


Figure 4.3: Combined RII and rank of time related factors

Based on the combined (RII) and rank shown on figure 4.3, unavailability of resources with RII equals to (0.84) and time needed to implement variation orders with RII (0.81) has been the critical factor that affects the time performance. Those factors affects directly and practically on project performance such as time. If resources are not available as planned through project duration, the project will suffer problem of time and cost performance. And it also affects the whole performance of projects. This is because resource availability as planned schedule can improve time performance of projects. The time required to implement variation orders can affect the project time performance. This is because some variations takes or requires more time than the first planned activities. So

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that the project doer will suffer time and cost performance problems due to time needed to implement these orders.

Site preparation time (0.78), average delay in payments from owners to contractors (0.75), and average delay in claim approval also have been critical factors of project time performance. Site preparation requires solving the problems that relate to providing the conditions for carrying out a specific activity. Here we should consider creating an access path to the site, if it does not exist already, for easy access of construction equipment and vehicles that supply the site with road construction materials and if we cannot do those first it may affect the time performance of construction roads.

Average delay in payments from owners to contractors (0.75) has impacted negatively on the effectiveness of the contractor and as such affect project delivery schedule. Failure to pay contractors for work executed might lead to the contracting firm being insolvent and late in completion of project in the required time that implies to affect the performance of road construction project.

The critical factors that affect time performance from the case studies projects have been too much variation orders from the owner, design change, project complexity, disruption, time needed to rectify defects, major materials supply shortage, work suspension, time needed to importing materials that are not locally available, delay related to sub-contract works and delay in payments from owner to contractor.

Table 4.8: Spearman's correlation coefficient of time related factors

Respondents	Spearman's correlation coefficient	Relations of the Respondents
Client Vs. Consultants	0.76	strong
Client Vs. Contractors	0.78	strong
Contractors Vs. Consultants	0.67	moderate

Based on the spearman's correlation coefficient on table 4.8 above, there is strong relation between the responses of client-contractor, moderate relation between contractor-consultant and strong relation between client-consultant.

The reason for the occurrence of strong relation between owner and contractor is that the rank of responses to poor project management assistance, unavailability of resources, site

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preparation time and average delay in claim approval were the same. This implies that completing the project on time is the main objective of both owner and contractors.

And also for the other respondents' strong relation between owners and consultants are that they have the same or nearly the same ideas or need on unforeseen ground conditions, financial constraints, average delay in payments from owners to contractors, Unavailability of resources, time needed to implement variation orders and weather due to heavy rain and flooding. This indicates that the owners' and consultants attention is to receive the project on time without delay of projects and extension of time.

Also as we see from above Spearman's correlation coefficient table 4.8, for the moderate relation between the responses of contractors and consultants is that they have the same or nearly the same knowledge on the rank of project complexity, effective communication, and too many change orders from owner, site preparation time, and unavailability of resources and nearly the same on political problem happened suddenly.

4.5.3 Road Project Performance Related to Quality Factors

From the literature reviews there were nine quality related factors that affect the performance of quality in road construction projects. Based on the combined relative important index and ranked the critical ones on the selected road construction projects are discussed. Table 4.9 and figure 4.4 show the results of participants by combined RII and the rank of factors affecting quality performance of road construction projects respectively. Then next to figure 4.4 discussions are made on the critical factors based on the high rank frequency.

Table 4.9: Respondents RII and rank of Quality related factors

Quality Factors Description	Client		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Inflation in prices of construction resources	0.86	1	0.87	1	0.84	1
Conformance to specification	0.71	4	0.56	7	0.63	6
Unavailability of competent staff	0.4	9	0.42	8	0.57	7
Quality of equipment or machineries and raw materials	0.83	2	0.84	2	0.83	2
Quality assessment system in organization	0.6	6	0.8	4	0.53	8

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Quality training or meeting	0.69	5	0.82	3	0.81	3
Incomplete drawing	0.54	7	0.56	7	0.51	9
Incomplete technical specification	0.51	8	0.62	6	0.73	4
Test performed on materials of road projects	0.77	3	0.73	5	0.71	5

From the above table the researcher determine the combined relative important index, the factors rank and then the critical and top ranked factors of quality performance on the road construction projects are shown by using MS-excel as seen from below figure 4.4.

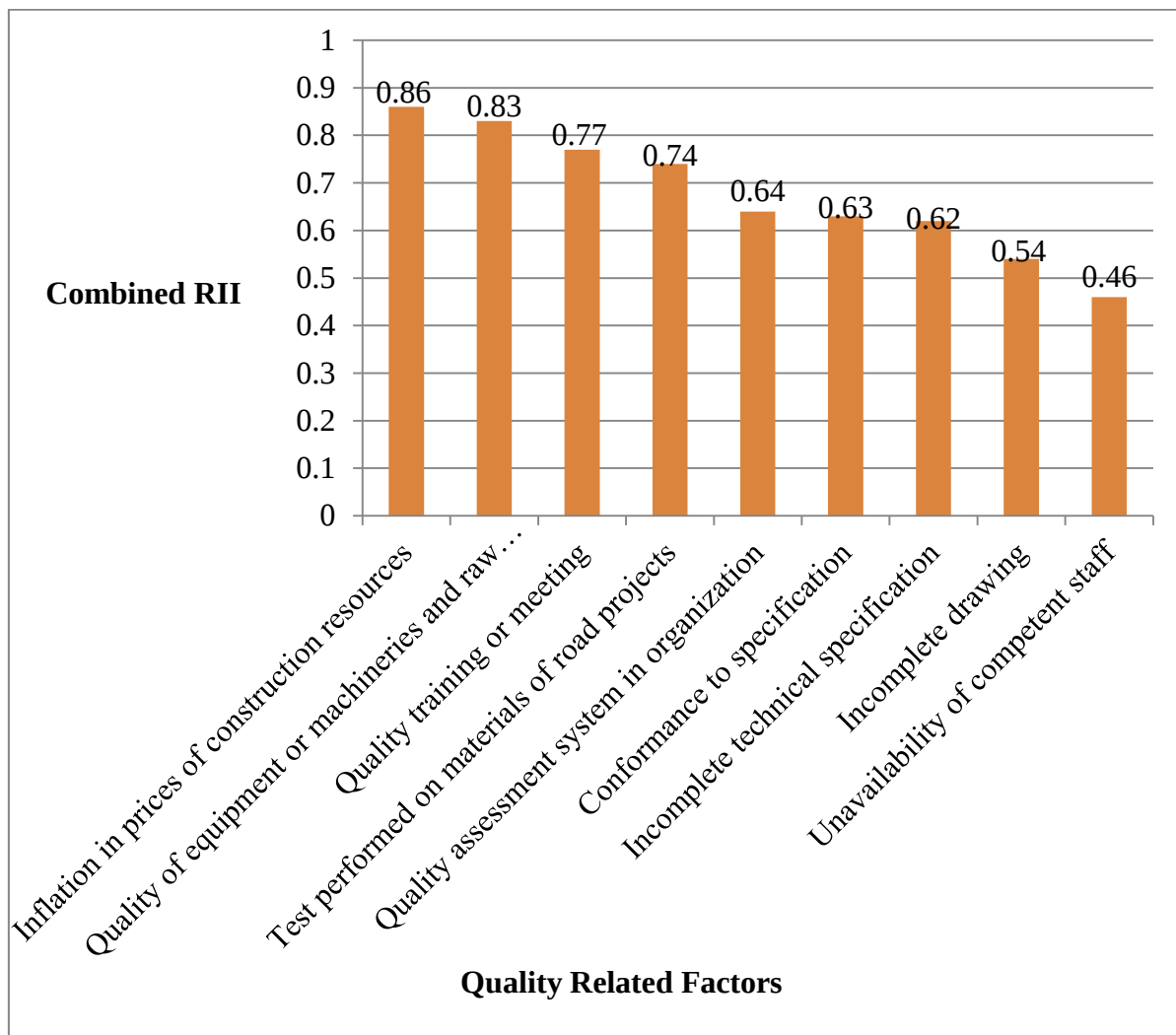


Figure 4.4: Combined RII and rank of quality related factors

From figure 4.4, Inflation in prices of construction resources (0.86), Quality of equipment or machineries and raw materials with RII of (0.83), have been the top two critical factors that affect quality performance of projects in construction of roads.

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These finding results indicate that the inflation in prices of construction resources from the contract price is raised; prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the special conditions of contract. if so provided, the amounts certified in each payment certificate, after deducting for advance payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due to a price adjustment factor to be applied to the amount for each payment certificate; a constant, specified in the contractor's bid, representing the nonadjustable portion in contractual payments and weightings or coefficients representing the estimated proportion of each cost element (labor, materials, equipment usage) were considered and adjusted. Unless otherwise price adjustment is made on the contract, the quality of the materials consumed on the project will greatly affected by the escalation. This is because the contractor wants himself to be free from bankruptcy; he will use some low cost materials and quality.

The quality of equipment or machineries and raw materials used in any project can affect the quality of the work executed. In Ethiopia most of the available materials are produced by a limited number of producers with a little variation in quality and there is the scarcity of industry to manufacture the raw materials used for road construction.

Also on the above figure, quality training or meeting with RII (0.77) and test performed on materials of road projects with RII (0.74), have been the critical quality performance factors. If these factors i.e. quality training or meeting and test performed on materials of road projects are not specified on the contract document, the contractor may use low quality materials and workmanship which are semi-skilled and un-skilled without taking any training full information about road construction in detail. Thus less quality training or meeting and unavailability of tests on quality of materials have been the critical factors that affect quality performance from the selected case studies projects.

From table 4.10 below, the spearman correlation coefficient indicates that the client has strong relations with the responses of consultants and moderate relations with contractors and there is a strong relation between the responses of contractors and consultants on the factors affecting quality of road construction performance.

Table 4.10: Spearman's correlation coefficient of quality related factors

Respondents	Spearman's correlation	Relations of the Respondents
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Evaluation of Performance Challenges for Contractors in Road Construction Projects

	coefficient	
Client Vs. Consultants	0.78	Strong
Client Vs. Contractors	0.66	Moderate
Contractors Vs. Consultants	0.78	Strong

From table 4.10, the spearman correlation coefficient indicates that there is a strong relation between the responses of clients and consultants. This is due to they have the same or similar perception towards the quality factors on the inflation in prices of construction resources, quality of equipment or machineries' and raw materials and incomplete drawing. This indicates the quality application on the project has been supervised both by owners and consultants and most of the time consultant is worried about owners' satisfaction.

Also this correlation table shows that contractors' responses have a moderate relation with clients on the factors affect quality performance. This implies that the contractor quality performance is affected by conformance to specification, incomplete technical specification, quality training or meeting and incomplete drawing, but owners do not give attention to quality problem during construction implementation. This means that owners want to control and supervise only what works executed on the project site by what types of materials, equipment's and workmanship.

Whereas for the strong relation between the responses of contractors and consultants is that they have the same responsibilities on Inflation in prices of construction resources, Quality training or meeting, Test performed on materials of road projects, Quality of equipment or machineries and raw materials and almost nearly the same ideas on conformance to specification and unavailability of competent staff which factors greatly affects the project of cost since consultant is besides of owner.

4.5.4 Road Project Performance Related to Client Satisfaction Factors

There are eight factors that affect the client satisfaction performance on road construction works were identified from literature reviews that affect the performance of owner satisfaction in road construction projects. Based on the combined relative important index and ranked the critical ones on the road construction projects are discussed. Table 4.11 and fig-

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ure 4.5 are showing the results of individuals' response and the results of participants by combined.

Table 4.11: Respondents RII and rank of Client satisfaction related factors

Client Satisfaction Related Factors	Client		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Poor workmanship and incompetence workers	0.80	2	0.78	3	0.82	1
Leadership skills for project manager	0.71	4	0.76	4	0.80	3
Number of disputes between owner and project parties	0.66	5	0.8	2	0.79	4
Speed and reliability of service to owner	0.83	1	0.82	1	0.73	5
Additional work by the client during project implementation	0.71	4	0.71	6	0.81	2
Information coordination between owner and project parties	0.77	3	0.73	5	0.5	8
Number of rework incidents	0.46	7	0.64	7	0.68	7
Preparation of drawings and other contract documents by the client	0.57	6	0.51	8	0.71	6

From the above table the researcher determine the combined relative important and then the critical and top ranked factors of client satisfaction performance on the road construction projects.

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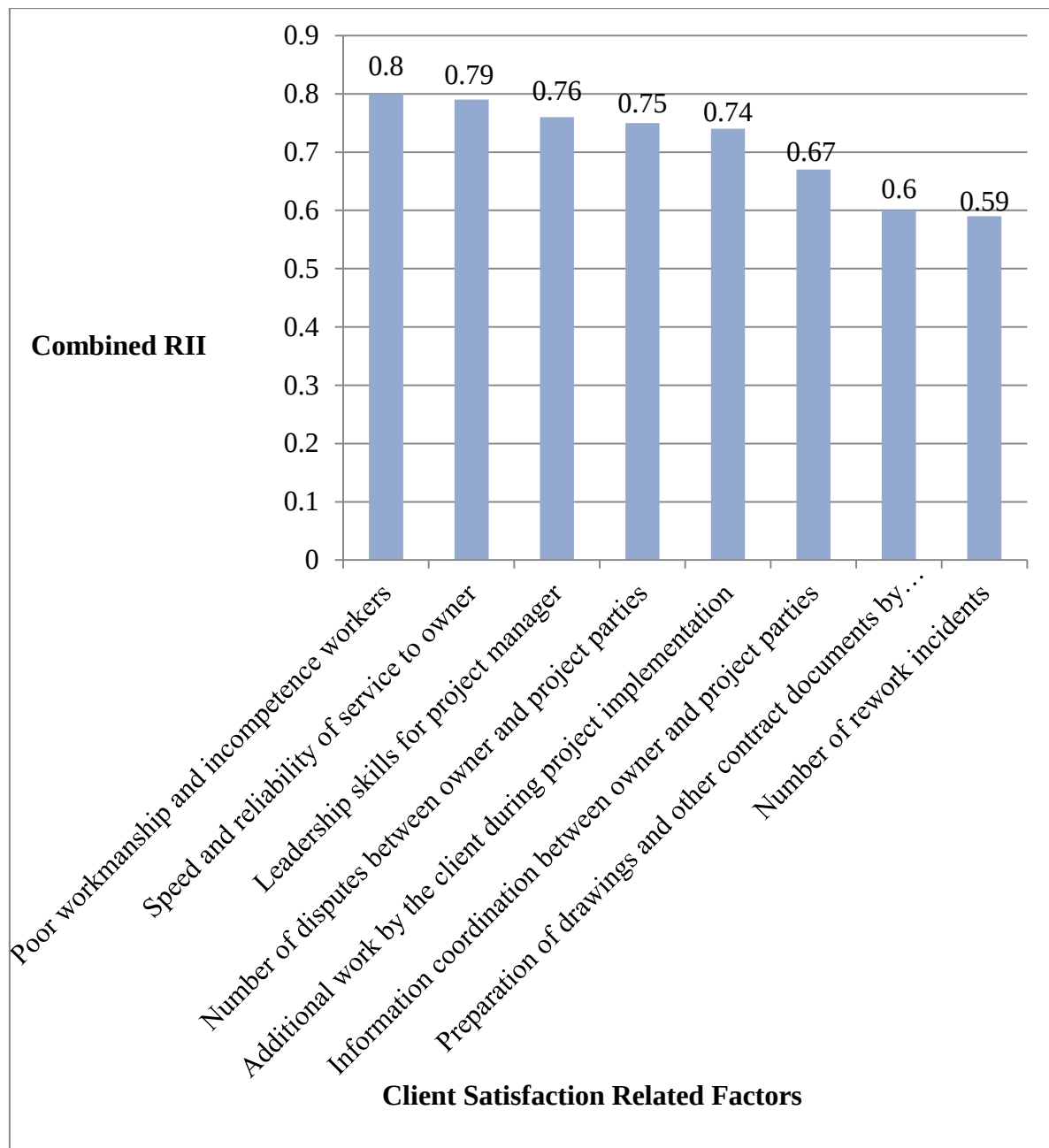


Figure 4.5: Combined RII and rank of Client satisfaction related factors

As shown on the figure 4.5 above, poor workmanship and incompetence workers have been the first rank and the critical factor which affects the performance of client satisfaction with RII having (0.80). The existence of poor workmanship and incompetent staff on the project site will greatly affect the client satisfaction. This is an important factor of client satisfaction because it affects the quality of the project and service life of the project.

Speed and reliability of service to owner with RII (0.79), Leadership skills for project manager (0.76), Number of disputes between owner and project parties (0.75), Additional

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work by the client during project implementation with RII (0.74) have been the second critical client satisfaction performance factors next to poor workmanship and incompetence workers.

Speed and reliability of service from contractor or consultant to client or client representative affect the degree of satisfaction with respect to client. This is because the clients need to take the project on time even before time so that it generates money rapidly.

Leadership skill for project manager is the most important one because leadership skills for project manager affect the construction project performance and it is significant and an important for effectiveness on project performance because client satisfaction depends up on it. It also assists to supervise the project with strong and suitable performance. This will convenient and satisfy the project client.

Number of disputes between owner and project parties has been also other top rank and the critical factor which affects the performance of client satisfaction with RII having (0.75). Disputes between owner and contractor and owner and consultants were affecting the relationship between them and the degree of client satisfaction will be affected.

Additional works by the client during project implementation has been also the factor which affects the performance of client satisfaction because if the owner choose to add additional work, such additional work shall be described in a separate written amendment to agreement wherein the additional work shall be described and the parties shall set forth the amount of compensation to be paid by client for the additional work. Therefore contractor shall not be obligated to pay for any additional work unless a written amendment to this agreement has been signed by both parties. This implies that the factor affects the client satisfaction in the completion of the project within the contract and within its intended scope. Based on the result of the selected case studies speed of delivering the project to the owner, number of claims submitted from the contractor and performance of contractor has been the critical factors affecting the performance of client satisfaction.

Table 4.12: Spearman's correlation coefficient of Client satisfaction related factors

Respondents	Spearman's correlation coefficient	Relations of the Respondents
Client Vs. Consultants	0.74	Strong
Client Vs. Contractors	0.43	Weak
Contractors Vs. Consultants	0.36	Weak

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On table 4.12, the spearman correlation coefficient shows that the clients' responses have very strong relation with the consultants. This implies that consultants satisfy owners on the overall project performance by controlling the factors like leadership skills for project manager, number of rework incidents and speed and reliability of service to owner in road construction projects.

The weak relation between contractors and clients indicates that contractors and clients have different response on Speed and reliability of service to owner, additional work by the client during project implementation and information coordination between owner and project parties.

Also the correlation table shows that there is a weak relation between consultants and contractors. This is due to the different response ranks between them Speed and reliability of service to owner, additional work by the client during project implementation, information coordination between owner and project parties, poor workmanship and incompetence workers, number of disputes between owner and project parties and preparation of drawings and other contract documents by the client.

4.5.5 Road Project Performance Related to Health and Safety Factors

There are seven factors that affect the health and safety performance of road construction works were identified from literature reviews. Based on the combined relative important index and ranked the critical ones on the road construction projects are discussed.

Table 4.13: Respondents RII and rank of health and safety related factors

Health and Safety Related Factors	Client		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Reportable accidents rate in project	0.37	7	0.42	6	0.41	6
Application of health and safety factors in organization	0.83	1	0.82	1	0.83	1
Assurance rate of project	0.66	3	0.64	3	0.68	3
Easiness to reach to the site (location of the project).	0.46	5	0.62	4	0.63	4
Wastes around the site	0.49	4	0.51	5	0.5	5
Climate condition and Air quality	0.71	2	0.78	2	0.71	2

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Noise level	0.43	6	0.40	7	0.41	6
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From the above table the researcher determine the combined relative important index and the factors rank shown in the below figure and then the critical and top ranked factors of health and safety performance on the road construction projects is determined.

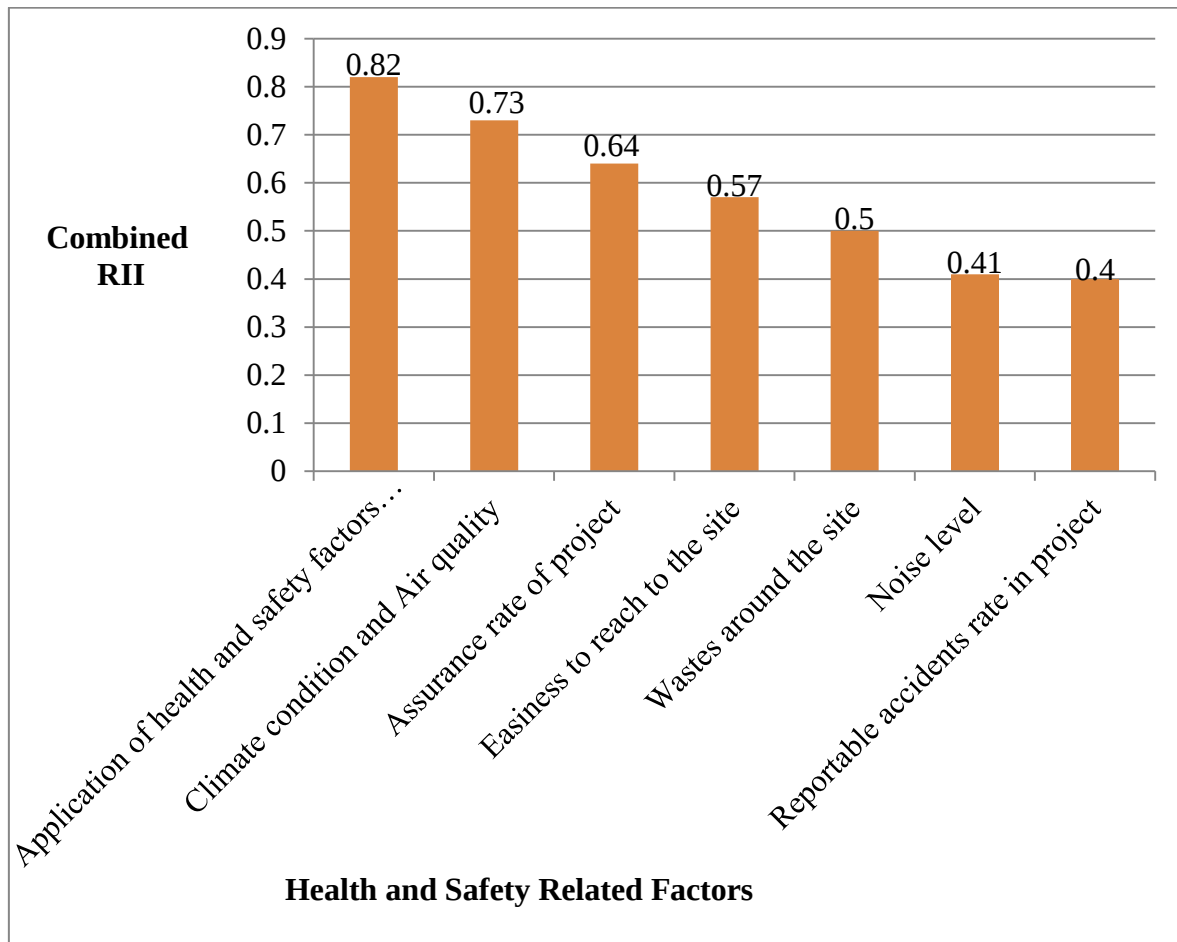


Figure 4.6: Combined RII and rank of health and safety related factors

As shown on the figure 4.6, application of health and safety factors in organization (0.82) and climate condition and air quality (0.73) has been the critical and top rank of health and safety performance factors on road construction projects. The application of health and safety factors on projects decrease the occurrence problems related to health and safety and it improve the awareness of the workers. This factor affects strongly on performance of projects because it affects the safety system in projects. The air quality with in and around the site will greatly affect productivity of the labors; this is because it affects the health and safety of the labors.

Next to application of health and safety factors in organization and climate condition and air quality, assurance rate of project RII of (0.64) has been the second critical factors

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affecting the performance of health and safety. Assurance is a type of insurance in which money is paid out after an agreed period of time when somebody dies. Assurance rate of project affects the safety and cost performance of project. This factor is the critical one because assurance rate of project usually affects the safety performance and the client and regulatory satisfaction in projects.

From the research findings workers' lack of awareness to safety, improper using of safety equipment's, problems in fall into excavated hole, sudden truck bit and helmet, site shoes have been the critical factors that affects health and safety performance on the projects.

Table 4.14: Spearman's correlation coefficient of health and safety related factors

Respondents	Spearman's correlation coefficient	Relations of the Respondents
Client Vs. Consultants	0.93	Strong relations
Client Vs. Contractors	0.93	Strong relations
Contractors Vs. Consultants	0.97	Strong relations

As shown on the spearman's correlation coefficient table 4.14, there is a strong relation between all respondents. This implies that all factors have the same effect on the projects. This strong relation between contractors and consultants was happens because of similar response on reportable accidents rate in project and near the same response on the other factors like application of health and safety factors in organization, assurance rate of project, easiness to reach to the site (location of the project), wastes around the site and climate condition and air quality.

Whereas the reason for strong relation between clients and contractors was that there are similar responses on Application of health and safety factors in organization, assurance rate of project, climate condition and air quality and noise level.

4.5.6 Road Project Performance Related to Regulatory and Community Satisfaction Factors

There are seven factors identified by the researcher that may affect the regulatory and community satisfaction performance of road construction works. Based on the combined

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relative important index and ranked the critical ones on the road construction projects are then discussed.

Table 4.15: Respondents RII and rank of regulatory and community satisfaction factors

Regulatory and Community satisfaction Factors	Client		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Economic stability	0.46	5	0.56	4	0.50	5
Environmental protection and mitigation costs	0.54	3	0.53	5	0.53	4
Cost of compliance to regulators requirements	0.57	2	0.64	2	0.68	2
Number of non-compliance events	0.46	5	0.44	6	0.40	7
Site condition problems	0.66	6	0.73	7	0.71	6
Quality and availability of regulator documentation	0.49	4	0.62	3	0.63	3
Formation of Dispute Resolution Board	0.77	1	0.78	1	0.79	1

From the above table the researcher determine the combined relative important index and the factors rank shown in the below figure and then the critical and top ranked factors of regulatory and community satisfaction performance on the road construction projects is determined.

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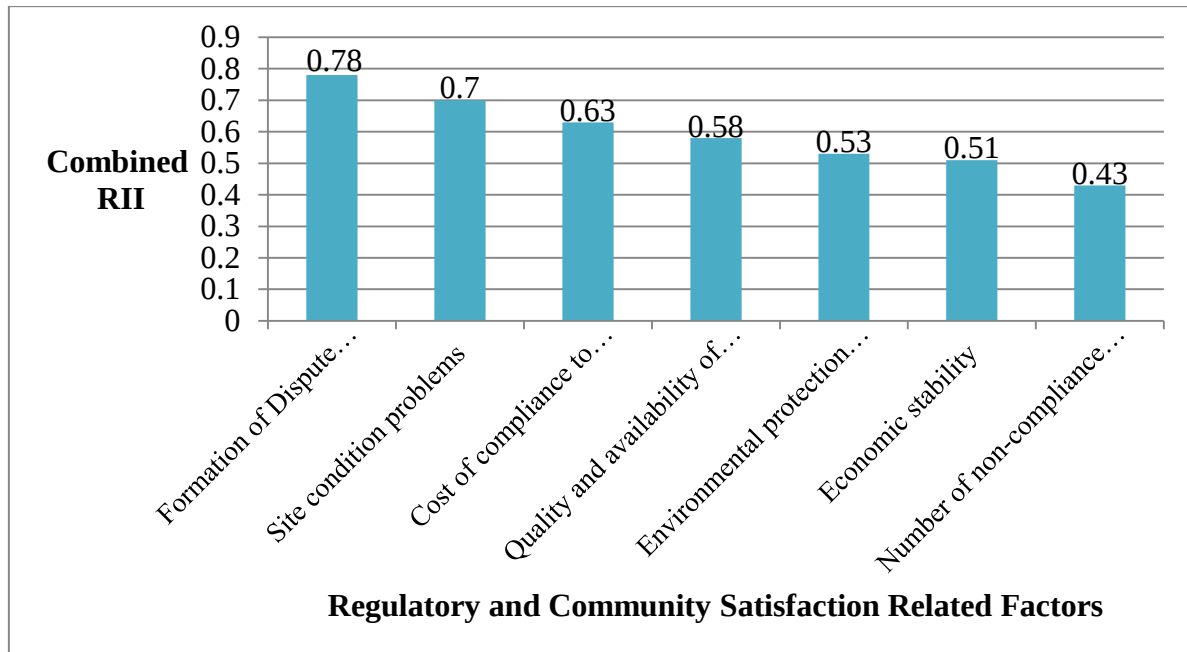


Figure 4.7: Combined RII and ranks of regulatory and community satisfaction factors

As we see from figure 4.7, above, formation of dispute resolution board with RII (0.78) has been the critical and first top factor which affects the performance of regulatory and community satisfaction because it is the creature of the contract between each parties and each board members providing advice and suggestions for the conditions and practices existing in project areas. Here problems, disagreements and claims arise in most large and complex construction projects regardless of the project delivery methods. These disputes can and do delay and significantly increase the cost of the project and implies factors that can affects performance of road projects of regulatory and community satisfaction.

The site conditions problems with RII equals to (0.70) has been the second critical factor which affects the performance of regulatory and community satisfaction. This factor is the most important one for all parties. The problem has been related to most project sites that affects the movement of peoples' near the site. This problem affects the time performance of project and causes disputes and delays in construction projects.

The figure also shows that cost of compliance to regulators requirements has been the third critical factor which affects the performance of regulatory and community satisfaction performance factor with RII of (0.63). The amount of cost compliance which paid to regulatory bodies and the compensation cost paid for the properties of land greatly affect the degree of satisfaction of regulators and community and also this affects the cost performance of project. This will affect the overall project performance.

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Table 4.16: Spearman's correlation coefficient of regulatory and community satisfaction factors

Respondents	Spearman's correlation coefficient	Relations of the Respondents
Clients Vs. Consultants	0.86	Strong relations
Clients Vs. Contractors	0.89	Strong relations
Contractors Vs. Consultants	0.93	Strong relations

Based on the spearman's correlation coefficient table 4.16, contractors have a strong relation with consultants responses; this is because of they had similar response rank on the Cost of compliance to regulators requirements and quality and availability of regulator documentation and formation of dispute resolution board and also there is almost similar responses on the factors that affects regulatory and community satisfaction on economic stability, environmental protection and mitigation costs, number of non-compliance events and site condition problems.

Also the reasons for strong relations between clients and contractors were that owners have similar responses of all factors of regulatory and community satisfaction on economic stability, cost of compliance to regulators requirements, site condition problems and formation of dispute resolution board. These are site condition problems, quality and availability of regulator documentation, cost of compliance to regulators requirements and number of non-compliance to regulations.

There is also a strong correlation between clients' and consultants' responses. This is because of they had similar response rank on the cost of compliance to regulators requirements and formation of dispute resolution board in the construction projects.

4.5.7 Road project Performance Related to Innovation and Learning Factors

There are eight factors identified by the researcher that may affect the innovation and learning performance of road construction works. Based on the combined relative important index and ranked the critical ones on the road construction projects are then discussed under the figure.

Table 4.17: Respondents RII and rank of innovation and learning factors

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Innovation and Learning Factors	Client		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Research, Innovation and improvement	0.6	6	0.51	8	0.57	8
Learning from own experience and past history	0.71	3	0.73	3	0.73	4
Learning from best practice and experience of others	0.77	2	0.78	1	0.79	2
Review of failures and solving them	0.80	1	0.76	2	0.77	3
Work in group	0.69	4	0.57	7	0.60	7
Training the human resources in the skills demanded by the project	0.71	3	0.71	4	0.8	1
Enhancing training & education	0.66	5	0.64	5	0.68	5
Technology Adaptability	0.57	7	0.62	6	0.63	6

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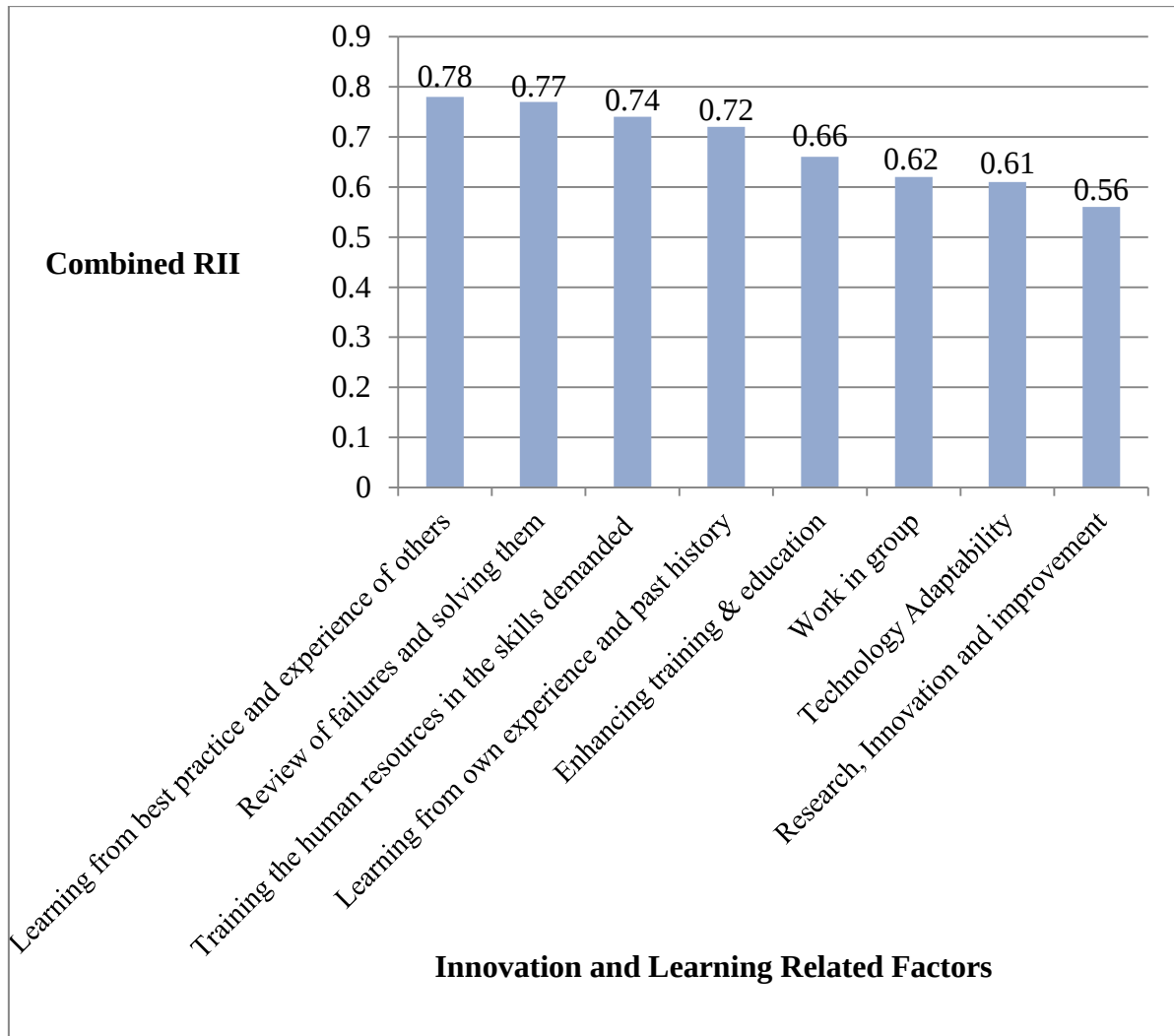


Figure 4.8: Combined RII and ranks of innovation and learning factors

As shown on the figure 4.8, above, learning from best practice and experience of others with RII (0.78) has been the first critical factor that affects innovation and learning performance project. Learning from best practice and experience of others will improve performance of projects. It can also improve and develop the performance of current and future projects. Taking the practice and experience of best organizations will make others organizations to minimize risks related to safety, health, time, cost and quality performance of projects through construction industry.

According to figure 4.8, review of failures and solving them with RII (0.77) have been the second critical factor which affects the innovation and learning performance of road projects. Once failures occurred in a project, reviewing, solving and protecting them before happen again will improve the cost, time and quality of project performance. This factor

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also enhances project performance and will satisfy the project stakeholders through construction works.

As shown on the same figure, Training the human resources in the skills demanded by the project and Learning from own experience and past history with RII of (0.74) and (0.72) have been the third and fourth critical learning and innovation performance factor of the projects. Training the human resources in the skills demanded by the project assists employees to perform the project effectively and successfully. This is an important learning and innovation factor because it improves the productivity performance of a project.

Learning from own experience and past history with RII 0.72 has been the fourth factors that affect the performance of innovation and learning since it develop, implement and communicate new ideas to others effectively, demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas and it improves the productivity performance of a project in construction industry.

Table 4.18: Spearman's correlation coefficient of innovation and learning factors

Respondents	Spearman's correlation coefficient	Relations of the Respondents
Client Vs. Consultants	0.80	Strong relations
Client Vs. Contractors	0.73	Strong relations
Contractors Vs. Consultants	0.86	Strong relations

As shown on the table 4.18, it is shown that there is a strong relationship between owners' and consultants responses. The similar responses on learning from own experience and past history and enhancing training & education were made this strong relation on innovation and learning factors.

This correlation coefficient table also shows that there is a very strong relation between the responses of contractors and consultants. This is because of similar responses on research, innovation and improvement, enhancing training and education, technology adaptability and work in group to develop the innovation and learning concepts in road construction projects and it may increase the performance of road projects.

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On the same table, there is strong relation between clients and contractors. This happens because of similar response ranks between them on the learning from best practice and experience of others, enhancing training and education but also the respondents had almost similar responses on learning from own experience and past history with technology adaptation through innovation and learning in construction industry.

4.5.8 Road Project Performance Related to Productivity Factors

There are ten identified factors by the researcher that may affect the productivity performance of road construction works. Based on the combined relative important index and ranked the critical ones on the road construction projects are then discussed under the figure 4.9.

Table 4.19: Respondents RII and rank of productivity factors

Productivity Related Factors	Client		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Project size and complexity	0.54	7	0.53	7	0.5	8
Management-labour relationship	0.63	4	0.64	4	0.6	6
Absenteeism rate through project (late start and early exists)	0.74	1	0.73	2	0.73	2
Number of new projects per year	0.57	6	0.56	6	0.57	7
Sequencing of work according to schedule	0.71	2	0.71	3	0.68	3
Local cultural characteristics	0.43	9	0.42	9	0.36	10
Non-working holidays	0.34	10	0.47	8	0.41	9
Local climate conditions	0.6	5	0.62	5	0.63	4
Poor workmanship Resulting Defective Work and Rework	0.69	3	0.76	1	0.78	1
Low Labor productivity	0.49	8	0.64	4	0.62	5

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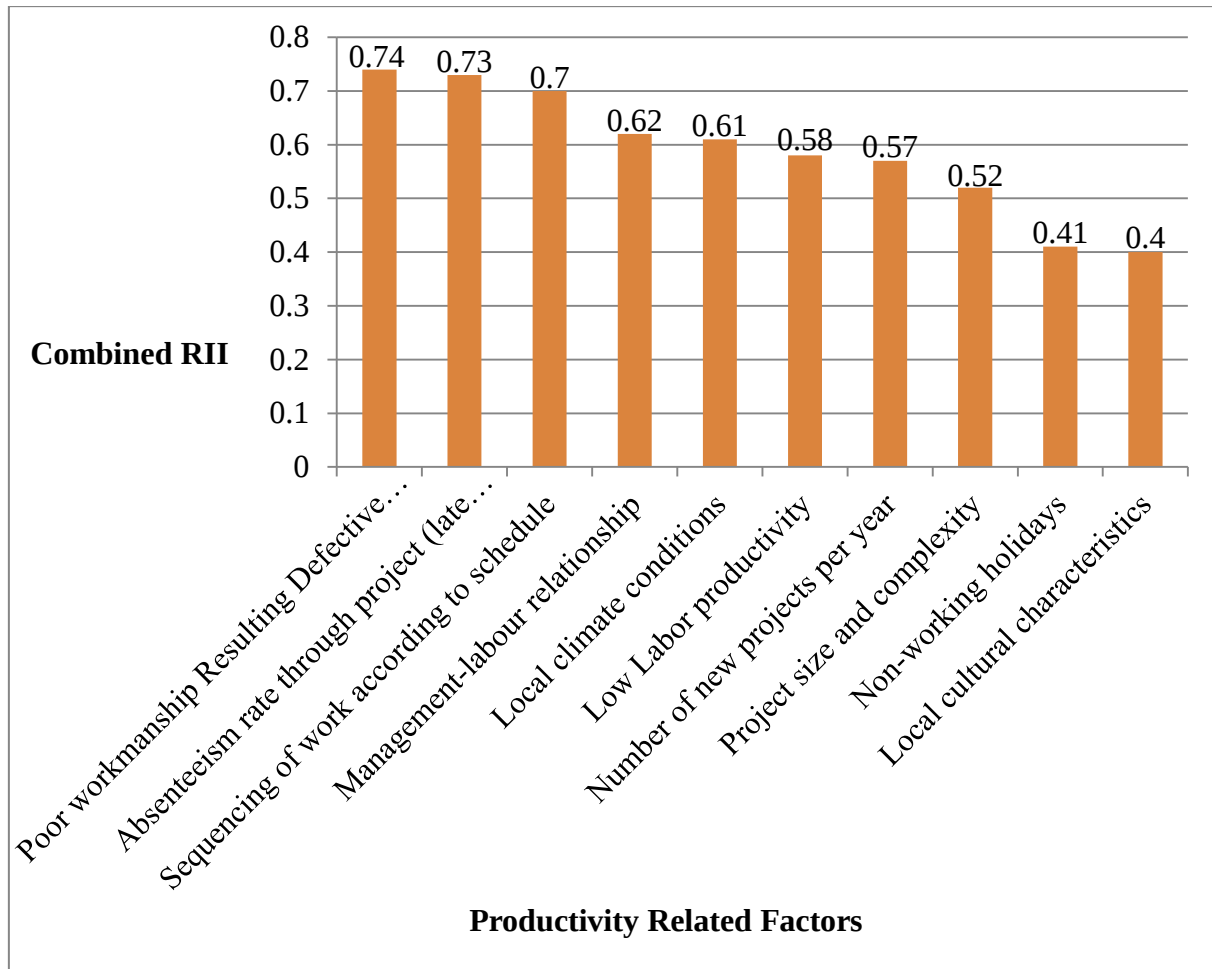


Figure 4.9: Combined RII and ranks of productivity related factors

Figure 4.9, shows Poor workmanship resulting defective work and rework with RII (0.74), absenteeism rate through project (late start and early exists) with RII (0.73) and sequencing of work according to schedule with RII of (0.70) have been the top and the critical factors that affect the performance of productivity.

Poor workmanship arises when a contractor fails to follow industry quality standard practices, construction documents or the installation instructions from the manufacturers. When protocol is not followed this can result in unfinished or defective work, both of which are signs of poor workmanship. Poor workmanship is one of the major factors that lead to road defects and cracking problems. Usually road project are the one which experienced most of the defects or maintenance problems due to poor workmanship.

Absenteeism rate through the project will affect the productivity performance of project. Therefore, the project will suffer from delay due to these late entries and early exits of labors from the site.

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The above combined RII and rank figure 4.9 of productivity factors indicates sequencing of work according to schedule also has been the critical factors that affect performance productivity. Sequencing of work according to the schedule assists the project doer to implement the project according to scheduled time. Therefore, the project will not suffer from time and cost performance problems and there will no delay or cost overruns.

From the result of selected case studies projects the critical productivity factors have been sequencing of work according to schedule, weather condition, shortage of manpower, unskilled machine operators, unavailability of equipment's, and shortage of manpower as per the planned schedule and failure of machines leads the productivity performance on the road construction projects.

Table 4.20: Spearman's correlation coefficient of productivity factors

Respondents	Spearman's correlation coefficient	Relations of the Respondents
Client Vs. Consultants	0.84	Strong relations
Client Vs. Contractors	0.85	Strong relations
Contractors Vs. Consultants	0.95	Strong relations

From correlation table 4.20, the spearman correlation coefficient indicates that there is a strong relation between the responses of clients and consultants. This indicates that they have similar awareness on project size and complexity, management-labor relationship, local cultural characteristics and local climate on project productivity.

Also based on table 4.20, the response of contractors has a strong relation with consultants' because they have similar responses on absenteeism rate through project (late start and early exists), sequencing of work according to schedule and poor workmanship resulting defective work and rework.

The strong relation between clients and contractors indicates that they have almost similar response rank on project size and complexity, absenteeism rate through project (late start and early exists), number of new projects per year, sequencing of work according to schedule, local cultural characteristics, non-working holidays and local climate conditions that affect the productivity of construction projects.

4.5.9 Road Project Performance Problems from Interview and Site Investigation

Based on the Interview and site investigation the factors that affect the performance of road construction projects that were investigated and asked by researcher were discussed below. Therefore based on the participants response and site investigation five current major project performance problems (Cost, Time, Quality and Client satisfactions and Productivity) were identified.

4.5.10 Project Performance Problems from Owners Response Related to Cost Factors

This part of study provides an indication of perceptions of respondents for the cost factors on the road construction projects based on their answer.

Escalation of material prices has been the current major project performance problem by the owners' answer in the first position and also observed it as it is real problem in construction project. It is worth noticing that this factor is the major one for owners because rapid shortage of construction materials leads to escalation of construction material prices. This escalation of material prices affect the liquidity of owners' projects and cost performance of their projects.

Differentiation of currency prices has been put by the owners' respondents in the second position. This factor affects the owners' liquidity, project budget and cost performance. Because of economic situation there has been differentiation of currency prices in Ethiopia.

Material and equipment cost has been seat by the owners respondents in the third position. This factor affects the owner's liquidity and project cost performance.

Cost of variation orders has been ranked by the owners' representatives in the fourth position. This is an important factor for owners because changes from time to time affect their liquidity and this will disturb their cash flow on the project.

Also as investigated by researcher the project labour cost factor affects the cost performance of project because labor cost is one of the main components of project cost in road construction. Therefore it affects the project budget and cost performance of construction projects.

4.5.11 Project Performance Problems from Contractors Response Related to Cost

Material and equipment cost, Escalation of material prices and cost of variation orders have been the current major problems of project performance from the response of

contractors'. Material and equipment cost factor is considered as one of project cost components. Therefore, material and equipment cost affects the contractors' profit rate and hence their cost performance. Escalation of material prices also the first performance problem because rapid shortage of construction materials leads to escalation of construction material prices. This escalation of material prices affect the liquidity of contractors and profit rate of their projects. Cost of variation orders is an important factor for contractors because changes that come from owners from time to time affect their liquidity and this will disturb their cash flow on the project.

Differentiation of currency prices and project labour cost has been ranked by the contractors' response in the second position. Differentiation of currency prices affects the project's profit rate for contractors and the contractors' cost performance. Project labour cost factor affects the cost performance of project because labor cost is one of the main components of project cost. Therefore it affects the project budget and cost performance of contractors project.

4.5.12 Project Performance Problems from Consultants Response Related to Cost

Escalation of material prices has been ranked by the consultants' response in first since shortage of construction materials leads to the escalation of construction material prices. This escalation of material prices affect the cost performance of projects which is related to client's representative. Material and equipment cost, Differentiation of currency and Cost of variation orders prices has been ranked first by the consultants' response. Material and equipment cost This in an important factor which affect cost performance of the owner's liquidity and project cost performance for consultants because as consultants are clients representatives.

Differentiation of currency prices affects the project's profit rate of projects and the construction cost performance and Cost of variation orders prices is an important factor for consultants because a change from owners has been designed by the consultants.

4.5.13 Project Performance Problems from Clients Response Related to Time

Unavailability of resources, average delay in payments from owners to contractors, time needed to implement variation orders and site preparation times have been the major performance problem that related to time. If resources are not available as planned through project duration, the project will suffer from problem of time and cost performance. This is

because resource availability as planned schedule can improve time performance of projects. Time needed to implement variation orders can affect the performance of basic schedule. Due to time needed to implement variation orders estimated schedule would be changed and modified and this factor affects strongly the time performance.

Average delay in payments from owners to contractors may also lead to disputes and claims between contractor and consultant of project. All of that will affect the overall performance of project that has been implemented. Site preparation time requires solving the problems that relate to providing the conditions for carrying out a specific activity. Here we should consider creating an access path to the site, if it does not exist already, for easy access of construction equipment and vehicles that supply the site with road construction materials and if we cannot do those first it may affect the time performance of construction roads.

4.5.14 Project Performance Problems from Contractors Response Related to Time

Unavailability of resources, average delay in payments from owners to contractors, average delay in claim approval, Site preparation time and Time needed to implement variation orders has been the main project performance related problems. Unavailability of resources affects directly and practically on contractors' performance through projects. If resources are not available for contractors as planned through project duration, the project will suffer from problem of time and cost performance. Resource availability can affect the processes performance of contractors.

Average delay in payments from owners to contractors leads to delay of contractors' performance and cause problem in time performance and this may also lead to disputes and claims between contractor and consultant of project. All of that will affect the overall performance of project that has been implemented. Average delay in claim approval has been the main project performance problem directly affects the contractors time and cost performance. If claims are not approved within a short period of time, the contractor will suffer delay in project. Therefore, this is greatly affects the time and cost performance contractors.

Site preparation time requires solving the problems that relate to providing the conditions for carrying out a specific activity. Here we should consider creating an access path to the site, if it does not exist already, for easy access of construction equipment and vehicles that

supply the site with road construction materials and if we cannot do those first it may affect the time performance of construction roads. Time needed to implement variation orders will affect the performance of basic schedule. Due to time needed to implement variation orders estimated schedule will be changed and modified and this factor affects strongly the time performance and may leads delay of projects for some years.

4.5.15 Project Performance Problems from Consultants Response Related to Time

Unavailability of resources, Time needed to implement variation orders, Site preparation time and Average delay in payments from owners to contractors has been the project performance problems related to time. If resources are not available as planned through project duration, the project will suffer from problem of time performance. Resource availability is an important factor for consultants because it affects the processes performance of construction projects. Time needed to implement variation orders that affect the performance of basic schedule and due to time needed to implement variation orders estimated schedule will be changed and modified and this factor affects strongly the time performance and may leads delay of projects for some years.

Site preparation time requires solving the problems that relate to providing the conditions for carrying out a specific activity. Here we should consider creating an access path to the site, if it does not exist already, for easy access of construction equipment and vehicles that supply the site with road construction materials and if we cannot do those first it may affect the time performance of construction roads. Average delay in payments from owners to contractors leads to delay of contractors' performance and cause problem in time performance of project progress and also lead to disputes and claims between contractor and consultant of project usually in road construction projects.

Average delay in claim approval has been also the problem of project performance related to time factors. This factor directly affects the time and cost performance. If claims are not approved within a short period of time, the project will suffer delay in project. Therefore, this is greatly affects the time and cost performance project.

4.5.16 Project Performance Problems from Client Response Related to Quality

Escalation in prices of construction resources indicates that price is raised and prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the special conditions of contract. if so provided, the amounts certified in each payment certificate,

after deducting for advance payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due to a price adjustment factor to be applied to the amount for each payment certificate; a constant, specified in the contractor's bid, representing the nonadjustable portion in contractual payments and weightings or coefficients representing the estimated proportion of each cost element (labor, materials, equipment usage, etc.) were considered and adjusted. Unless otherwise price adjustment is made on the contract, the quality of the materials consumed on the project will greatly be affected by the escalation. This is because the contractor wants himself to be free from bankruptcy; he will use some low cost materials and quality.

Quality of equipment or machineries and raw materials has been the main problem of project performance related quality. The owners usually want materials used in their project with a good quality and according to specification. In Ethiopia, most of available materials are with little variation in quality and produced by a limited number of producers. Therefore, this factor affects the quality project performance and the degree of owners' satisfaction. Also they suggested that less quality training or meeting and unavailability of tests on quality of materials have been the critical factors that affect quality performance from the owner's response.

4.5.17 Project Performance Problems from Contractors Response Related to Quality

Inflation in prices of construction resources indicates that a price adjustment factor to be applied to the amount for each payment certificate; a constant, specified in the contractor's bid, representing the nonadjustable portion in contractual payments and weightings or coefficients representing the estimated proportion of each cost element (labor, materials, equipment usage, etc.) were considered and adjusted. Unless otherwise price adjustment is made on the contract, the quality of the materials consumed on the project will greatly be affected by the escalation.

Quality of equipment or machineries and raw materials used in any project can affect the quality of the work executed. In Ethiopia most of the available materials are produced by a limited number of producers with a little variation in quality. If quality training or meetings are not specified on the contract document, the contractor may ask to use good quality materials and workmanship which are semi-skilled and skilled by giving training and full information about road construction in detail, while less quality training or meeting and unavailability of tests on quality of materials have been the critical factors that affect

quality performance from the contractors' response on the factors that affect quality of road construction.

4.5.18 Project Performance Problems from Consultants Response Related to Quality

Inflation in prices of construction resources indicates that the inflation in prices of construction resources from the contract price is raised; prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the special conditions of contract. if so provided, the amounts certified in each payment certificate, after deducting for advance payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due to a price adjustment factor to be applied to the amount for each payment certificate; a constant, specified in the contractor's bid, representing the non-adjustable portion in contractual payments and weightings or coefficients representing the estimated proportion of each cost element (labor, materials, equipment usage, etc.) were considered and adjusted.

Quality of equipment or machineries and raw materials has been ranked by the consultants' respondents in the first position. Consultants usually want materials used in supervised project with a good quality and according to specification. This factor affects the project performance and the degree of owners' satisfaction which is one of the main responsibilities of consultants. If quality training or meetings are not specified on the contract document, the contractor may use low quality materials and workmanship which are semi-skilled and un-skilled without taking any training full information about road construction in detail. Thus less quality training or meeting and unavailability of tests on quality of materials have been the critical factors that affect quality performance of projects.

4.5.19 Project Performance Problems from Client Response Related to Client Satisfaction

A poor workmanship and incompetence worker has been the major project performance problem that affects client satisfaction and the existence of poor and incompetent workers on the project site will affect the quality and productivity of projects. This is an important factor because it affects performance of owners' satisfaction. Leadership skills for project manager are the critical important one for owners because leadership skills for project manager affect the degree of project performance and client satisfaction.

Also speed and reliability of service to owner has been the main factor that increases the degree of satisfaction with respect to client. This factor is very important for owners because it affects strongly the client satisfaction.

Number of disputes between owner and project parties will also be the problem of project performance that affect the relationship between parties and also the degree of client satisfaction will be decreased. All of that can affect the performance of project. This factor is high important for owners because number of disputes affects strongly on client satisfaction and project performance.

4.5.20 Project Performance Problems from Contractors Response Related to Client Satisfaction

Leadership skills for project manager are the most important one for contractors because leadership skills for project manager affect the construction contractors' performance. This factor is an important for contractors because it is significant for effectiveness on project performance. Poor workmanship and incompetence workers with the existence of poor and incompetent workers on the project site will affect the quality and productivity of projects. This is an important factor because it affects the degree of clients' satisfaction on the road construction projects.

Number of disputes between owner and project parties has been ranked by the contractors' respondents as the major performance problem of project and affects the satisfaction of clients. Disputes between owner and contractor will affect the relationship between them and the degree of client satisfaction will be affected. All of these affect the performance of contractors. This factor is high important for contractors because number of disputes affects strongly on client satisfaction and construction contractors performance.

Speed and reliability of service from contractor to client representative affect the degree of satisfaction with respect to client. This factor affects strongly on project performance because it affects the client satisfaction degree.

4.5.21 Project Performance Problems from Consultants Response Related to Client Satisfaction

Speed and reliability of service to owner has been the problem that affects the project performance of construction and from consultant to owner affect the degree of satisfaction

with respect to client. This factor is an important for effectiveness on construction project performance because it affects strongly on client satisfaction.

Disputes between owner and consultant will affect the relationship between them and the degree of client satisfaction will be affected. All of that can affect the performance of project. This factor is an important for construction project performance because it affects strongly on client satisfaction. The existence of poor and incompetent workers on the project site will affect the effectiveness, quality and productivity of projects. This is an important factor for consultants because it affects the degree of owners' satisfaction.

Also the leadership skill for project manager is the most important one for consultants because leadership skills for project manager assist consultants to supervise the project with strong and suitable performance. This factor is an important for effectiveness on project performance because client satisfaction depends up on consultants' perception.

4.5.22 Project Performance Problems from Client Response Related to Productivity

Absenteeism rate through project (late start and early exists) has been the major project performance problem by the owners' respondents. Absenteeism through project will affect the productivity performance of project. Therefore, the owner will suffer from delay of project. Absenteeism through project implementation is very important for owners because it may affect the productivity performance of construction projects.

Attitudes of employees on the project will affect the productivity performance of project. It is very important factor for owners because it affects the productivity of project performance. Therefore, the owner will suffer delay of project. Also from response of client the different situation of local climate condition will affect the productivity performance of project. In the difficult climate condition some activities of the project will stop and this cause suffer delay the owners on the project.

4.5.23 Project Performance Problems from Contractors Response Related to Productivity

Absenteeism through project will affect the productivity performance of project. Therefore, the contract will suffer from cost overrun of project. Absenteeism through project implementation is very important for contractors because it may affect the time, cost and productivity performance of construction projects. Wedges amount of workers high, their motivation to work will be also high and this increases the productivity on the project.

Therefore, it is very important factor for contractors because it affects their cash flow on the project, cost and productivity performance of project.

The different situation of local climate condition will affect the productivity performance of project. In the difficult climate condition some activities of the project will stop and this cause suffer less productivity on the project. This is an important factor for contractors because it affects the time and productivity performance on the project.

4.5.24 Project Performance Problems from Consultants Response Related to Productivity

Absenteeism through project will affect the productivity and time performance of project. Absenteeism affects the productivity performance of construction projects. This also affects owners' satisfaction on the project. Also when the wedges amount of workers high, their motivation to work will be high and this increases the productivity on the project. It also affects the cash flow of owners on the project. Therefore, it is very important factor for contractors because it affects clients' satisfaction performance on the project.

Attitudes of employees on the project will affect the productivity performance of project. It is very important factor for consultants because it affects the productivity of project performance. And the owner will suffer delay of project and it affects the speed of service to owners.

The different situation of local climate condition will affect the productivity performance of project. In the difficult climate condition some activities of the project will stop and this cause suffer delay the owners on the project. Therefore, it is very important for consultants because it affects the satisfaction of owners.

4.6 The Key Performance Indicators on Road construction Projects

Results of this study provides an indication of the participants' and combined relative importance index (RII) and rank of the key performance indicators on road construction projects according to all and each participants' response respectively and correlation coefficients between responses of the participants is done.

There were eight key performance indicators in road construction projects that were identified from the literatures reviews. Table 4.21 and Figure 4.10, shows that the RII of participants' and combined RII of the respondents with their rank. Also discussions made to the correlations between respondents.

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Table 4.21: Participants' RII and ranks of Key performance indicators

Key Performance Indicators	Client		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Cost	0.80	2	0.82	1	0.83	1
Time	0.83	1	0.78	2	0.80	2
Quality	0.71	3	0.76	3	0.81	3
Client Satisfaction	0.69	4	0.71	4	0.77	4
Health and Safety	0.63	7	0.56	8	0.66	7
Regulatory and Community Satisfaction	0.67	5	0.64	6	0.71	6
Innovation and Training	0.57	8	0.62	7	0.60	8
Productivity	0.66	6	0.67	5	0.76	5

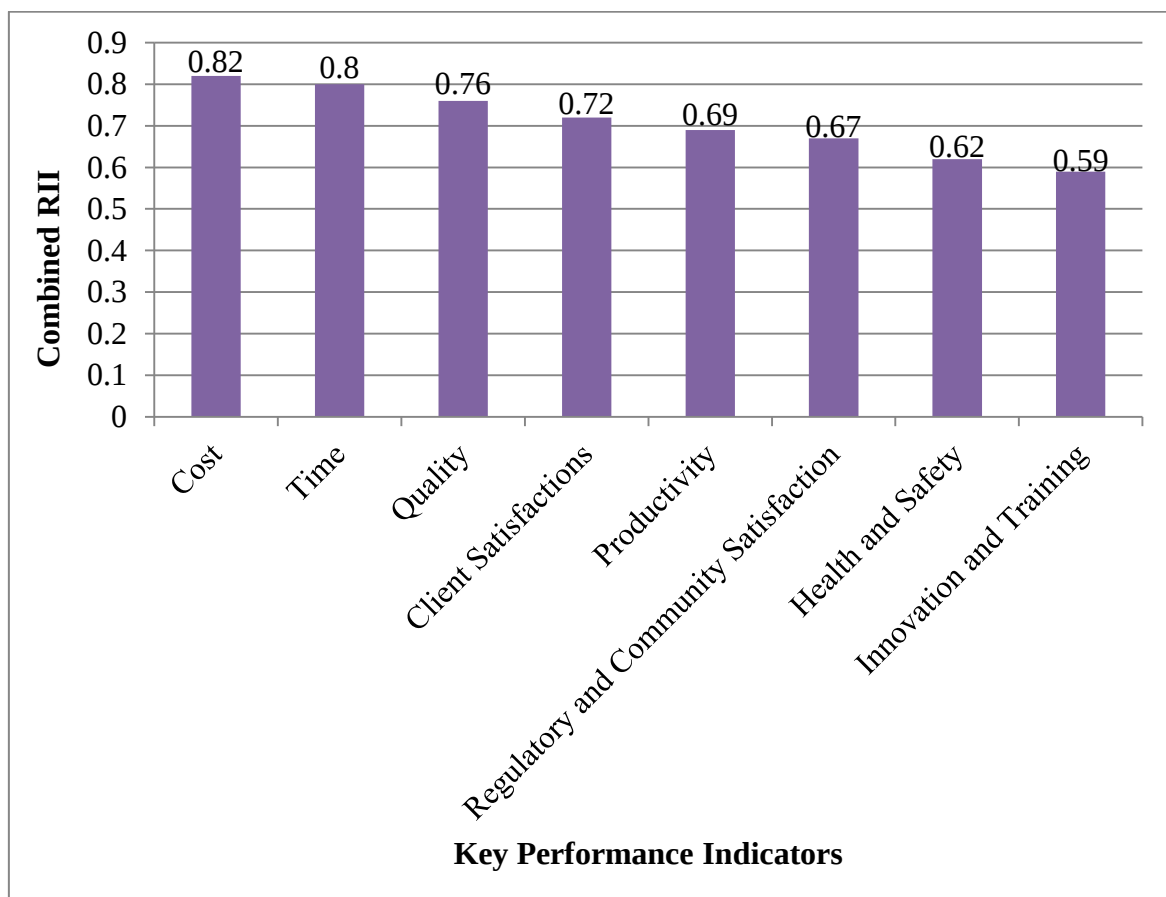


Figure 4.10: Combined RII and Rank of key Performance indicators on road projects

From the combined RII and ranks result shown on figure 4.10 above, cost has been ranked the first main key performance indicator with RII of 0.82. This is because the effect of cost

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on the project performance is very high and it has been the first rank performance problem in road construction projects.

Time has been the second main key performance indicator with RII equal 0.80. Time has a great effect on the overall performance of construction projects.

The third main key performance indicator is quality having 0.76 shown on the figure 4.10. Its effect on the overall project performance will be high.

Client satisfaction has been the fourth top ranked key performance indicator with RII of 0.72 next to quality. This factor ranked in this position is due to that its effect on the overall project performance has been moderate.

Productivity has been ranked the fifth main key performance indicator with RII equals to 0.69. The productivity on the project has a great effect on the overall performance of construction projects.

Based on the combined figure 4.10, regulatory and community satisfaction has been ranked on the sixth position with RII of 0.67. It affects the overall project performance.

Health and safety and innovation and learning have been the least key performance indicators in the seventh and eighth position having RII of 0.62 and 0.59 respectively. This is because their effects on the overall performance of projects have been very low.

Table 4.22: Spearman correlation coefficient key performance indicators

Respondents	Spearman's correlation coefficient	Relations of the Respondents
Client Vs. Consultants	0.93	Strong relations
Client Vs. Contractors	0.95	Strong relations
Contractors Vs. Consultants	0.98	Strong relations

As seen from table 4.22 above, the spearman correlation coefficient indicates that there is strong relation between the responses of clients and consultants, clients and contractors and also there is a very strong relation between consultants and contractors.

The reasons for strong relation between the responses of clients and consultants there were the same rank on quality and client satisfactions and almost nearly the same ranked with

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the response of cost, time, health and safety, regulatory and community satisfaction, innovation and training, productivity.

Also the reasons for strong relation between clients and contractors were the same responses on the key performance indicators of construction projects on quality, client satisfactions, Health and Safety and innovation and learning, whereas the reason for very strong relation between contractors and consultants are the same ranked on the response of Cost, time, quality, client satisfactions, regulatory and community satisfaction and productivity and near the same ranked response on innovation and learning and health and safety.

4.6.1 The Main Critical and Top Ranked Key Performance Indicators in Road Projects

Based on the researcher analysis, there were eight key performance indicators on road construction projects. From the analysis and discussions made above the top six key performance indicators with combined RII of 0.67 and above have been established as follows.

Table 4.23: The main and top ranked key performance indicators

The Main Key performance Indicators	Combined RII	Rank
Cost	0.82	1
Time	0.80	2
Quality	0.76	3
Client Satisfactions	0.72	4
Productivity	0.69	5
Regulatory and Community Satisfaction	0.67	6

4.7 Remedial Measure for Performance Challenges in Road Project Construction

A total of twenty one methods of remedial measures for performance challenges were identified based on the literature review and distributed questionnaires. The questionnaire survey was developed and distributed to the targeted respondent in the West Arsi Zone. Data from a questionnaire survey was analyzed and ranked based on relative importance index as shown in Table 4.24. The ranking of methods of remedial measure for performance challenges in Arsi zone Projects have been identified. This shows that there is a sig-

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nificant degree of agreement in the ranking between three groups of respondents of contractors, consultants and clients.

Table 4.24: The remedial measures given for the project performance challenges

Rank	Proposed Remedial Measures	Clients RII	Consultants RII	Contractors RII	Combined RII
3	Proper project planning and scheduling	0.89	0.91	0.93	0.91
9	Ensure adequate and available source of finance	0.86	0.84	0.84	0.85
7	Complete and proper design at the right time	0.86	0.87	0.88	0.87
5	Complete and accurate project feasibility study	0.91	0.89	0.86	0.89
8	Site management and supervision;	0.83	0.89	0.87	0.86
1	Competent and capable of client's representative;	0.97	0.93	0.89	0.93
6	Competent personnel of consultant/designer;	0.86	0.96	0.83	0.88
10	Absence of bureaucracy;	0.81	0.84	0.87	0.84
11	Competent project manager;	0.83	0.84	0.84	0.83
7	Use of experienced subcontractors and suppliers;	0.86	0.84	0.9	0.87
8	Availability of resources	0.91	0.82	0.84	0.86
2	Commitment to projects;	0.94	0.89	0.92	0.92
4	Comprehensive contract	0.89	0.93	0.89	0.9

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	documentation;				
9	Use of appropriate construction methods;	0.83	0.84	0.87	0.85
3	Proper emphasis on past experience;	0.91	0.89	0.93	0.91
4	Community involvement	0.86	0.91	0.92	0.9
11	Research & development	0.83	0.84	0.83	0.83
1	Meets technical Specification	0.89	0.96	0.94	0.93
6	Absence of any legal claims & proceedings	0.8	0.93	0.9	0.88
7	Pleasant Environment	0.86	0.87	0.88	0.87

These methods were ranked based on the value of combined RII which calculating the average important index of methods identified by the contractors, consultants and clients.

The results (table 4.24 above) of the research indicated that competent and capable of client's representative and meets technical specification with combined RII of (0.93), commitment to projects (0.92), proper project planning and scheduling and proper emphasis on past experience with combined RII of (0.91), comprehensive contract documentation and community involvement with RII of (0.90), complete and accurate project feasibility study with RII of (0.89), competent personnel of consultant/designer and absence of any legal claims & proceedings (0.88), complete and proper design at the right time, use of experienced subcontractors and suppliers and pleasant environment (0.87), site management and supervision and availability of resources with RII of (0.86), ensure adequate and available source of finance and use of appropriate construction methods with RII of (0.85), absence of bureaucracy (0.84), competent project manager and research and development (0.83) are the very high effective remedial measures for performance challenges in West Arsi zone road construction projects.

As observed from the table 4.24 above the remedial measures of project performance challenges in west Arsi zone construction participants view there were twenty remedial measures of project performance. Among the listed twenty remedial measures for project performance challenges the most frequent and most critical methods for taking remedial measures in road construction project performance are: competent and capable of client's representative and meets technical specification, commitment to projects, proper project planning and scheduling and proper emphasis on past experience, comprehensive contract documentation and community involvement, complete and accurate project feasibility study, competent personnel of consultant/designer and absence of any legal claims and proceedings, complete and proper design at the right time, use of experienced subcontractors and suppliers and pleasant environment, site management and supervision and availability of resources, ensure adequate and available source of finance and use of appropriate construction methods, absence of bureaucracy, competent project manager and research and development.

In this research the top five remedial measures for project performance challenges are: meets technical Specification and competent and capable of client's representative, commitment to projects, proper project planning and scheduling, proper emphasis on past experience, comprehensive contract documentation and community involvement, complete and accurate project feasibility study respectively. The research done by (Dinaker.A, 2014) about the analysis of the delay in construction project, the last part of the survey was on measures to be taken on how to avoid delays in construction projects and the results shows that the 5 highest ranking are conduct meeting to monitor progress more often, latest technology should be used, using modern construction equipment that works well, use appropriate construction methods and have a strategic and effective planning.

4.8 Contractors Project Performance Measure Analysis

Based on the respondents' perspectives at organization and project site, the participants view towards the Contractors performance measure in the road construction are ranked as seen in the table 4.25 below.

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Table 4.25: Contractors performance measure analysis from the respondents view

Contractors Performance Measure	Client		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
providing training to their employees	0.66	5	0.71	5	0.79	5
Ability to adapt to changes and meet client needs	0.74	1	0.67	6	0.77	6
Contractors having the ability to do the right job the first time	0.69	3	0.71	5	0.82	2
Ability to use high quality supplies	0.71	2	0.80	1	0.81	3
Contractors being reasonable when it comes to contract changes	0.63	6	0.64	7	0.73	7
Contractors having the ability to efficiently use materials	0.60	7	0.76	3	0.71	8
Contractors having the ability to work as team players	0.57	8	0.73	4	0.80	4
Having ability to keep their equipment's clean	0.67	4	0.78	2	0.83	1

4.8.1 Contractors Performance Measures According to Clients Response

The road construction performance determinant measure of contractors are ranked and presented in the table 4.25 as per the perspectives of the client. Based on the analysis the first ranked critical determinant measure found as ability to adapt to changes and meet client needs with a relative importance index value of 0.74. The second and third factor was found ability to use high quality supplies and contractors having the ability to do the right job the first time with a value of 0.71 and 0.69 respectively. Having ability to keep their equipment's clean and providing training to their employees are ranked in fourth and fifth place with RII value of 0.67 and 0.66 respectively. In the clients view, contractors being reasonable when it comes to contract changes , having the ability to efficiently use materials and contractors having the ability to work as team players are ranked are listed as the lowest three measures of contractors performance in the road construction with RII 0.63, 0.60 and 0.57 respectively.

4.8.2 Contractors Performance Measures According to Consultants Response

Based on the respondents' perspectives at organization and project site, the consultants' views towards the performance measure in the road construction are ranked as seen in the table 4.25 above the first and second leading performance measure of contractors' is Ability to use high quality supplies and Having ability to keep their equipment's clean with RII 0.80 and 0.78 Respectively. Contractors having the ability to efficiently use materials and Contractors having the ability to work as team players are ranked in third and fourth place with a value of RII 0.76 and 0.73.

In equal value, contractors having the ability to do the right job the first time and providing training to their employees are ranked in the fifth with RII value of 0.71. Similarly, ability to adapt to changes and meet client needs and contractors being reasonable when it comes to contract changes are ranked in the seventh and eighth with the value of relative important index 0.67 and 0.63 respectively.

4.8.3 Contractors Performance Measures According to Contractors Response

The performance measure with in the road construction as per joint perspective of professionals of the contractors working in project site and organizations the RII analysis and ranking is also clearly stipulated in the table 4.25 above. Contractors having ability to keep their equipment's clean, Having the ability to do the right job the first time and Ability to use high quality supplies ranked as first, second and third with RII value of 0.83,0.82 and 0.81 respectively.

Similarly, Contractors having the ability to work as team players, providing training to their employees and Ability to adapt to changes and meet client needs are ranked in the fourth, fifth and sixth with relative important index of 0.80, 0.79 and 0.77 in the ordered. In the last rank, Contractors being reasonable when it comes to contract changes and Contractors having the ability to efficiently use materials are ranked with RII value of 0.73 and 0.71 respectively.

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Table 4.26: Spearman correlation coefficient for contractors' performance measure

Respondents	Spearman's correlation coefficient	Relations of the Respondents
Client Vs. Consultants	0.20	weak relations
Client Vs. Contractors	0.36	weak relations
Contractors Vs. Consultants	0.56	Moderate relations

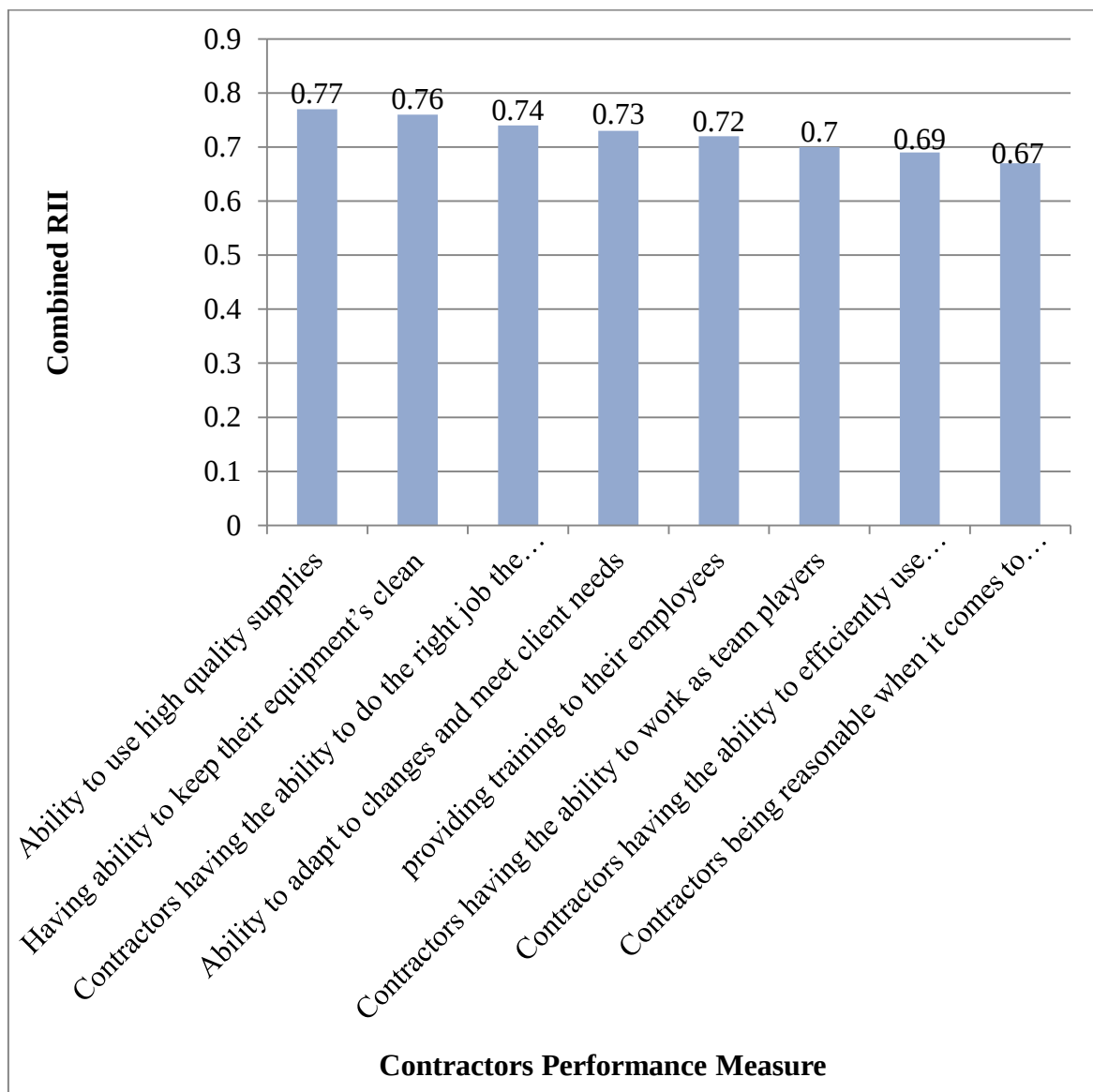


Figure 4.11: Combined RII and Rank of contractors performance measure

In the road construction performance determinant measure of contractors as we see from Combined RII and Rank of contractors' performance measure presented in the figure 4.11,

with the perspectives of the respondents. Based on the analysis the first ranked critical determinant measure found as ability to use high quality supplies with combined RII of 0.77.

The second and third factor was found having ability to keep their equipment's clean and contractors having the ability to do the right job the first time with a value of 0.76 and 0.74 respectively.

Similarly, Ability to adapt to changes and meet client needs, providing training to their employees and contractors having the ability to work as team players are ranked in the fourth, fifth and sixth with relative important index of 0.73, 0.72 and 0.70 in the ordered as we observe from figure 4.11 above.

In the last rank, Contractors have the ability to efficiently use materials and Contractors being reasonable when it comes to contract changes are ranked with RII value of 0.69 and 0.67 respectively.

4.9 Results of the Case Study

Case studies were collected from four road construction projects, project1 road from Shasha goyke to Shello Abore, project2 from Aje Dida to Mitubinsho, project3 Witago Sire to Wakenxara in Gadab Hasasa and the fourth project is Gutu to Danshe in Kokkosa woreda that have been under execution from the year of 2020 G.C until 2022 G.C. The data were collected from discussion with the participants on the project site, archival documents and monthly progress report from contractors and consultants.

The general profiles of the projects such as project location, commencement date, completion date, contract period, contract amount, contractor, consultant, road length and project status are included in the case studies. The case studies findings are project performance challenges and factors that affecting the performance of the projects. Table 4.38 below shows the results of the selected case studies.

Project 1

Location.....	Shasha Goyke to Shello Abore
Commencement date.....	March 11, 2020 G.C
Completion date.....	January 14, 2021 G.C
Contract Period.....	330 calendar days
Contract amount.....	13, 000,000 ETB

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Contractor.....C''
Consultant.....C
Road length.....12km
Project Status.....78%

Project 2

Location..... Aje Dida to Mitubisho
Commencement date.....January 21, 2020 G.C
Completion date.....May 6, 2021 G.C
Contract Period.....456 calendar days
Contract amount.....21, 000,000 ETB
Contractor.....B''
Consultant.....B
Road length.....26km
Project Status.....89%

Project 3

Location..... Witago Sire to Wakenxara
Commencement date.....December 4, 2020 G.C
Completion date..... December 6, 2021 G.C
Contract Period.....360 calendar days
Contract amount.....24, 000,000 ETB
Contractor.....A''
Consultant.....A
Road length.....12km
Project Status.....91%

Project 4

Location..... Gutu to Danshe in Kokkosa
Commencement date.....October 9, 2020 G.C
Completion date.....June 11, 2021 G.C
Contract Period.....302 calendar days
Contract amount.....13, 000,000 ETB
Contractor.....D''

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Consultant.....D
 Road length.....11km
 Project Status.....96%

Table 4.27: Results of case study collected from different projects

Factors Affecting the Project Performance				Project Performance Challenges
Project 1	Project 2	Project 3	Project 4	
✓ Inadequate budget allocation by the government ✓ Problem in estimated cost ✓ Delay in progress payments	✓ Lack of economic stability ✓ Cost variation orders ✓ Shortage of resources	✓ Escalation of material price ✓ Design and Technical challenge ✓ Project over time cost	✓ Less financing capability of the owner ✓ Material and equipment cost	Cost
✓ Topography and soil condition ✓ delay related to sub-contract works	✓ Rework due to error Work ✓ Suspension ✓ Disruption	✓ Project complexity ✓ Design change ✓ Nature of project	✓ Too much variation orders ✓ Transport inaccessibility	Time
✓ Poor communication ✓ Material quality availability	✓ Inadequate design and specification ✓ Conformance to specification	✓ Poor Ownership (un belonging) ✓ Lack of codes and standards	✓ Poor Planning monitoring ✓ Un availability of skilled	Quality

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			man	
✓ Performance of contractors ✓ Inadequate compensation for the land	✓ poor coordination between parties ✓ Speed of delivering the project	✓ frequent change of sub-contractor	✓ Speed of delivering the project to the owner	Client Satisfaction
✓ Absenteeism rate through project	✓ Management-labor relationship	✓ Unskilled machine operators ✓ Low labor productivity	✓ Shortage of manpower as per the planned schedule	Productivity
✓ Quality and availability of regulator documentation	✓ Falling of soil in to excavated hole	✓ Law and regulation change ✓ Government policy (work law)	✓ Environmental protection ✓ Lack of codes and standards	Regulatory and Community Satisfaction
✓ Application of health and safety factors ✓ Transport inaccessibility	✓ Safety regulation ✓ Noise and dust pollution ✓ un expected surface and subsurface condition	✓ The weather condition on execution activities ✓ water, or ground pollution	✓ Safety regulation ✓ Application of health and safety factors	Health and Safety
✓ Lack of progress meeting	✓ Lack of learning from own	✓ Lack of progress meeting	✓ Review of failures	

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✓ Working in group	experience and past history	✓ Delay in solving design problems	and solving them	Innovation and Learning
✓ Lack of new technology use	✓ Un availability of skilled engineers	✓ Technology Adaptability	✓ Learning from best practice	
✓ imperfect drawing and detailing	✓ manager	✓ Delay in solving design problems	and experience of others	

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study has identified the performance challenges of contractors in road construction projects that are found around West Arsi Zone. The objectives of this study were to identify the major current performance challenges of contractors in road construction projects and factors that affect the overall functional activity of them, to give remedial measures for contractors' performance challenges on road construction projects in West Arsi Zone.

Therefore the following are the main and critical performance challenges of contractors in road construction projects that are found around West Arsi Zone.

- The major performance challenges of contractors most frequently occurs in West Arsi Zone road construction projects are Cost, Time, Quality, Client Satisfaction, Productivity and Regulatory and Community Satisfaction and in most of road construction projects there is no more health and safety and innovation and learning adaptation.
- Escalation of material prices, Material and equipment cost and Differentiation of currency prices and cost of variation orders have been the major critical factor that leads to project cost overrun and affect cost performance of the project and has a great impact on the project cost performances of road projects.
- Unavailability of resources, Time needed to implement variation orders, Site preparation time, have not been sufficient resources in the project sites to accomplish the projects on the schedule and the critical factors which affect the time performance of the projects and also there has been average delay in payments from owners to contractors during road construction process which can affect time performance of projects.
- Inflation in prices of construction resources, Quality of equipment or machineries and raw materials has been the critical quality factors and most of the projects have no quality training or meeting to achieve the quality of the projects and also contractors have problems of performance to take test daily on materials of road projects.

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- The critical factors which affect client satisfaction has been Poor workmanship and incompetence workers, Speed and reliability of service to owner, Leadership skills for project manager, Number of disputes between owner and project parties and Additional work by the client during project implementation this leads the problem of delivering the projects to the owner and to unsatisfying the project owners.
- The critical factors which lead the road projects to failure in productivity performance have been absenteeism rate through project (late start and early exists), sequencing of work according to schedule and there has been poor workmanship resulting defective work and rework due to this factor there is productivity problem on the road project sites.
- The main key performance indicators have been cost, time, quality, client satisfactions and productivity.
- In the road construction performance determinant measure of contractors the main critical performance measure found from combined relative important index is ability to use high quality supplies, having ability to keep their equipment's clean, contractors having the ability to do the right job the first time, ability to adapt to changes and meet client needs and providing training to their employees.
- A correlation of the responses of each party showed the contractor and owner to have nonmatching opinions concerning contractors' performance measure, while the consultant held an intermediate position with moderate relation.

5.2 Recommendations

It is important to for road construction industry to identify the weakness of performance in order to solve and overcome challenges. Based on the results of the research the following recommendations are given.

5.2.1 Recommendations for the Contractors

- Contractors are recommended to develop application of health and safety factors and awareness of workers on the advantages and usage of safety equipment's and minimize waste rate through project implementation in order to improve cost performance.
- Contractors should be more interested with quality materials to improve cost, time and quality performance and recommended to give more attention with sequencing of work according to schedule and should have to develop the innovation and learning through road construction.

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- Contractors should not increase the number of projects over lap that cannot be performed successfully. In addition, contractors should consider business environment risk in their cost estimation in order to overcome delay because of materials shortage. A proper motivation and safety systems should be established for improvement of productivity performance of construction projects.
- There is need to encourage growth of manpower skills through training and new technology and skill up-grading within construction firms as skilled manpower was found to be an asset, which sustainable over the long term. There is also need to develop a mechanism that will aim at alleviating high cost associated with training of engineers and technicians in Ethiopia.
- To provide a continuous and regular project works is required from the government to capacitate and strengthen the performance of contractors. In order to prevent contractors from cost/financial failure, late completion of project and poor quality of works the clients which are mostly government project offices should make payments on time.

5.2.2 Recommendations for the Clients

- One of the most important client support role is to ensure that contractors for road projects are given possession of land that is without any encumbrances to ensure an early project commencement. This calls for the client to acquire land and compensate and involve the project affected persons well in advance of commencement of the project. Clear policies on client involvement must be put in place. This is based on revelation that client involvement enhanced the implementation of road construction projects.
- Clients should not award road construction contracts to contractors without having a solid financial plan to ensure adequate budgets to complete the projects as per schedule. This will help to alleviate operational delays which lead to slow project implementation process and overrun in cost and period for construction.
- Clients need to improve on the speed of approval of interim payments, variations to the contract, evaluation of claims by the contractors and also prompt resolution of disputes in the contract, if contractor performance is to be enhanced.
- Owners are recommended to facilitate payment to contractors in order to overcome problem of delay, disputes and claims. All managerial levels should participate with sensitive and important decision-making in order to solve problems and develop

project performance and it is recommended to minimize disputes between owner and project parties.

5.2.3 Recommendations for the Consultants

- The slow decision making by client was the main factor of project performance challenges in road construction projects and thus the consultant should have to enforce the client to make a decision immediately because slow decision making is the main challenges of project performance.
- Consultants are recommended to study and evaluate other types of construction projects like buildings, water and infrastructural construction projects which differ from the population used in this research.

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APPENDICES

Appendix 1: Letter of Transmittal

Ref. -----

Date. _____



Adama Science and Technology University

School Of Civil Engineering and Architecture

Department Of Civil Engineering

To Whom It May Concern

Dear Respondents,

Re: Mahmud Abubaker Haji

This is to confirm that the above named is a student at the **university of Adama Science and Technology**; school of **Civil Engineering And Architecture**, Department of **Civil Engineering (Specialization in Construction Engineering and Management)** pursuing of course leading to the award of master of Engineering in **Construction Engineering and Management**. The purpose of this letter is to request you to kindly participate in this re-search by filling the attached questionnaires' as accurately as you can. I seek your understanding and assistance in this study. The information you provide will be treated as strictly confidential.

I kindly request you to take few times to fill out the questionnaire as genuinely and completely as possible. He is proceeding for thesis entitled “**performance challenges of contractors in road construction projects**” Case of West Arsi Zone. The data including findings will be used for academic purposes only.

Any assistance given to him will be appreciated.

Yours Sincerely!

APPENDIX 2: Research Questionnaire

SECTION A: Respondents' Profile: (Please tick the appropriate box (√)).

1. Kindly indicate your gender? Male [] Female []
2. Respondents' Position in the firm
Contractor [] Client [] Supervising Engineer [] Consultant []
Technical auditor []
3. In which organization do you work?
Government ministry [] Zone Administration [] ERA [] ORRA []
Consultancy firm [] others (specify).....
4. Which one best describes your age bracket?
20 – 29 years [] 30 – 39 years [] 40– 49years [] Over 50 years []
5. Years of experience of the respondents:
Less than 5 years [] between 5 to 10 years [] between 10-15years []
between 15-20 years [] above 20 years []
6. Please indicate the level of your education?
Diploma [] Bachelor's degree [] Masters [] PHD []
Others (Please specify).....
7. Company Size (Number of labors or employees) involved in your construction company.
Less than 35 [] from 35 to 70[] from 70 to 105[] More than 105[]

SECTION B: Performance related problems on Road construction projects?

8. To what extend do you rate the following factors affects the completion of road construction projects. From your experience, please express your opinion on rate of occurrences on road construction projects based on the representative numbers listed below. (Please tick the appropriate box (√)).

1= Never, 2= Sometimes, 3= Usually, 4= Frequently and 5= Most Frequently.

Performance Problems	1	2	3	4	5
Cost					

Evaluation of Performance Challenges for Contractors in Road Construction Projects

Time					
Quality					
Client Satisfaction					
Health and Safety					
Regular and End User Satisfaction					
Innovation and Training					
Productivity					

If any other, please specify.....

SECTION C: Factors Affecting the Performance of Road Construction Projects

9. From your experience, please express your opinion on the importance of the following as factors that affecting performance of Road construction projects in West Arsi zone projects based on the associated numbers given here. (Please tick the appropriate box (√).

1=Very Low 2= Low 3= Medium 4=High 5=Very High

No	1) Cost related factors	1	2	3	4	5
1	Political interference during project implementation					
2	Profit rate of project					
3	Material and equipment cost					
4	Project labour cost					
5	Project overtime cost					
6	Cost of rework					
7	Cost of variation orders					
8	Waste rate of materials					
9	Escalation of material prices					
10	Differentiation of currency prices					
11	Cash flow problem of the project					
12	Incomplete drawing					
13	Government policy					
14	Sudden change in taxation by the Government					

If any other, please specify.....

Evaluation of Performance Challenges for Contractors in Road Construction Projects

10. How significant are the followings affects the Time on Road construction projects you have been involved in Arsi Zone? Please use the scale below to answer the following questions.

1=Very Low 2= Low 3= Medium 4=High 5=Very High

No	2) Time Related factors	1	2	3	4	5
1	Poor project management assistance					
2	Unforeseen ground conditions					
3	Low speed of decision making					
4	Project complexity					
5	Effective communication					
6	Financial constraints					
7	Average delay in claim approval					
8	Average delay in payments from owners to contractors					
9	Too many change orders from owner					
10	Site preparation time					
11	Unavailability of resources					
12	Changes in technology after agreement					
13	Time needed to implement variation orders					
14	Weather due to heavy rain and flooding					
15	Political problem happened suddenly					

If any other, please specify.....

11. How significant are the followings affects the Quality of Road construction projects you have been involved in Arsi Zone? Please use the scale below to answer the following questions.

1=Very Low 2= Low 3= Medium 4=High 5=Very High

3) Quality factors	1	2	3	4	5
Inflation in prices of construction resources					
Conformance to specification					
Unavailability of competent staff					
Quality of equipment or machineries and raw materials					

Evaluation of Performance Challenges for Contractors in Road Construction Projects

Quality assessment system in organization					
Quality training or meeting					
Incomplete drawing					
Incomplete technical specification					
Test performed on material of road projects					

If any other, please specify.....

12. How significant are the followings affects the Client Satisfaction of Road construction projects you have been involved in Arsi Zone? Please use the scale below to answer the following questions.

1=Very Low 2= Low 3= Medium 4=High 5=Very High

No	4) Client Satisfaction factors	1	2	3	4	5
1	Poor workmanship and incompetence workers					
2	Leadership skills for project manager					
3	Number of disputes between owner and project parties					
4	Speed and reliability of service to owner					
5	Additional work by the client during project implementation					
6	Information coordination between owner and project parties					
7	Number of rework incidents					
8	Preparation of drawings and other contract documents by the client					

If any other, please specify.....

13. How significant are the followings affects the health and safety of road construction projects you have been involved in Arsi Zone? Please use the scale below to answer the following questions

1=Very Low 2= Low 3= Medium 4=High 5=Very High

No	5) Health and Safety factors	1	2	3	4	5
1	Reportable accidents rate in project					
2	Application of health and safety factors in organization					
3	Assurance rate of project					
4	Easiness to reach to the site (location of project).					
5	Wastes around the site					

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6	Climate condition and Air quality					
7	Noise level					

If any other, please specify.....

14. How significant are the followings affects the regulatory and community Satisfaction of road construction projects you have been involved in Arsi Zone? Please use the scale below to answer the following questions

1=Very Low 2= Low 3= Medium 4=High 5=Very High

No	6) Regular and Community Satisfaction factors	1	2	3	4	5
1	Economic stability					
2	Environmental protection and mitigation costs					
3	Cost of compliance to regulators requirements					
4	Number of non-compliance events					
5	Site condition problems					
6	Quality and availability of regulator documentation					
7	Formation of Dispute Resolution Board					

If any other, please specify.....

15. How significant are the followings affects the innovation and learning on road construction projects you have been involved in Arsi Zone? Please use the scale below to answer the following questions

1=Very Low 2= Low 3= Medium 4=High 5=Very High

No	7) Innovation and Learning	1	2	3	4	5
1	Research, Innovation and improvement					
2	Continuous improvement & increase in size					
3	Learning from own experience and past history					
4	Learning from best practice and experience of others					
5	Review of failures and solving them					
6	Work in group					
7	Training the human resources in the skills demanded by the project					

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8	Enhancing training & education					
9	Technology Adaptability					

If any other, please specify.....

16. How significant are the followings affects the productivity of road construction projects you have been involved in Arsi Zone? Please use the scale below to answer the following questions

1=Very Low 2= Low 3= Medium 4=High 5=Very High

No	8) Productivity factors	1	2	3	4	5
1	Project size and complexity					
2	Management-labour relationship					
3	Absenteeism rate through project (late start and early exists)					
4	Number of new projects per year					
5	Sequencing of work according to schedule					
6	Local cultural characteristics					
7	Non-working holidays					
8	Local climate conditions					
9	Poor workmanship Resulting Defective Work and Rework					
10	Low Labor productivity					

If any other, please specify.....

SECTION D: Key Performance Indicators' of Road Construction Projects

17. Based on the occurrence of performance related problems you filled under Section B above; below are numbers of key performance indicators' of Road construction projects. From your experience, please fill the effect of these occurrences on project performance to determine the key performance indicators of road construction projects in Arsi Zone on the following rating numbers. (Please tick the appropriate box (√)).

1=Very Low, 2=Low, 3=Medium, 4=High, 5=Very High

No	Key Performance Indicators'	1	2	3	4	5
1	Cost					

Evaluation of Performance Challenges for Contractors in Road Construction Projects

2	Time					
3	Quality					
4	Client Satisfaction					
5	Health and Safety					
6	Regular and End User Satisfaction					
7	Innovation and Training					
8	Productivity					

If any other, please specify.....

SECTION E: Remedial Measures for Performance Challenges in Road Construction

18. To what extend do you rate the following factors give remedial measures for performance challenges related to road construction projects in West Arsi Zone (✓).

1 = Very low effective

2 = Low effective

3 = Medium effective

4 = High effective

5 = Very high effective

No	Proposed Remedial Measure	1	2	3	4	5
1	Proper project planning and scheduling;					
2	Ensure adequate and available source of finance;					
3	Complete and proper design at the right time;					
4	Complete and accurate project feasibility study					
5	Site management and supervision;					
6	Competent and capable of client's representative;					
7	Competent personnel of consultant/designer;					
8	Absence of bureaucracy;					
9	Competent project manager;					
10	Use of experienced subcontractors and suppliers;					
11	Availability of resources					
12	Commitment to projects;					
13	Comprehensive contract documentation;					
14	Use of appropriate construction methods;					
15	Proper emphasis on past experience;					
16	Community involvement					

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17	Research & development					
18	Meets technical Specification					
19	Absence of any legal claims & proceedings					
20	Pleasant Environment					

SECTION F: Contractors Performance

19. To what extent do you rate the factors that affects the quality, cost, capacity, time and environmental related performance measurement of road construction projects in West Arsi Zone (✓). React to the likert scale of 1 to 5. Where;

1= Never 2= Sometimes, 3= Usually, 4= Frequently and 5= Most Frequently.

Contractors measures of project performance	1	2	3	4	5
Contractors providing training to their employees					
Ability to adapt to changes and meet client needs					
Contractors having the ability to do the right job the first time					
Ability to use high quality supplies					
Contractors being reasonable when it comes to contract changes					
Contractors having the ability to efficiently use materials					
Contractors having the ability to work as team players					
Having ability to keep their equipment's clean					

20. Did you encounter any challenges in your effort to meet the, Cost, Time and Quality, health and Safety, productivity aspects of the projects you were involved? Yes [] No []
If Yes, state the challenges.....

21. Kindly give your opinion on what is the biggest factor influencing performance of Road construction projects in Arsi zone?

Thank You Very Much for Your Participation!