

**JIMMA UNIVERSITY  
SCHOOL OF GRADUATE STUDIES  
INSTITUTE OF TECHNOLOGY  
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING**



**ASSESSMENT OF MANAGERIAL CAUSES OF PROJECT DELAY  
AND QUALITY PROBLEM ON COBBLESTONE ROAD  
CONSTRUCTION PROJECTS IN JIMMA TOWN**

A thesis submitted to the school of graduate studies of Jimma University in partial fulfillment of the requirements for the degree of Master of Science in civil engineering (construction engineering and management).

BY

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April 2016  
Jimma, Ethiopia

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## **DECLARATION**

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

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### ***Abstract***

*One of the most common challenges facing road construction projects is road project performance. The failure of any construction project is mainly related to the problems and failure in time and quality performance. Three principal parties (Client, Consultant and Contractors) severally contribute failure in project performance based on managerial time-related causes and quality-related causes.*

*The main objective of this study is to assess the managerial causes of project delay and quality problem and suggests appropriate measures that can be taken to improve project delay and quality problem in future Jimma Town cobblestone road construction projects. This research study is descriptive cross sectional and explanatory survey design with quantitative research approach. Census survey and purposive sampling techniques were used to select respondents and collect data. The former technique was used to select and collect data from client and consultant whereas the latter technique was used to select and collect data from contractors. The research work mainly consists of literature review, questionnaire survey, and case study. Based on the literature review a total of twenty-five managerial causes affecting project delay and twenty-three causes affecting quality problem and also fifty remedial measures were identified in both cases.*

*The results of the case study indicated that all cobblestone road projects under in Jimma town experienced time overrun and quality problem. The extent of project delay and quality problem varies from 53.33% to 130% and 10% to 41% respectively. The causes and remedial measures of delay and quality problem were identified and ranked based on the value of relative important index (RIIS). The most top five important managerial causes that contributed to the project delay and quality problem from case study and questionnaire survey in Jimma town cobblestone road construction projects were identified and ranked. Financial difficulties faced by contractors, lack of project management system of those parties, poor planning and scheduling of the project, delay to handover and delivering the site and delay in response to decision making process for time overrun. Financial difficulties faced by contractors, inappropriate construction methods as per design & Specification, lack of Proper derange during construction, lack of quality control and assurance system and poor maintenance system after construction for quality problem. Finally the results of the research study propose remedial measures to improve, project delay and quality problem in future cobblestone road construction projects in Jimma Town.*

*Key Words: managerial causes, project delay and quality problem, cobblestone road projects*

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## Abbreviations

BPM	– Building Project Management
E.C	– Ethiopian Calendar
ECBP	– Engineering Capacity Building Project
ERA	– Ethiopian Roads Authority
ETH	– Ethiopian
IAMP	– Infrastructure Asset Management Plan
IDA	– International Development Association
IDCON	– Infrastructure Development Consultants
RIIS	– Relative Importance Index
JTM	– Jimma Town Municipality
CRCP'S	– Cobblestone Road Construction Projects
JU	– Jimma University
TOR	– Term Of Reference
TVET	– Technical and Vocational Education & Training
UCBP	– University Capacity Building Programs
SPSS	– Statistical package Social Science
PM	– Project Management
PLC	– Private Limited Company
PPMS	– Project Performance Monitoring System
TQM	– Total Quality Management
FIDIC	– International Federation of Consulting Engineers
KPIs	– Key Performance Indicators
ISO	– International Standards Organization
USA	– United State of America
EELPA	– Ethiopia Electric Power Authority
ULGDP	–Urban Local Government Development Program
MUDC	–Ministry of Urban Development and Construction
RSDP	–Road Sector Development Program

## CHAPTER 1

### INTRODUCTION

#### 1.1. Research Background

For any urban development, constructing new and/or managing, maintaining and improving the existing infrastructure are very important. Urban Infrastructural provision (cobble stone roads, drainage, solid waste landfills, abattoirs etc.), housing development, urban business development and strengthening cities capacity to self-govern are strategic interventions necessary to create conditions for economic development and create employment and reduce poverty.

Growth of urban areas is essential to the overall development of a country. However, large urban areas in developing countries are not accessing enough infrastructures and employment institutions to sustain with the rapid inflow of people who are in search of jobs. One of the strategic interventions is urban road construction. Road infrastructure is one of the problems observed in many urban areas of developing countries especially in Ethiopia in general and Jimma town in particular. Based on the MUDC (2012: 2) manual, one of the priority services selected by ULGs for improvement is improved road access through the construction of Cobblestone roads. So the Cobblestone road construction is a project aimed at creating job opportunity to reduce poverty and to make the cities clean and beautiful with Cobblestone at a very lower cost than asphalt.

Cobblestones are the original stones that were used as road paving material in Egypt more than 3, 500 years ago and also during the 15th century in many European countries. Moreover, Cobblestone paving is not really a new concept, even for Ethiopia, where the technology was used over 100 years ago [1]. Nowadays cobblestone pavements have been used worldwide in cities such as Berlin, New York and Paris. In Ethiopia, the Germany International cobblestone project was introduced in 1998 E.c as part of the university capacity building programs.

Adama was the first city to train workers in the different processes of producing and paving with cobblestones. In one year, the German cobblestone experts have trained more than 5000 people with whom they have paved 20,000 square meters in Adama city [2]

Cobblestone road construction in Jimma was started in 2001 E.c. and until the end of 2006 E.c budget Year the City has constructed and opened for use 13.41Km road and 3km Pedestrian sidewalks. Further, the city administration has a plan to construct 30km cobblestone road with a financial support of World Bank (International Development Association (IDA) and 18km by city administration budget for the next three year until 2009 E.c [3].

Jimma has 309.93km of measured roads, divided between asphalt, Gravel road, cobbles stone road and compacted earth. This doesn't include the asphalt roads within the municipal boundary that are owned by the Ethiopian Roads Authority (ERA). The road sector is mainly dominated by earthen road that constitute more than 50% of the total road networks. Since recent years, the city is taking initiations to develop main routes with standardized asphalt concrete roads and cobblestones for inner roads. Earthen roads mainly characterize the expansion areas and slum areas. According to infrastructure asset management plan (IAMP) and TOR report the summaries of existing road network in Jimma city is shown on the following table.

Table 1.1: Status of existing road construction projects in Jimma Town

<b>Road Sub-Category</b>	<b>Unit</b>	<b>Quantity</b>
Asphalt Roads	km	34.5
Gravel Roads	km	74.25
Cobble stone road	km	13.41
Earth Roads	km	211.37
Pedestrian Sidewalks(2m)	km	3

Source: Jimma City infrastructure asset management plan (IAMP) Report

Road Construction programs are now in stage of more rapid expansion in Ethiopia. project delay and quality problem in construction is a major concern in the global construction industry. The project delay and quality problem of civil engineering project work became an issue of concern to the government, contractors, consultants, project customers and end-users.

Like many other developing countries, Ethiopia is also facing various problems among which project delay and quality problem on road construction is quite serious problem in construction projects and it is also the main problem on the existing cobblestone road project in Jimma town.

## 1.2. Research problems

The failure of any construction project is mainly related to the problems and failure in performance. Construction industry in the global phenomenon faces challenges with regard to problems associated with project performance. The project performance is affected by many factors usually linked to the performance of time, cost, and quality [4].

Ethiopia also facing grate challenges on project delay and quality problem. In the developing countries like Ethiopia, the cost of road construction takes a major part of the budget. majority of the road projects funded by financing bodies as loan or donation. Therefore keeping the project without delay and quality problem in road construction is an inevitable [5].

Unfortunately cobblestone road construction in Jimma town has been facing grate challenges on project delay and quality problem. According to Jimma city administration Infrastructure Asset Management Plan (IAMP) report on 2007E.c budget year indicated that On Appendix – B table 4.37 from the total of 11 cobblestone road projects constructed by 11 contractors there is an average of 23.48 % of project delay [3].

Cobblestone road construction starts 2001 E.c. Until the end 2006 E.c Jimma has constructed and opened for use 13.41Km main cobblestone road and 3km Pedestrian sidewalks in 10 kebles. However, with in this short period of time most of the existing already finished cobblestone roads are not in good condition. On Appendix – B table 4.38 show 26.88% of main cobblestone road and 10.33% of Pedestrian sidewalk are in severe a condition respectively [3].

As a consequence most of the project faces huge amount of delay and quality problem. With this regard, it is very essential to assess the causes of delay and quality problem of cobblestone road construction projects in order to enhance the status of road sector. Therefore, it is the right time to study identifying the causes and remedial measures of project delay and quality problem on cobblestone road construction projects in Jimma town.



Figure 1.1: Jimma Town main cobblestone road constructed on 2003 E.c



Figure 1.2: Jimma Town main cobblestone road constructed on 2005 E.c



Figure 1.3: Jimma Town cobblestone pedestrian sidewalk constructed on 2006



### **1.3. General Objectives**

The aim of the research is to assess the managerial causes of project delay and quality problem on cobblestone road construction projects in Jimma town and propose remedial measures.

#### **Specific Objectives:**

1. To determine the extent of project delay and quality problem on cobblestone road construction projects in Jimma town.
2. To identify the main managerial causes of project delay and quality problem on cobblestone road construction projects in Jimma town.
3. To propose remedial measures to improve, project delay and quality problem in future cobblestone road construction projects in Jimma town.

### **1.4. Research Questions**

The proposed study is motivated to fill the gap by answering the following research questions by assess various managerial causes for project delay and quality problem on cobblestone road projects in Jimma town.

1. What is the extent of construction project delay and quality problem on cobblestone road construction projects in Jimma town?
2. What managerial causes for project delay and quality problem in cobblestone road construction projects in Jimma town?
3. What are the possible remedial measures in order to improve project delay and quality problem in future cobblestone road construction projects in Jimma town?

## **1.5. Research Scope**

The scope of this study is limited only on the cobblestone roads construction projects in Jimma town. The study focuses on only the managerial causes for project delay and quality problem on cobblestone roads construction projects in Jimma town and the data for this study has been gathered through literature review, questionnaire survey and case study.

### **1.5.1. Significance of the research (outcome)**

The findings of the research work are expected to

- ✓ Contribute sufficient information for cobblestone road construction contractor, local consultants and client about project delay and quality problem on cobblestone road construction projects in Jimma Town.
- ✓ The result of this study will provide a guide for road construction sectors to take the necessary actions and precautions that threaten the existence as well as future development of road construction projects in general and cobble stone projects in particular.
- ✓ Hence, this study provide an important academic ground for further studies to be undertaken in analyzing the contribution of enhancing the project delay and quality problem on cobblestone road projects construction in Jimma Town.

### **1.5.2. Limitations**

The sample size was limitation to the research because the client and Consultant firms which participated during construction was the same organization but different department, were limited in number. However, the researcher tried his best by including all the available respondents.

The last limitation is that the Cobblestone road construction is more than 100 years ago experience in most of the USA and European urban areas. Currently, as they are more developed, they are constructing their streets and roads with very attractive asphalts. Even they are covering some of the Cobblestone roads with asphalts or ranges where as some of

them kept as they are as historic roads. So because of this reason very few literatures are written in relation to Cobblestone roads. In other words, there is shortage of latest literature reviews for this research in the world in general and in Ethiopia in particular as it is new emerging practice.

## **1.6. Research Structure**

This research consists of five main chapters as follows:

- ✓ Chapter one: Introduction: this chapter discusses research background, Statement of the problems, the main and specific objectives of research, research question, research scope and structure of the research.
- ✓ Chapter two: Literature review: this chapter shows a historical review from previous studied to assess the main causes of construction projects delay and quality problem on different sources such as archival document (progress and completion report), books, journal and internet sources.
- ✓ Chapter three: Methodology: this chapter discusses the research methodology in order to achieve the required objectives.
- ✓ Chapter four: Results of Analysis and Discussion: focuses on the analysis of results and discussions of the data obtained from the case study on selected road construction projects and questionnaire survey.
- ✓ Chapter five: Conclusions and recommendations: provides a final conclusion on the research and recommendations for further research.
- ✓ Appendix:

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1. Introduction

One very important aspect of this study is assess and analyzes various managerial causes of project delay and quality problem on road construction project in general and cobblestone road in particular on Jimma town. In order to develop a better understanding of the research objective, a comprehensive literature review has been conducted by focusing on related to this study.

#### 2.2. Construction project management

Before we directly enter into construction performance, it is better to understand what construction project management mean. Construction management is a discipline that deals with the management of construction projects<sup>1</sup> from their inception to their completion with the aim of achieving projects within budget, time and quality. Besides when the term construction management is used for project delivery system, it represents the owner for managerial decisions related with the project. Construction work, like any other work, involves the systematic integration of various resources such as human, finance, physical resources, information and attributes that are used to achieve transformations of input to output. The key to productive work is appropriate planning for such transformations [6]. The construction work like any other work can be conceptualized using Input – Output model as:

Competent management performance can be engineered just as we have learned to engineer the structures we erect. Every construction project can be improved provided that management knows what to improve and how to improve it [7].

The central concept for competent management is better information. To improve performance, above all other things, contractors need to focus their attention on how they collect, interpret, and act on jobsite information [7]. But good information does not just pop out of a construction job. It requires a systematic effort to collect, analyze and make sense out of it.

### **2.3. Construction management and performance**

There is a strong relation between project management and project performance. Management in construction industry is considered as one of the most important factors affecting performance of works. Brown and Adams [8] studied a new approach to the measurement of the effect of Building Project Management (BPM) on time, cost and quality outputs using 15 'cases' derived from UK data. The evaluation undertaken demonstrates that BPM as it is presently implemented in the UK fails to perform as expected in relation to the three predominant performance evaluation criteria; time, cost and quality. Lehtonen[9] obtained a model for performance measurement which assist both firms' top management and operational managers for continuous feedback on operational activities. Thomas [10] stated that documenting and archiving performance data could be useful for future reference, such as for settling disputes on claims, and in maintenance and repair works.

Kuprenas [11] remarked that quantification of the impacts of the project management processes are identified through three steps of analysis: comparison of summary statistics of design performance, proof of statistical significance of any differences and calculation of a least squares regression.

Cheung et al [12] studied the project performance related to project managers. It is remarked that development of a Web-based construction Project Performance Monitoring System (PPMS) can assist project managers in exercising construction project performance indicators and can help senior project management, project directors, project managers, etc., in monitoring and assessing project performance. Pheng and Chuan[13] stated that while project management is only one of the many criteria upon which project performance is contingent, it is also arguably the most significant as people formulating the processes and systems who deliver the projects. Ugwu and Haupt[14] stated that an adequate understanding and knowledge of performance are desirable for archiving managerial goals such as improvement of institutional transformations, and efficient decision making in design, specification and construction, at various project-level interfaces, using appropriate decision-support tools. Ling et al [15] investigated project management (PM) practices adopted by Singaporean construction firms. It was determined the performance level of their projects in China; identifies PM practices that led to better performance; and recommended

key PM practices that could be adopted by foreign construction firms in China to improve project performance. Success of construction projects depends mainly on success of performance. Many previous researches had been studied performance of construction projects.

Performance can be defined as a means to represent accomplishment through subject and object relationships and metaphors [16]. Accordingly construction performance can be defined as a means to represent accomplishment through activity or method relationship and their output. Others define performance as a concept that is very closely linked a company's competitiveness [17].

The project performance is affected by many factors usually linked to the performance of time, cost, and quality [4].

Time performance usually means the project is completed on or before the agreed handover date. Sometimes contractual documents refer to time being the 'essence of the contract', which exemplifies the criticality of timely completion due to subsequent plans that cannot be delayed [18]. Prediction of construction time has been studied at length. One of the earlier studies was Bromilow [19], in which a predictive model was developed using the relationship between cost and duration. It was found that the time taken to construct a project is highly correlated only with the project's size, as measured by its final cost.

Quality performance is referenced to the standard of the delivered project and that specified in the contract documents. The expectation is to receive what is specified, no more and no less, and often this is judged in the detail of the finishes and the workmanship applied. There is no convenient unit of measurement for quality, and it therefore involves a collection of issues, some of which are objective (e.g. number of identified defects) and others are subjective. Quality is influenced by a number of related factors, all of which would normally add cost and time to some extent as the level of quality increases. These include build ability, innovation, building height, and extent of fit-out, environmental performance, compliance, standard of finish, supervision levels and efficiency [18].

Quality management has grown in prominence over the years. Lesley and Malcolm [20] believed that quality was probably the best strategy to ensure customer loyalty, defend against foreign competition and secure continuous growth and profits in difficult market conditions. ISO-9000 (Quality Management) is the current international standard for assuring quality, and

ISO-certification is a demonstrable way that construction contractors can communicate to customers that they have systems in place to deliver quality outcomes and grow in abilities through continuous process improvement [21].

#### **2.4. Time and quality performance measurement in construction industry**

Performance is not just about efficiency but achieving desired results. According to Navon Ronie [22] performance measurement is the process of quantifying the efficiency and effectiveness of actions. To help in this endeavor, a wide variety of KPIs have been identified and used to measure the success of construction projects. These include indicators of client satisfaction, stakeholder engagement, service delivery, investment return, urban renewal, defect minimization, trust, dispute avoidance, innovation, safety and standard. Three of the most commonly cited KPIs are on-time completion (time), within agreed budget (cost) and non-defective workmanship as specified (quality) [18].

William Gyadu - Asiedu [23] study Project performance measurements which are based on the multidimensional, multi-criteria concept. In all, they identified seven dimensions: respect for time, respect for budget and technical specification, knowledge creation and transfer, contribution to business success, financial and commercial success.

The systematic measurement of performance is a significant, as it is needed in order to determine areas of improvement. Basically performance can be assessed on two dimensions: the objective measures and subjective measures. As highlighted by chan [24] the objective approach use mathematical formula to calculate the value of the project based on time and cost, while the subjective approach uses subjective opinions and the personal judgment of participants.

Time performance of the project is monitored according to the work program prepared prior to commencement of the project. Assert that the time performance concerns the duration needed to complete the project according to its schedule and are calculated as the numbers of days or weeks from starting on site to the practical completion of the project [25].

Quality performance of the project is a common determinant that is applied to assess the level of performance in construction projects. [25] Quality mines the ability of service or product to perform its specified tasks. In addition, project performance also can be obtained based on the participants' satisfaction levels. This approach's can provide a negative or positive result by comparing perceptions and expectations.

## **2.5. Managerial causes of project delay and quality problem construction project**

This paper reviews the managerial causes that contribute to the project delay and quality problem on cobblestone road project in Jimma town. This review was achieved via both a comprehensive literature review and a highway road project survey. The significant managerial causes were arranged into two groups: (1) project delay-related causes and quality problem-related causes.

### **2.5.1. Project delay related causes**

#### **2.5.1.1. Definition of project delay**

There are a number of definitions for delay. In the construction management context, the simplest definition of delay was set by;

In construction, delay is the time overrun either beyond the contract date or beyond the date that the parties agreed upon for delivery of a project [26]. A project consists of a collection of activities. Delays can occur in any or all of these activities and these delays in activities can concurrently cause delays in the completion of the project. A project delay is the accumulated effect of the delays in the individual activities. Delay analysis used to determine the cause(s) of the delay in order to ascertain whether an extension of time would award. An extension of time relieves the contractor from the liability for damages [27].

The analysis of delays in construction projects is difficult and complicated because of the large number of individual activities that need to be dealt with, even for a relatively simple project. A medium-sized project may consist of hundreds of activities, many of which may take place at different times and with different durations than originally planned. Some activities may be delayed or accelerated, and such changes may partially or fully, or may not, affect the project completion date.

In many studies, researchers defined project delay as follows:

- Construction delay is defined as “... the time overrun beyond completion date specified either in a contract, or beyond the date that the parties agreed upon for delivery of a project....” [28].



- Construction delay refers to “.... a situation where a construction project does not come to completion within the planned time....” [29].
- Delay is “.....a situation when the contractor and the client jointly and severally contribute to the no completion of the project within the original or the stipulated or agreed contract period....” [30].

### **2.5.1.2. Causes of project delay/time Overrun**

The majority of road construction projects in Ethiopia are not completed within the initially set targets of time. Project delays are a common problem around the world internationally in the construction industry in modern times. Investigating the reasons for delay has become an important contribution to improved construction industry performance.

The causes of project delays fluctuate due to the faults and weaknesses of the client, the consultant and the contractor. Project delays may happen in the preconstruction phase which means the period beginning from the initial conception of the project to the signing of the contract between the client and the contractor; however, some of them may happen in the construction phase that is the period when actual construction is under way. Project schedules are consistently dynamic and uncertain. Several controllable and uncontrollable factors can adversely affect the project schedule and cause delays. These delays definitely create negative impacts on project performance.

Many studies have been conducted to examine the factors affecting time overrun in construction projects. The history of the construction industry worldwide is full of projects that were completed with significant time and cost overruns [31]. A World Bank report confirms an average of 70% overruns of initial time in 88% of 1627 projects during the last 15 years [32].

The management issues was one of the most important factors that affected construction delay for developed economic of countries. Different studies in different country proof this Ibrahim Mahamid [33], conducted a study to consultant’s view toward the factors affecting time overrun in public construction projects analysis of the identified 34 factors indicates that the top five important factors affecting time overrun in public construction projects are: improper planning, poor labor productivity, additional works, rework, and lack of contractor

experience. The results also indicate that the top five severe factors affecting time overrun in public construction projects in Saudi Arabia are: bid award for lowest price, poor labor productivity, improper planning, additional work, and lack of contractor experience. While the top five frequent factors are: rework, improper planning, changes in material types and specifications during construction, poor contract management, and poor resource management, also Koushki P & Al-Rashid, K [34] conducted a study in Kuwait to identify and rank the main time and cost overrun causes in construction projects. They concluded that the factors affecting time overrun are changing orders, owners' financial constraints, and owners' lack of experience.

Another study Mansfield [35] causes of delay and cost overruns in Nigerian construction projects were financing and payment for completed works, poor contract management, changes in site condition and shortages in materials. contractor's improper planning, contractor's poor site management, inadequate contractor experience, inadequate client's finance and payments for completed work, incompetence of subcontractors, shortage in material, labor supply, equipment availability and failure, lack of communication between parties, and mistakes during the construction stage. Were the top ten important delay factors evaluated in Malaysian construction industry Sambasivan and Soon [36].

Alinaitwe, Apolot and Tindiwensi [37] carried out a study on causes of delays and cost overruns in Uganda's public sector construction projects and the results showed the major causes as: Change of work scope and/or changes in material specifications; High inflation, Poor monitoring and control, due to incompetent and/or unreliable supervisors; Delayed payment to contractors, subcontractors and/or suppliers; and Fuel shortages. Sweis [38] investigated factors affecting time overruns in public construction projects in Jordan and revealed that the major causes of delay were: Too many change orders from owner; Poor planning and scheduling of the project by the contractor; Ambiguities and mistakes in specifications and drawings; Slow decision making from owner; and Poor qualification of consultants, engineers and staff assigned to the project In India, Desai and Bhatt [39] studied the critical causes of delay in residential construction projects and found out that the most important delay factors were: Original contract duration was too short; Legal disputes between various parties; Ineffective delay penalties; Delay in progress payments by owner; and Delay to furnish and deliver the site to the contractor by the owner.

In Sri Lanka, Dolage and Rathnamali [40] carried out a study causes of time overrun in construction phase of building projects and found out that the following were the major causes of time overrun: Delay in progress payment by clients; Inaccurate planning and scheduling of projects by contractors; Rainy weather; Non availability of experienced technical staff of contractor. Wong and Vimonsatit [41] studied the factors affecting construction time in Australia and the results showed that the following were the major factors affecting construction time: Skills shortage, financial difficulties; Shortage of labor; Unrealistic deadlines for project completion; and unforeseen ground conditions.

There are in seven groups of causes for delay in construction project: According to the study of [60], categorized causes of delay into seven groups: causes of construction delay late in by owner such as late in revising and approving design documents, slowness in decision making process, Suspension of work...etc, causes of construction delay by contractor such as difficulties in financing project, poor communication and coordination, ineffective planning and scheduling of project, improper construction methods implement, and...etc: causes of construction delay by consultant such as delays in producing design documents, unclear and inadequate details in drawings, insufficient data collection and survey before design, un-use of advanced engineering design software; causes of construction delay by materials such as shortage of construction materials in market, delay in material delivery, late procurement of materials ; causes of construction delay by equipment such as low productivity and efficiency of equipment, lack of high-technology mechanical equipment; causes of construction delay by labors such as low productivity level of labors and shortage of labors and causes of construction delay by external factors such as weather inclement, Effects of subsurface conditions (e.g. soil, high water table, etc.) Moreover, weather effect on construction activities identified as the major factor of delay in construction industry.

There are also many study investigation factors that contributing to causes of delays in construction projects. Delays in highway construction in Thailand conducted by [42]; and concluded that delays can be caused by all parties involved in projects however; main causes come from inadequacy of sub-contractors, organization that lacks of sufficient resources, incomplete and unclear drawings and deficiencies between consultants and contractors. The study suggested that delay could be minimized by discussions that lead to understanding. poor planning, poor site management, inadequate supervisory skills of the contractor, delayed

payments, material shortage, labor supply, equipment availability and failure, poor communication and rework. Conclusions made from the study that the major causes of delay in road construction projects in Zambia were delayed payments, financial deficiencies on the part of the client or contractor, contract modification, economic problems, material procurement, changes in design drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site, changes in specifications, labor disputes, and strikes[43].

Generally, the causes of delay are significant and should be given attention by client organizations, consultants, and contractors to enable the timely completion of projects in future based on all the above information the general factors causing delays are summarized in the table 2.1 in order to prepare the questionnaire to identify causes of delay in Jimma Town road construction projects

Table 2.1 Summary of literature reviewed causes of delay/ time overrun in different countries

Country where survey was conducted		S. Arabia	Nigeria	Uganda	Jordan	Malaysia	S. Lanka	Australia	S. Lanka	Thailand	Zambia
Authors		[33]	[35]	[37]	[38]	[39]	[40]	[41]	[60]	[42]	[43]
NO	Factors causing Time overrun										
1	Type of project bidding and award of contract(to the lowest bidder)	✓	✓		✓		✓			✓	✓
2	Improper technical selection of contractor during the bidding stage			✓			✓				
3	Inadequate duration of contract period	✓				✓		✓	✓		
4	Delay to handover and delivering the site to the contractor ( right of way problem)					✓			✓	✓	
5	Delay in approving interim payments of completed works		✓	✓		✓	✓	✓		✓	✓
6	Poor planning and scheduling of the project by the contractor	✓	✓		✓		✓	✓	✓	✓	
7	Improper construction technical and methods		✓	✓	✓			✓	✓		✓
8	Rework due to errors during construction		✓								
9	Lack of frequent meeting	✓	✓					✓	✓	✓	
10	financial difficulties faced by contractors		✓			✓		✓	✓		
11	Shortage of construction materials	✓	✓	✓					✓	✓	✓
12	Use low productivity and efficiency equipment or machine		✓						✓	✓	✓

Country where survey was conducted		S. Arabia	Nigeria	Uganda	Jordan	Malaysia	S. Lanka	Australia	S. Lanka	Thailand	Zambia
Authors		[33]	[35]	[37]	[38]	[39]	[40]	[41]	[60]	[42]	[43]
NO	Factors causing Time overrun										
13	Delay in response to decision making process				✓			✓	✓	✓	
14	Lack of practicing contract administration(liquidated damage rule ,etc)					✓					✓
15	Variations orders due to(design changes/ extra work)	✓		✓							✓
16	Lack of communication between those parties of the project		✓						✓	✓	
17	Poor site management/ Insufficient coordination						✓			✓	
18	Poor supervision		✓			✓				✓	✓
19	Lack of project management system on those parties						✓	✓	✓		
20	Insufficient number of management staffs on those parties							✓	✓		
21	Inflation of construction material		✓				✓				
22	Delay in provisional and final acceptance of completed project					✓			✓		✓
23	Lack of personnel training and management support						✓	✓			
24	Changes in laws and regulations			✓						✓	
25	Contractual claims, such as, extension of time with cost claims					✓			✓		✓

## **2.5.2. Quality problem related causes**

### **2.5.2.1. Definition of quality and quality defective**

Many previous researchers provided a different definition of the construction project quality Chan and Chan (2004) confer that in the construction industry, quality is defined as a totality of features required by a product or service to satisfy a given need- “fitness for purpose”. However the way in which quality is determined is by the extent to which a product or service successfully serves the purpose of the user during usage (not just at the point of sale). [24]

The word quality has many meanings: a degree of excellence; conformance with requirements; fitness for use; delighting customers; freedom from defects, imperfections or contaminations (Hoyle, 2006). [44]

According to the (Chan and Tam, 2000).quality mean the finished product in any industry should be manufactured to a required standard, on that provides customer satisfaction and value for money. [45]

Atkinson (1999) defines quality defective construction works as those which fell short of complying with the specific descriptions or requirements of the contract, especially any drawings or specifications, together with any implied terms and conditions as to its quality, workmanship, durability, aesthetics, performance or design. [46]

Defects according to Harris (2006) are faults that may reduce the durability, usefulness, or strength of a construction work. They are the unacceptable quality of a project which can be identified and remedied. [47]

Quality defect in construction refers to works which fall short of complying with specified descriptions or requirements of a construction contract, especially any drawings or specifications, together with any implied terms and conditions as to its quality, workmanship, durability, aesthetics, performance or design. [48]

### **2.5.2.2. Causes quality problem in construction works**

The International Federation of Consulting Engineers (FIDIC) notes that: “The survey on quality of construction by FIDIC within member associations in 2001 confirmed that failure to achieve appropriate quality of construction is a problem worldwide. The pressure to reduce the initial costs of construction and supervision were found to have had an adverse effect on quality, as could be predicted. The problem is serious and is evident in both developed and developing countries. Lack of quality in construction is manifested in poor or non-sustainable workmanship, and unsafe structures, and in delays, cost overruns and disputes in construction contracts. [49]

The quality work of some roads was below satisfactory level. The study of quality construction works in University of Bangkok, Thailand the quality problems in construction are different and varied. The construction quality is based on the organization's characteristics, procedure of working, and contractor follows the drawings and specifications under defined budgets, skill of labor, quality of materials and applied equipment. [50]

A number of studies have been conducted on factors causes of the quality of construction project road construction project in general and cobblestone road construction project in particular. The management issues were the most important factors that affected construction quality for developed economic of countries. Jha and Iyer [51] studied the critical factors cause quality problem in construction projects, which focused on two sets of success and failure attributes. The factors that adversely affected (failure attributes) the quality performance of projects are: conflict among project participants; hostile socio-economic environment; harsh climatic condition; project manager's ignorance and lack of knowledge; imperfect project conceptualization; and aggressive competition during tendering, and availability of resources, including machinery and labor, was particularly important because it affects construction quality in underdeveloped countries.

Another study Mailot Sysoulath<sup>1</sup>, Noppadon Jokkaw [50] Based on the result of the data analysis for factors causes the quality of construction works in Lao PDR, it was found that top most significant factors were ranked by both local and international respondent's perspective, namely, unskilled labors, improper material usage as the contract, poor experience and competency of project manager on quality planning, lack of quality inspection and control system, low experience and competency of supervisor and according to local respondent's



perspective such as condition for selecting the contractor by the owner, lack of timely supervision, low quality drawing and specification, lack of quality assurance system, and poor planning of construction operating procedures and techniques and also international respondent's perspective: lack of technical and professional expertise and resources to perform task, undocumented construction (in case of changing order during construction), low experience and knowledge of designers, and the owner's satisfaction regarding quality of construction works, respectively.

Another study Tengan Callistus, Anzagira Lee Felix, Kissi Ernest [52] on "Factors Affecting Quality Performance of Construction Firms in Ghana" The results discussed the most ranked by respondents under consultant and contractor related factors affecting poor quality performance of small scale contractors (SSCs) was: lack of previous experience, poor planning and control techniques, poor financial control on site, lack of previous experience of contractor, lack of education and training to drive the improvement process under contractor related factors and fraudulent practices and kickbacks, poor monitoring and feedbacks, Lack of coordination between designers and contractors, inefficient team work among stakeholders, Poor Information and communication channels and lack of On-Site project manager/supervisor/ clerk of works under consultant related factors respectively.

According to M. Abas, S.B. Khattak [53] on the study of Evolution of factors affecting the quality of construction projects the most Fifty factors that affect the quality was continuous improvement, Communication, Technical Person Availability, ISO certification, procurement unit of contractor, shortage of material/equipment, escalation of material prices, solving, bad weather, bureaucracy and political influence, cash flow, funding, low bid, financial capability of contractor, management team of contractor. And also according to the study of Ali and Wen [54] finds out the factors that contribute to poor workmanship and possible measures to minimize the problem. The factors contribute to poor workmanship in construction through literatures, they are: poor project management; complicated role of subcontractor; lack of experience and competency of labors; language barrier to communication and lack of communication; unsuitable construction equipment; poor weather condition; limited time and limited cost. Nevertheless, they suggested six possible ways to minimize the workmanship quality problem; strict supervision, training and education, proper communication among parties involved, proper construction management, proper manpower management, and proper design.

Another study of H-Abdul-Rahman et al. [55] investigated the causes of quality failures in the building construction projects. The results showed top five causes of quality failure that insufficient skill levels among workers, inadequate reviews of the design and engineering drawings, lack of site layout studies, poor quality improvement programs, and lack of training personnel. The top three factors as barrier to improve quality in construction industry are: lack of skilled labors, awarding of contracts to the lowest bidder, and lack of effective teams and/or team building skills, respectively. Other study on Rifat N. Rustom1 and Mohammad I. Amer2 [56] investigated on the study of “Identification of the factor affecting quality in building construction projects in Gaza” results yielded 14 main factors and 60 sub-factors by using 65 contracting companies and 24 consulting offices participated in responding to the questionnaire the analysis of results showed that 10 main factors contribute 74% of the weight of all factors such as availability of good quality construction materials, Skill and experience of construction project staff, Training courses for labor, good utilization of equipment, implement quality control and assurance system, amount of contractor’s cash flow, quick response (no delays in making decisions), Stability of political environment, using a comprehensive material management system and types of awarding system.

According to Mulatu Berihanu[57]. On the study of “Assessing cobblestone road management and maintenance” the case of Addis ketema sub city the findings of the result show the quality of cobblestone road construction in addis ketema sub city mainly affected by many reason out of those the main factor causes the quality was: poor maintenance system, unrestricted traffic load control, decision-making problem, un proper use of community for complete road work by putting any dry waste materials on the roads, unrestricted traffic load control affect the road by destruction of curve stone from the edge of the roads, accumulation of water on the body of some of the roads and the up-side-down of the roads because of large load vehicles are some of the problems, government policy and strategy because from the very beginning, when these roads were constructed, the quality was not considered as a major deal because of the aim to reduce the number of unemployment and to cover all the intra urban earthen roads with Cobblestones.

Many researchers have been carried out both in developed and developing countries to investigate the factors that have a substantial affect the construction projects performance. Some literature is explained below to highlight the managerial causes affecting quality problem of construction projects was reviewed (Karim, H. (2008)) to identify the causes affecting the problem of construction projects [58].

Table 2.2 Summary of literature reviewed causes that affecting quality of work in different countries

Country where survey was conducted		Thailand	India	Ghana	Pakistan	U.K	Malaysia	Gaza	Ethiopia	Sweden
Authors		[50]	[51]	[52]	[53]	[54]	[55]	[56]	[57]	[58]
NO	Factors Affecting Quality problem									
1	Project Fund and project budget is small	✓			✓				✓	
2	Awarding of contracts to the lowest bidder		✓		✓		✓	✓		
3	Poor planning and scheduling of the project during & per-construction phase	✓		✓			✓		✓	
4	Inappropriate method of consultant & contractor selecting	✓								
5	Low effective quality management system and lack of commitment.	✓	✓	✓			✓	✓		
6	Inappropriate construction methods as per design & Specification	✓	✓		✓			✓		
7	Poor technical & managerial efficiency assign to construction project	✓	✓	✓	✓	✓	✓	✓		
8	Lack of frequent quality meeting	✓	✓			✓	✓	✓		
9	Use of improper equipment or machine for construction process		✓		✓	✓		✓		
10	Improper material selection & low quality construction material use	✓	✓		✓			✓	✓	
11	financial difficulties faced by contractors			✓	✓			✓		
12	Lack of quality training			✓			✓		✓	

Country where survey was conducted		Thailand	India	Ghana	Pakistan	U.K	Malaysia	Gaza	Ethiopia	Sweden
Authors		[50]	[51]	[52]	[53]	[54]	[55]	[56]	[57]	[58]
NO	Factors Affecting Quality problem									
13	Change order during construction	✓				✓				
14	Lack of timely supervision/inspection at construction site	✓		✓		✓			✓	
15	Insufficient coordination/Lack of communication between those parties of the project			✓	✓	✓	✓			
16	Lack of quality control and assurance system	✓			✓			✓		
17	Insufficient number of management staffs on those parties		✓			✓				
18	Lack of Proper drainage construction				✓				✓	
19	Delay in response to decision making process		✓		✓			✓	✓	
20	Road Operation above design limits (Unrestricted traffic load control)								✓	
21	Un proper use of community for complete road work								✓	
22	Poor maintenance system during & after construction								✓	✓
23	Government policy and strategy				✓			✓	✓	

## **2.6. Remedial measures of causes of project delay and quality problem in construction project**

Managerial causes of project delay and quality problem on construction projects can be reduced by applying measures that reflected as mitigation of delay and quality problem. This mitigation of causes affecting project delay and quality problem is possible only by re-sequencing of the works wherever possible and without increasing the resources and work force. The works that achieved without any additional cost to the project is the mitigation. The mitigation of project delay and quality problem can be possible by also applying the knowledge gained through previous projects experience and these will implemented wherever their application can be suited for any specific requirement in the process of project learning. Such knowledge management will help in mitigating those causes affecting project delay and quality problem and the awareness of such knowledge through lessons learnt feedback could in fact be helpful in preventing the delay and quality problem itself.

Many researchers have been carried out both in developed and developing countries to investigate the mitigation measures on managerial causes of project delay and quality problem factors that have a substantial affect the construction projects performance. Some literature is explained below to highlight the managerial mitigation measures causes affecting project delay and quality problem of construction projects was reviewed.

Based on several studies list on the study for methods of minimizing construction time performance of construction project successive factors and rectification has been identified by several researchers.15 methods have been identified [59] as follows; Frequent progress meeting, use up-to-date technology utilization, use proper and modern construction equipment, use appropriate construction methods, effective strategic planning, proper material procurement, accurate initial cost estimates, clear information and communication channels, frequent coordination between the parties involved, proper emphasis on past experience, proper project planning and scheduling, complete and proper design at the right time, Site management and supervision, Collaborative working in construction, compressing construction durations.

The methods of minimizing construction delays were identified based on several studies of project success factors and ranked based on the mean value by calculating the average indexes from the viewpoint of contractor and consultant. From this study, the best effective methods

of minimizing construction delays includes: site management and supervision; effective strategic planning; clear information and communication channels; collaborative work in construction; proper project planning and scheduling; frequent coordination between the parties involved; complete and proper design at the right time; use appropriate construction methods; accurate initial cost estimates; proper material procurement; proper emphasis on past experience; Frequent progress meeting and use of proper and modern construction equipment. Besides these it recommended that contractors should arrange some training programs for their workers in order to update their knowledge and improve their management skill [61].

According to the study of Adnan Enshassi1, (2009) owners develop human resources in the construction industry through proper and continuous training programs, encouraged to facilitate payment to contractors in order to overcome delay, disputes, and claims, All managerial levels should participate in sensitive and important decision making and Continuous coordination and relationship between project participants developing project performance. Consultants are urged to facilitate and expedite orders delivered to contractors to obtain better time performance and to minimize disputes and claims. Conformance to project specification to overcome disputes, time, and cost performance problems, using quality materials it improve cost, time, and quality performance. Also the contractor applying quality training and more interested in sequencing of work according to schedule is more important to improve project performance [62].

## CHAPTER 3

### RESEARCH METHOD

#### 3.1. Description of the Study Area

This study is conducted in Jimma Town cobblestone road construction projects. Jimma is one of the ancient and largest towns in the country located in southwestern part of Ethiopia. Jimma city is situated in Oromia Regional State at about 358 kms away from Addis Ababa (Finfinnee); the capital city of Ethiopia.

Geographically, the city is located at  $7.667^{\circ}$  N latitude and  $36.833^{\circ}$  E longitudes. topographically, the Jimma area might be divided into escarpment and alluvial plains. elevation within the city boundary ranges from the lowest 1720 m. above sea level .of the airfield (kitto) to the highest 2010 m. above sea level at Jiren. According to the current used development plan, Jimma has the total area of 4623 hectares. Information on land zoning of the city shows 25.7% of the total area of the city is to be covered by residential buildings, 2.65% by commercial activities, 4.01% by industrial activities, 10.6% by social & public services, 2.6% by administrative zone, 15.4% is land reserved for construction of roads and the proportion of land left for other infrastructures is about 39.1%.

Based on the 2008 national survey this town has a total population of 137,688 of whom 69,442 were men and 68,226 were women [21]. Jimma zone and Jimma town are mainly known for coffee production and marketing. The origin of Arabic coffee is believed to be in Jimma zone and coffee which is the main product of the locality contributes enormously to the national economy. There are also historical places like Abba Jiffar palace the home of King Abba Jifar and Jimma museum for visitors. The University of Jimma has also provided the town with another color.

Despite the city has a long history of foundation for more than 17.8 decades, the level of development of public infrastructures is poor. The road sector is mainly dominated by earthen road that constitute more than 50% of the total road networks. Asphalt roads are only found in very few areas/routes/ mainly among the main routes and four outlets of the cities. Since recent years, the city is taking initiations to develop main routes with standardized asphalt concrete roads and cobblestones for inner roads. However, the Jimma city administration.

capital investment plan for infrastructure (CIP), 2011/12-2013/14 comes up with a high magnitude of cobblestone roads with a severe condition and this initiates this study to be done in Jimma city cobblestone project.



Figure 3.1: Map of the study area.

### 3.2. Research design

This research followed a four-stage process; having established the basis of the research, necessary data were collected, analyzed, and conclusions and recommendations were made based on the findings. The methods of data collections employed for the research were case study, desk study, questionnaire, group discussion and interview. The case study analyzed in relation to theoretical propositions, and the responses obtained from the interview were analyzed using descriptive statistics method. The next sections discuss the tools used for data collection and method of analysis.

The strategy followed in this research first started with problem identification that had done through unstructured literature review, case study, and informal discussion with colleagues and professionals in the sector; then data and information sources were determined based on the formulated research design. On the based on the data and information sources, the research instruments decided; and available documentary sources relevant to the research reviewed. The review includes books, journal and articles, internet sources and archival document search such as progress and completion reports within Jimma town municipality the client of the project.



Finally, after an in-depth review of literature and case study, a questionnaire was designed and distributed to contractors, consultants, the employers of Jimma Town municipality. Upon obtaining the desired data, checking and sorting of data has been done for the selected method of analysis. It enabled to obtain the result followed by comprehensive discussions in order to draw a conclusion and to forward recommendations based on the finding of the research study.

A descriptive cross sectional and explanatory survey design with quantitative research approach has been used in this study. It was attempted to collect data from the relevant population implementing agency such as, client, consulting and contracting firms to evaluate the perception of different stakeholders on the issues of delay and quality, ranking of project time overrun and quality problem variables and the current practice of delay and quality problem mitigation methods in Jimma Town cobblestone road construction projects.

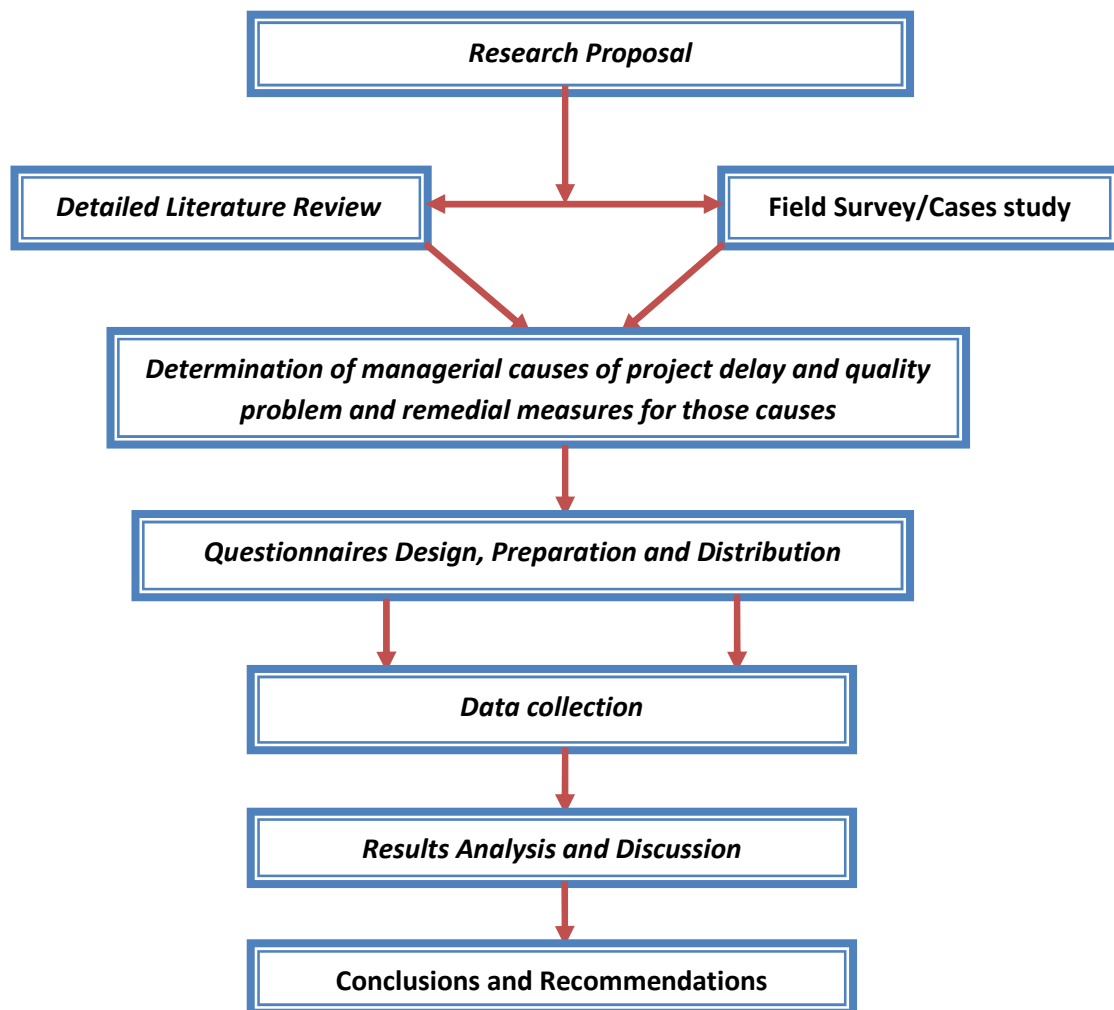


Figure 3.2: Study design or frame for the research methodology

### **3.3. Population**

The research population was eight cobblestone road projects, which were delayed and have quality problem in Jimma town cobblestone road construction projects that was completed/ substantially completed or under construction during the past two years.

There are three contracting party are involved for the cobblestone road construction projects such as clients, contractors, and consultants. The total population used in this research study is 40, comprising of 20 for contractors representative, 10 for clients representative and 10 for consultants representative. Two sampling procedures were used due to the nature of respondents for this research study. Census survey was used to select respondents from clients and consultants but contractors are selected using purposive sampling.

### **3.4. Sources of data and research instruments**

Three researches instruments were used for the collection of relevant information. To identify and rank the major managerial causes of project delay and quality problem on cobblestone road construction project in Jimma town, a case study approach and questionnaire survey were carried out in addition with information on archival documents and literature review.

#### **3.4.1. Case study**

Case studies were conducted on eight cobblestone road projects, which were delayed and have quality problem in Jimma town cobblestone road construction projects that was completed/ substantially completed or under construction during the past two years. The documents referred during the case study include progress and completion reports, contract documents and claim submittal, variation orders, correspondences and other important documents of the projects in addition to this direct observation of site condition, correspondences from discussion and interview for criterion based selected projects. These cases discussed in depth by organizing information and focusing on managerial causes of project delay and quality problem on cobblestone projects in Jimma town and to illustrate the link between the result obtained by questionnaire and result in case study.

#### **3.4.2. Questionnaire approach**

Questionnaire is designed in this research first started with problem identification that had done through unstructured literature review, case study, and informal discussion with colleagues and professionals in the sector. Based on the data and information sources the research instruments decided; and available documentary sources relevant to the research

reviewed. The review includes books, journal and articles, internet sources and archival document search such as progress and completion reports on Jimma Town municipality the client of cobblestone road project. The document search mainly intended to measure the extent of time overrun and quality problem Jimma town cobblestone road projects that was completed/ substantially completed or under construction during the past four years.

Finally, after an in-depth review of literature and case study, a questionnaire was designed and distributed to reputed construction professionals to get their professional opinion based on their experience to crosschecking validate whether the questions are intelligible, easy to answer, unambiguous. Then improve the questions of questionnaire corresponding to real situation of managerial causes of project delay and quality problems on road construction project in Jimma town in general and cobblestone road construction project in particular.

After verifying initial questionnaire was improved and then the second questionnaire has been developed in order to use for data collection. This questionnaire is used to evaluate the level of important managerial causes of project delay and quality problem with appropriate remedial measures of construction project and rank such causes. In addition, the questionnaire form comprises into three parts. The first part is the respondent's demographics characteristics (e.g. experience and occupation). The second part contains the list of managerial causes of project delay and quality problem of construction works and the third part is mitigation measures for those factors. The respondents were asked to assess the level of important managerial causes of project delay and quality problem and those mitigation measures of construction works by using five-point Likert scales from 1 to 5 (1-very low ; 2-low ; 3-medium; 4 High and 5-very high) and they were asked to provide the reasons of each causes as well.

For the questionnaire survey, Census survey was used to select respondents from clients and consultants but contractors are selected using purposive sampling, those organizations have been involved on cobblestone road construction project in Jimma town.

### 3.5. Data processing and analysis

In this research descriptive statistical method is used for analysis of data collected from various sources through questionnaire. The case study is analyzed using the theoretical propositions and respondent's information.

A flow diagram that shows the components and sequence of project delay and quality problem analysis is shown in Figure 3.3.

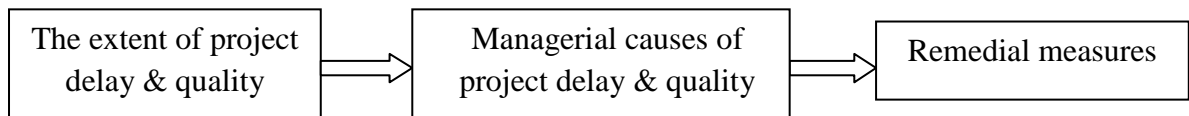


Figure 3.3: Flow diagram for causes of project delay & quality problem analysis

Data is analyzed using relative important index (RIIS) technique [51]. The relative importance index, (RIIS) computed for each causes to identify the most significant causes and its remedial measures. The causes are ranked based on RIIS values. From the ranking assigned to each cause of delays and quality problem the most important causes and remedial measures of delays on road construction projects in Jimma Town can be identified.

The Relative Importance Index (RIIS) is calculated as follows:

$$RIIS = \frac{\sum Wi Xi}{\sum Xi} \dots\dots\dots (1)$$

Where:

i = response category index

WI = the weight assigned to i<sup>th</sup> response = 1, 2, 3, 4, 5, respectively.

Xi = frequency of the i<sup>th</sup> response given as percentage of the total responses for each factors.

The RII value ranges from 0 to 1 (0 not inclusive), the higher the value of RII, the more that causes is. Both the primary and secondary data collected are entered in to Excel and R-statistical software. The result is organized and presented in terms of tables

Spearman's rank correlation coefficient (r) is used to demonstrate whether there is the agreement or disagreement of ranking between any two parties. The spearman's rank correlation is a non-parametric test. Non-parametric tests are also referred to as distribution-

free test. These tests do not require the assumption of normality or the assumption of homogeneity of variance. They compare the medians rather than means and, as a result, if the data have one or two outliers, their influence is excluded. The correlation coefficient varies between +1 and -1, where +1 implies a perfect positive relationship (agreement), while -1 results from a perfect negative relationship (disagreement) [52]. Spearman's rank correlation coefficient can be calculated by the following formula

$$r = 1 - \frac{6 \sum d^2}{(n)(n^2-1)} \dots\dots\dots (2)$$

Where:

d = the difference between the ranks given by any two respondents for an individual cause

n = the number of causes or groups, which in this case is 25 causes for project delay and 23 causes for quality problem.

## CHAPTER FOUR

### RESULTS OF ANALYSIS AND DISCUSSION

#### 4.1. General Overview

This chapter deals with the analysis of the information gathered from both the case study and the questionnaire survey. This includes the extent of project delay versus contract amount and the extent quality defect from existing road condition, identification and analysis of the main managerial causes of project delay and quality problem and remedial measure on cobblestone roads construction projects in Jimma town.

A case study had conducted within the cobblestone road project in Jimma Town. The documents referred during the case study include progress and completion reports, contract documents and claim submittal, variation orders, correspondences and other important documents of the projects in addition to this direct observation of site condition, correspondences from discussion and interview for selected projects. The purposes of the case study were to investigate the amount of project delay as compared to the original contract period and the quality defect from existing road condition and identify the managerial cause of project delay and quality problem and remedial measures on cobblestone roads construction projects in Jimma town.

For this research, 8 cobblestone road projects on Jimma town were selected for case study. The details and the list of eight projects are described hereunder.

1. Back side of Jimma zone police office – west region EELPA office.(project site No- 1)
2. Mars bakery – Sala bakery & Tirunesh hotel – Gibe clinic. (project site No-2)
3. Eyob clinic – Umer mosque cobble junction & Boni hotel – zone office asphalt junction. (project site No-3)
4. Nur restaurant asphalt junction - Infront of Arinet church cobble junction & Ato Nasir Residence - Hayat Bakery.(project site No-4)
5. JU kolober – Arinet church 1km with some masonry retaining around the river bank.(project site No-5)

6. Jimma University Asphalt junction to prison office & Kedir shop to Protestant church. Contract. (project site No-6)
7. Higher 02 Clinic - Bishishe Asphalt Junction and Dina Wood work A jip Shell Fuel Station. Contract. (project site No-7)
8. Green Hotel Asphalt Junction – Ato Bahiru Residence New Gravel Road. Contract.(project site No-8)

A questionnaire survey was designed based on the objectives of the study, which are managerial causes and remedial measures of project delay and quality problem on cobblestone road construction in jimma town.

Likewise, a questionnaire was sent to get the opinion and understanding from the client, consultant and local contractor regarding to managerial causes and remedial measures of project delay and quality problem on cobblestone road construction in jimma town. The questionnaires classified into three sections:

Section 1: Respondent rates and profile

Section 2: Managerial causes of project delay and quality problem.

Section 3: remedial measures to minimize managerial causes for project delay and quality problem.

## **4.2. Case study result**

### **4.2.1. Investigation the extent of project delay and quality problem from case study**

Information on eight-road projects; i.e. brief descriptions of the location, the contractors, clients, consultants, and contract type, commencement and completion time, original contract price and the road condition and estimation of maintenance budget of existing cobblestone road information are described and attached appendix B from table 4.25 to table 4.34.

During the case study an investigation of the extent of project delay was done by comparing the elapsed time from original contract period. Review of all the data received from the Eight-road construction projects on table 4.1 show that all the projects experienced delays. For these cobblestone road construction projects, an average time overrun was found to be 80.61% of the contract time, the actual delay ranging from 53.33% to 130%.

Table 4.1: The extent of project delay in eight cobblestone road construction project selected for the case study

No	Projects	Original contract period	Time elapsed based on original	% age of time elapsed	% age of work accomplished	% age of Project delay	Status of the project
1	Project site No-1	150 cal. Days	270	180	100	80	Completed
2	Project site No-2	90 cal. Days	207	230	84.83	130	On going
3	Project site No-3	90 cal. Days	186	206.67	87	107	On going
4	Project site No-4	150 cal. Days	230	153.33	100	53.33	Completed
5	Project site No-5	150 cal. Days	256	170.67	55	70.67	On going
6	Project site No-6	300 cal. Days	570	190.00	100	58.30	Completed
7	Project site No-7	150 cal. Days	256	170.67	100	70.67	Completed
8	Project site No-8	150 cal. Days	260	173.30	100	73.30	Completed

Similarly, during the case study, an investigation of quality problem of the project was done directly measuring the actual defect area or area which has a quality problem from total area of the existing finished cobblestone road construction found in each selected project site. Table 4.2. Show all the selected road projects have a quality problem and from those the selected cobblestone road projects an average quality problem/defect was found to be 23.75% of the existing finished cobblestone road construction found in each project site and the actual quality problem directly measuring the project site was ranging from 10 % to 41 %.



Table 4.2: The extent of quality problem in eight-cobblestone road construction project selected for the case study

No	Projects	Original contract period	Original contract amount	Total length (km)	Total area in (m <sup>2</sup> )	Quality problem in (%)	Status of the project
1	Project site No-1	150 cal. days	1,765,672.97	0.649	4548.3	20	Completed
2	Project site No-2	90 cal. days	776,048.52	0.305	2432.0	15	On going
3	Project site No-3	90 cal. days	1,036,057.26	0.402	3236.1	10	On going
4	Project site No-4	150 cal. days	1,779,898.12	0.625	5312.5	20	Completed
5	Project site No-5	150 cal. days	3,335,799.25	1.00	8000.0	23	On going
6	Project site No-6	300 cal. days	2,251,431.14	0.470	3360.0	35	Completed
7	Project site No-7	150 cal. Days	1,371,223.2	0.623	2600.0	41	Completed
8	Project site No-8	150 cal. Days	2,194,385.15	0.750	5250.0	26	Completed

#### **4.2.2. Managerial causes of project delay and quality problem on cobblestone road construction projects in Jimma town.**

As the finding from the document reviewed and the finding from the field observation indicated that a great project delay and quality problem in the cobblestone roads construction projects are clearly visible, the majority of the cobblestone roads faced some delay and quality defects like becoming deteriorated or decreasing in their quality because of so many reasons. The respondents to the researcher's interview supported this idea even though the type and degree of the problem is different in project to project. Therefore, in this section it discusses the managerial causes for project delay and quality problem on the selected eight-cobblestone road project.

##### **Case study One: Back side of Jimma zone police office – west region EELPA office. (Project site No-1)**

As shown on table 4.1 and 4.2 project delay and quality problem on this road, project site was about 80% and 20 % respectively. The main managerial causes for project delay and quality problem for this road construction project based on the information collected through case study are listed below.

Table 4.3: Managerial causes of project delay and quality problem on case study for project No - 1

No	Causes of project delay	Causes of quality problem
1	Poor planning and scheduling	poor technical & managerial efficiency
2	poor technical & managerial efficiency assign to construction project site	financial difficulties faced by contractors
3	Delay in provisional and final acceptance	Lack of quality control and assurance system
4	financial difficulties faced by contractors	Inappropriate construction methods
5	Delay in payment of completed works	Lack of Proper drainage
6	Shortage of construction materials	Road Operation above design limits
7	Lack of personnel training and management Support	Lack of engineering capacity building training program
8	Delay in response to decision making	Poor maintenance system
9	Use of improper equipment or machine	

**Case study Two: Mars bakery – Sala bakery & Tirunesh hotel – Gibe clinic. (Project site No-2)**

As shown on table 4.1 and 4.2 project delay and quality problem on this road project site was about 130% and 15% respectively. The main managerial causes for project delay and quality problem for this road construction project based on the information collected through case study are listed below.

Table 4.4: Managerial causes of project delay and quality problem on case study for project No-2

No	Causes of project delay	Causes of quality problem
1	Poor planning and scheduling	poor technical & managerial efficiency
2	Delay in payment of completed works	financial difficulties faced by contractors
3	poor technical & managerial efficiency assign to construction project site	Lack of quality control and assurance system
4	Financial difficulties faced by contractors	Lack of Proper drainage
5	Shortage of construction materials	Low quality construction material use
6	Delay in furnishing and delivering the site	Un proper use of community for complete road
7	Rework of bad quality performance	Lack of timely supervision/inspection
8	Delay in provisional and final acceptance	Government policy and strategy

**Case study Three: Eyob clinic – Umer mosque cobble junction & Boni hotel – zone office asphalt junction. (Project site No-3)**

As shown on table 4.1 and 4.2 project delay and quality problem on this road project site was about 107% and 15% respectively. The main managerial causes for project delay and quality problem for this road construction project based on the information collected through case study are listed below.

Table 4.5: Managerial causes of project delay and quality problem on case study for project No - 3

No	Causes of project delay	Causes of quality problem
1	poor technical & managerial efficiency assign to construction project site	poor technical & managerial efficiency
2	Poor planning and scheduling	financial difficulties faced by contractors
3	Delay in payment of completed works	Lack of quality control and assurance system
4	Delay in decision making process	Inappropriate construction methods
5	Shortage of construction materials	Lack of proper drainage
6	Financial difficulties faced by contractors	Low quality construction material use
7	Lack of project management system of those parties	Lack of engineering capacity building training program
8	Delay in furnishing and delivering the site	Un proper use of community for complete road
9		Lack of timely supervision/inspection

**Case study Four: Nur restourant asphalt junction – In front of Arinet church cobble junction & Ato Nasir Residence - Hayat Bakery. (Project site No-4)**

As shown on table 4.1 and 4.2 project delay and quality problem on this road project site was about 53.33% and 20% respectively. The main managerial causes for project delay and quality problem for this road construction project based on the information collected through case study are listed below.

Table 4.6: Managerial causes of project delay and quality problem on case study for project No - 4

No	Causes of project delay	Causes of quality problem
1	Poor planning and scheduling	poor technical & managerial efficiency
2	Delay in payment of completed works	financial difficulties faced by contractors
3	Use of improper equipment or machine	Lack of quality control and assurance system
4	Financial difficulties faced by contractors	Inappropriate construction methods
5	Rework due to errors during construction	Lack of Proper drainage

6	Lack of personnel training and management Support	Road Operation above design limits
7	variation work(extra work)	Low quality construction material use
8	Lack of communication	Poor maintenance system
9		Lack of frequent quality meeting

**Case study Five: JU kolober – Arinet church 1 km with some masonry retaining around the river bank. (Project site No-5)**

As shown on table 4.1 and 4.2 project delay and quality problem on this road project site was about 70.67% and 23% respectively. The main managerial causes for project delay and quality problem for this road construction project based on the information collected through case study are listed below.

Table 4.7: Managerial causes of project delay and quality problem on case study for project No - 5

No	Causes of project delay	Causes of quality problem
1	Poor planning and scheduling	poor technical & managerial efficiency
2	Delay in response to decision making	financial difficulties faced by contractors
3	Delay in furnishing and delivering the site	Lack of quality control and assurance system
4	poor technical & managerial efficiency assign to construction project site	Inappropriate construction methods
5	Delay in payment of completed works	Lack of Proper drainage
6	Lack of project management system of those parties	Road Operation above design limits
7	financial difficulties faced by contractors	Low quality construction material use
8	Shortage of construction material	Lack of engineering capacity building training program
9	Lack of personnel training and management Support	Government policy and strategy

**Case study six: Jimma University Asphalt junction to prison office & Kedir shop to Protestant church. (Project site No-6)**

As shown on table 4.1 and 4.2 project delay and quality problem on this road project site was about 58.30% and 35% respectively. The main managerial causes for project delay and quality problem for this road construction project based on the information collected through case study are listed below.

Table 4.8: Managerial causes of project delay and quality problem on case study for project No - 6

No	Causes of project delay	Causes of quality problem
1	Poor planning and scheduling	poor technical & managerial efficiency
2	Shortage of construction materials	financial difficulties faced by contractors
3	poor technical & managerial efficiency assign to construction project site	Lack of quality control and assurance system
4	Lack of project management system of those parties	Inappropriate construction methods
5	Financial difficulties faced by contractors	Road Operation above design limits
6	Delay in payment of completed works	Poor maintenance system
7	Delay in provisional and final acceptance	Un proper use of community for complete road
8	Rework due to errors during construction	Lack of timely supervision/inspection
9	variation work(extra work)	Lack of frequent quality meeting

**Case study Seven: Higher 02 Clinic - Bishishe Asphalt Junction, Dina Wood work – Ajip Shell Fuel Station. (Project site No-7)**

As shown on table 4.1 and 4.2 project delay and quality problem on this road project site was about 70.67% and 41% respectively. The main managerial causes for project delay and quality problem for this road construction project based on the information collected through case study are listed below.

Table 4.9: Managerial causes of project delay and quality problem on case study for project No - 7

No	Causes of project delay	Causes of quality problem
1	Poor planning and scheduling	poor technical & managerial efficiency
2	Delay in furnishing and delivering the site	Financial difficulties faced by contractors
3	poor technical & managerial efficiency assign to construction project site	Lack of quality control and assurance system
4	Delay in provisional and final acceptance	Inappropriate construction methods
5	Financial difficulties faced by contractors	Lack of Proper drainage
6	Lack of practicing contract administration(liquidated damage rule ,etc)	Road Operation above design limits
7	Delay in response to decision making	Low quality construction material use
8	Delay in furnishing and delivering the	Lack of engineering capacity building training program
9	Use of improper equipment or machine	Poor maintenance system
10		Un proper use of community for complete road

**Case study Egiht: Green Hotel Asphalt Junction – Ato Bahiru Residence New Gravel Road. (Project site No-8)**

As shown on table 4.1 and 4.2 project delay and quality problem on this road project site was about 73.30% and 26% respectively. The main managerial causes for project delay and quality problem for this road construction project based on the information collected through case study are listed below.

Table 4.10: Managerial causes of project delay and quality problem on case study for project No-8

No	Causes of project delay	Causes of quality problem
1	Poor planning and scheduling	poor technical & managerial efficiency
2	Delay in payment of completed works	Financial difficulties faced by contractors
3	poor technical & managerial efficiency assign to construction project site	Lack of quality control and assurance system
4	Delay in provisional and final acceptance	Inappropriate construction methods
5	Lack of project management system of those parties	Lack of Proper drainage
6	Financial difficulties faced by contractors	Road Operation above design limits
7	Shortage of construction materials	Low quality construction material use
8	Delay in response to decision making	Lack of engineering capacity building training program
9		Poor maintenance system

**4.2.3. Summary of case study results on managerial causes for project delay and quality problem.**

➤ **For project delay**

The managerial causes of project delay and quality problem investigated from case study for the eight-cobblestone road projects above further analyzed were to spot the most frequent causes leading to project delay. Accordingly, the frequency and percentage of occurrence of each causes leading to project delay were determined and the results are shown in Table 4.11.

Table 4.11: Frequency of observed and rank managerial causes of project delay on cobblestone road projects for case study

No	Managerial causes of project delay based on case study	Number of Frequency	% age of frequency	Rank
1	Poor planning and scheduling of the project	8	11.94	1
2	financial difficulties faced by contractors	8	11.94	1
3	Delay in approving interim payments of completed Works	7	10.45	3
4	Poor technical & managerial efficiency assign to construction project site.	7	10.45	3
5	Shortage of construction materials	6	8.95	5
6	Delay in provisional and final acceptance of completed project	5	7.46	6
7	Delay in response to decision making process	5	7.46	6
8	Lack of project management system of those parties	4	5.97	8
9	Delay to handover and delivering the site to the contractor (i.e. right of way problem)	4	5.97	8
10	Rework due to errors during construction and design	3	4.48	10
11	Use low productivity and efficiency equipment or machine for construction process	3	4.48	10
12	Lack of personnel training and management support	3	4.48	10
13	Variations orders due to (design changes/ extra work)	2	2.99	13
14	Lack of communication between those parties of the project	1	1.49	14
15	Lack of practicing contract administration (liquidated damage rule ,etc)	1	1.49	14

From the result of the analysis observed from Table 4.11 that the top ten most causes as investigated from case studies among the 15 potential managerial causes for project delay on cobblestone road construction projects in Jimma town are:

- ☞ Poor planning and scheduling of the project
- ☞ financial difficulties faced by contractors
- ☞ Delay in approving interim payments of completed works
- ☞ Poor technical & managerial efficiency assign to construction project site.

- ☞ Shortage of construction materials
- ☞ Delay in provisional and final acceptance of completed project
- ☞ Delay in response to decision making process
- ☞ Lack of project management system
- ☞ Delay to handover and delivering the site to the contractor (i.e. right of way problem)
- ☞ Rework due to errors during construction and design

➤ **For Quality problem**

The managerial causes for quality problem investigated from case study for the eight-cobblestone road projects above further analyzed were to spot the most frequent causes leading to project quality problem. Accordingly, the frequency and percentage of occurrence of each causes leading to project quality problem were determined and the results shown in Table 4.12.

Table 4.12: Frequency of observed and rank managerial causes for quality problem on cobblestone road projects for case study

No	Factors affecting quality performance Based on Case Study	Number of Frequency	% age of frequency	Rank
1	poor technical & managerial efficiency assign to construction project site	8	11.27	1
2	financial difficulties faced by contractors	8	11.27	1
3	Lack of quality control and assurance system during construction	8	11.27	1
4	Inappropriate construction methods as per design & Specification	7	9.56	4
5	Lack of proper drainage during construction	7	9.56	4
6	Road operation above design limits (Unrestricted traffic load control)	6	8.45	6
7	Improper material selection & low quality construction material use	6	8.45	6
8	Poor maintenance system during & after construction	5	7.04	8
9	Lack of Engineering Capacity Building training Program	5	7.04	8



No	Factors affecting quality performance Based on Case Study	Number of Frequency	% age of frequency	Rank
10	Un proper use of community for complete road work	4	5.63	10
11	Lack of timely supervision/inspection at construction site	3	4.23	11
12	Government policy and strategy	2	2.82	12
13	Lack of frequent quality meeting	2	2.82	13

From the result of the analysis observed from Table 4.12 that the top ten most causes as investigated from case studies among the 13 potential managerial causes for quality problem on cobblestone road construction projects in Jimma town are:

- ☞ poor technical & managerial efficiency assign to construction project site
- ☞ financial difficulties faced by contractors
- ☞ Lack of quality control and assurance system during construction
- ☞ Inappropriate construction methods as per design & Specification
- ☞ Lack of Proper drainage during construction
- ☞ Road operation above design limits (Unrestricted traffic load control)
- ☞ Improper material selection & low quality construction material use
- ☞ Poor maintenance system during & after construction
- ☞ Lack of engineering capacity building training program
- ☞ Un proper use of community for complete road work

### 4.3. Questionnaire Survey Result

This section deals with the analysis of the information gathered from the questionnaire survey to obtain information on the causes that contribute to the managerial causes for project delay and quality problem from the perspective of owner, contractor and consultant. The section includes identification for managerial causes for project delay and quality problem, and remedial measure for project delay and quality problem on cobblestone road construction project in Jimma town.

### 4.3.1. Questionnaires Response Rate

As stated in section 3.4, questionnaires were distributed to the major parties that play dominant role in day-to-day construction activities. These are contractors, consultants and clients of the sector. For the preparation of comprehensive analysis on project delay and quality problem, 40 questionnaires were distributed and out of which 38 are collected from volunteer respondents. The number of questionnaire completed and returned by each main party comprised of 18 from contractor, 10 from consultant and 9 from client. This yields a response rate of 95 %. Before starting the analysis, the returned questionnaire were checked for their reliability and all the 38 were found to be suitable for data analysis with a valid response rate of 95%, while no responses were cast off in missing information. Fig 4.1 shows number and rate of responses by major stakeholders.

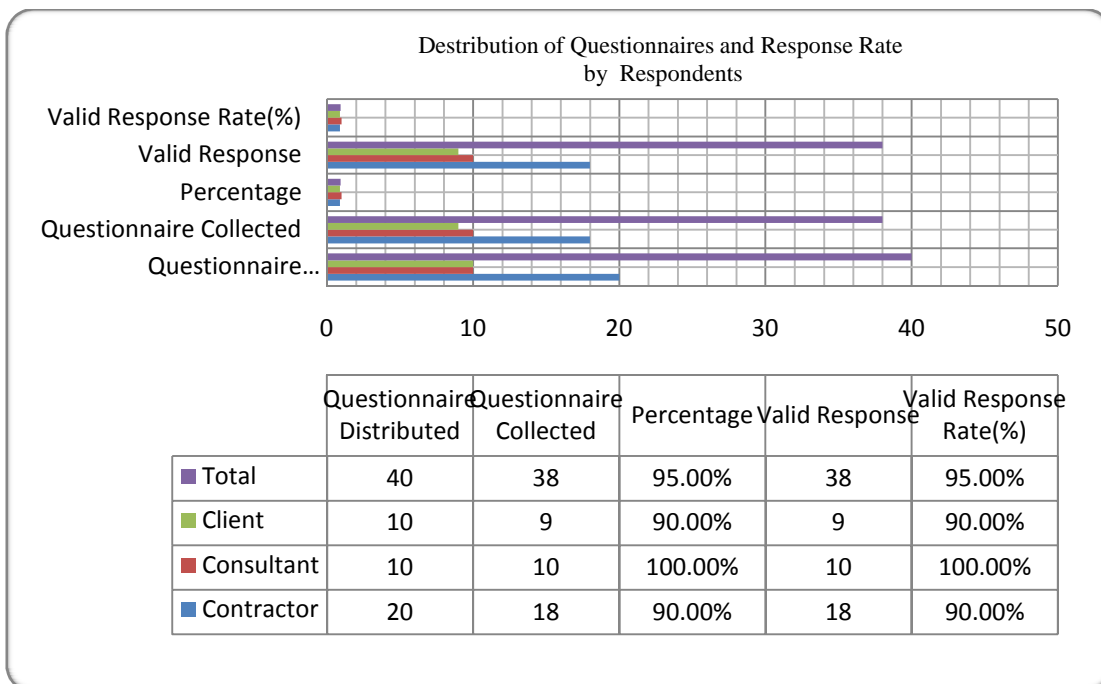


Fig. 4 .1: Distribution of Questionnaires and response rate by respondents

### 4.3.2. Respondents Profile

This is a part mainly designed to provide general information about the respondents in terms of organization, position and experience in year and involvement in road construction projects.

### 4.3.2.1. Respondents designation by Position

Figure 4.2 shows that 50 % (9) of contracting companies respondents were organization managers, 33.33% (6) were Forman and, 22.22% (4) were surveyors. From the client's respondent's 11.11% (1) project manager, organization manager, office engineer, surveyor for each and 55.56% (5) were others. The result also revealed that 10.00% (1) of consultant's respondents were project managers, organization managers for each and 80% (8) were site engineers. Totally, out of 38 respondents for the three parties, 5.00% (2) of the respondents were projects managers, 27.50% (11) were organization managers, 22.25% (9) were site/office Engineers, 15.00% (6) were Forman,12.50% (5) were Surveyor and 12.50% (5) were Others.

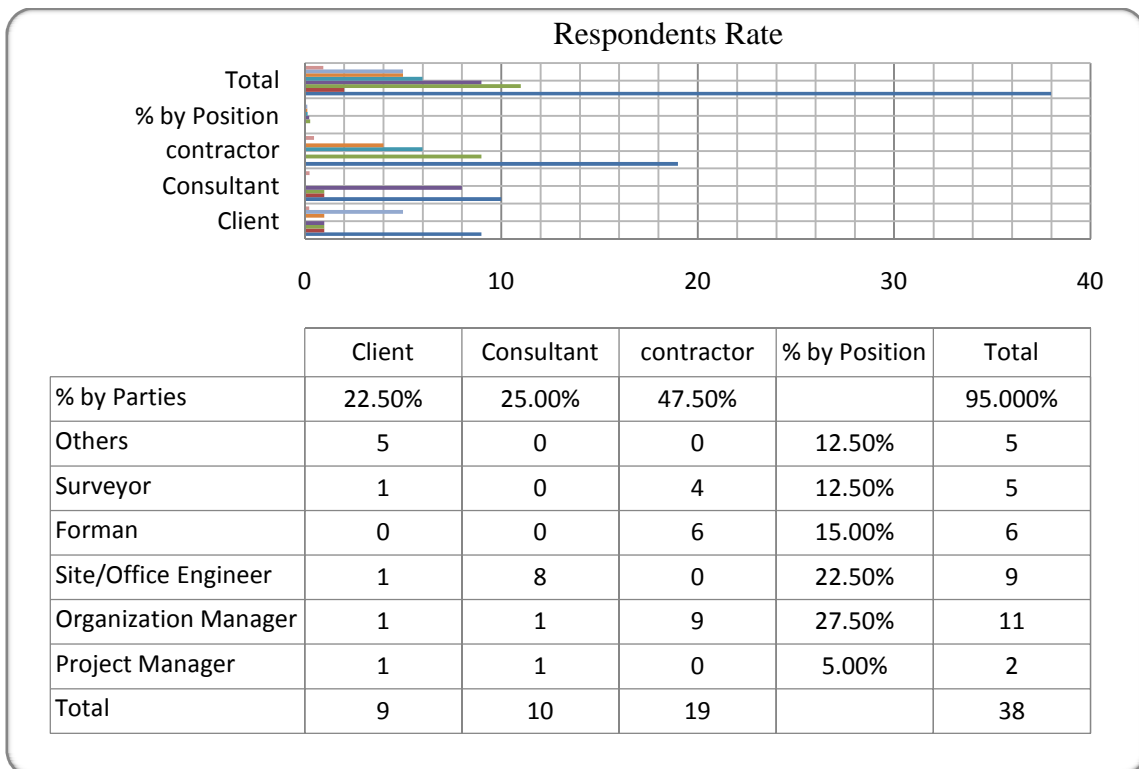
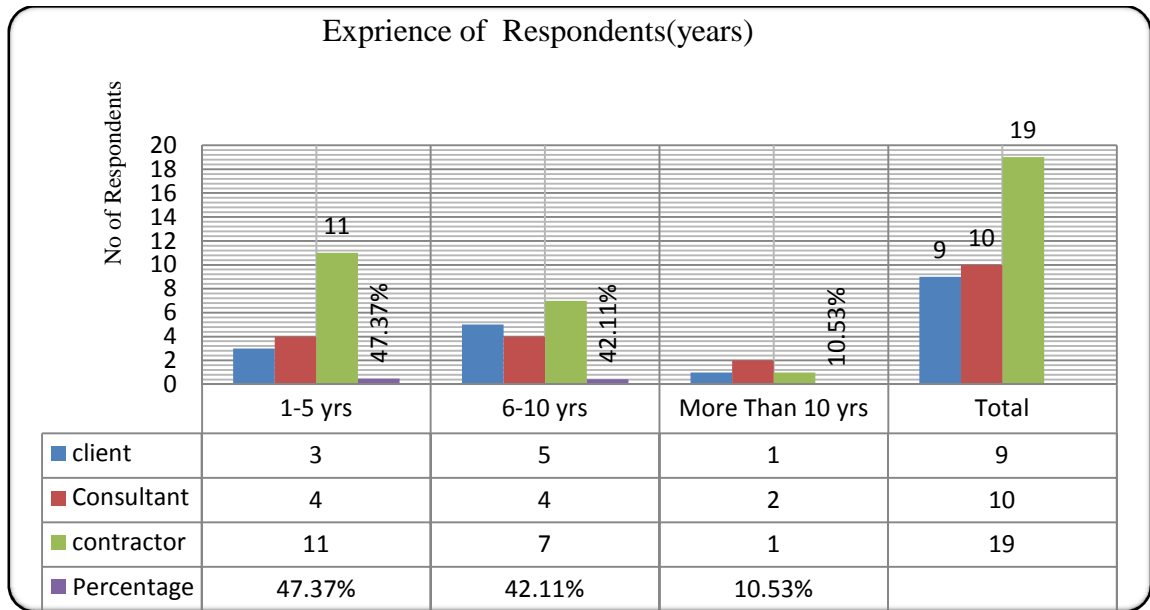


Fig 4.2: Respondents designation by position

### 4.3.2.2. Experience of respondents by service year

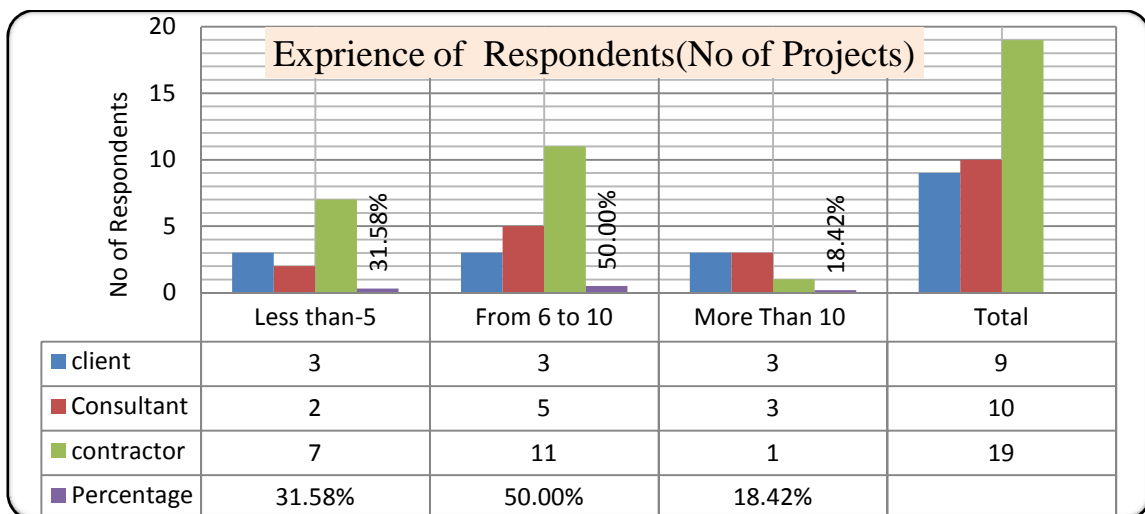
Figure 4.3 shows that 47.37 % (18) of the respondents have experience between 1 to 5 years road construction works, 42.11% (16) of the respondents have experience in between 5 and 10 years' service in road projects, and 10.53 % (4) of the respondents have experience from for more than 10 years.



Fig; 4.3: Experience of respondents

#### 4.3.2.3. Experience of respondents by involvement in road projects

Figure 4.4 shows that 31.58 % (12) of the respondents have experience of involvement in 1 to 5 road construction projects , 50.00% (19) of the respondents have experience of involvement in 5 to 10 road construction projects, and 18.42 % (7) of the respondents have experience of involvement in more than 10 road construction projects. Generally, all respondents have at least a single chance of involvement in road construction projects. This indicates that each respondent can respond to the questionnaire without problem.



Fig; 4.4: Experience of respondents based on project execution

### 4.3.3. Managerial causes of project delay and quality problem analysis from questionnaire survey results.

In this section, a list of 25 causes of project delay and 23 causes of quality problem were presented to the respondents to rank and score them according to rate of occurrence by identifying the most managerial causes, on the scale of 1 to 5. The relative importance index (RII) for each potential causes of delay and quality problem were calculated using equation (1) – section 3.5 of this thesis; and the correlation between the rank of the client, consultant and contractor were computed using equation (2) to rank the causes based on overall perception.

#### 4.3.3.1. Ranking managerial causes of project delay and quality problem according to each target groups

The results of this part of study provide an indication of the relative importance index and rank of managerial causes of project delay and quality problem on cobblestone road projects of Jimma town. Table 4.13 and 4:14 shows summary of causes according to each type of target groups.

Table 4.13: The relative importance index (RIIS) and rank managerial causes of project delay among those target groups

No	LIST OF FACTOR	CLIENT		CONSULTANTS		CONTRACTOR	
		RIIS	RANK	RIIS	RANK	RIIS	RANK
1	Type of project bidding and award of contract (the lowest bidder)	4.111	3	4.091	2	4.211	3
2	Improper technical selection of contractor during the bidding stage	1.778	11	1.200	15	2.211	12
3	Inadequate duration of contract period	2.111	10	2.000	12	2.947	10
4	Delay to handover and delivering the site (right of way problem)	3.333	6	3.800	4	4.211	3
5	Delay in approving interim payments of completed works	3.667	4	2.900	7	4.368	2
6	Poor planning and scheduling of the project	4.333	2	3.900	3	4.053	4
7	Improper construction technical and methods	2.333	9	1.600	13	2.211	12
8	Rework due to errors during construction	3.333	6	3.200	5	3.737	6
9	Lack of frequent meeting	3.556	5	3.000	6	2.632	11
10	financial difficulties faced by contractors	4.111	3	4.400	1	4.526	1
11	Shortage of construction materials	3.667	4	3.800	4	3.895	5
12	Use low productivity and efficiency equipment or machine	3.556	5	2.500	10	3.421	8

No	LIST OF FACTOR	CLIENT		CONSULTANTS		CONTRACTOR	
		RIIS	RANK	RIIS	RANK	RIIS	RANK
13	Delay in response to decision making process	3.667	4	3.200	5	4.368	2
14	Lack of practicing contract administration(liquidated damage rule ,etc)	1.556	12	1.300	14	1.474	14
15	Variations orders due to(design changes/ extra work)	3.333	6	2.700	8	3.421	8
16	Lack of communication between those parties of the project	3.222	7	2.500	10	3.053	10
17	Poor site management/ Insufficient coordination	4.333	2	3.200	5	4.053	4
18	Poor supervision	2.333	9	1.600	13	3.053	10
19	Lack of project management system on those parties	4.556	1	3.800	4	4.211	3
20	Insufficient number of management staffs on those parties	3.222	7	2.600	9	3.526	7
21	Inflation of construction material	2.333	9	2.200	11	3.421	8
22	Delay in provisional and final acceptance of completed project	3.333	6	3.200	5	3.737	6
23	Lack of personnel training and management support	2.778	8	2.600	9	2.632	11
24	Changes in laws and regulations	1.222	13	1.200	15	1.789	13
25	Contractual claims, such as, extension of time with cost claims	2.111	10	2.000	12	3.263	9

Table (4.13) shows all managerial causes of project delay and quality on cobblestone road construction project in jimma town. Included in the questionnaire and ranked in according to their weight from the client’s, consultants and contractor’s perspective based on the data in Table (4.13). The result shows that on jimma town cobblestone road construction project client’s considered lack of project management system on those parties to be the top significant factor affecting time performance Score of (RIIS = 4.556). Moreover, poor planning and scheduling of the project and Poor site management/ Insufficient coordination is the second significant factor with a score of (RIIS = 4.333 and RIIS = 4.333) each and then the third causes of project delay ranked by the client’s respondents was type of project bidding and award of contract (the lowest bidder) and financial difficulties faced by contractors with a score of (RIIS = 4.111 and RIIS = 4.111) each. The scores of the five most important causes of project delay was range between (4.556 And 4.111). Generally the results show that consultants considered(20.00%) of the delay causes as very high, (44.00%) of the delay causes as highly important, (24.00%) of them as medium important and rest of them is low important.

According to consultants, consideration on the result shows Table (4.13). Financial difficulties faced by contractors, type of project bidding and awarding of contracts to the lowest bidder to be the top significant causes of project delay Score of (RIIS = 4.400 and RIIS = 4.091) respectively. Poor planning and scheduling of the project is the third causes of project delay with a score of (RIIS = 3.900), delay to handover in furnishing and delivering the site (right of way problem), Shortage of construction materials and Lack of project management system on those parties was the fourth causes of project delay with a Score of (RIIS = 3.800, RIIS = 3.800 and RIIS = 3.800) each. The scores of the five most important causes of project delay was range between (4.400 And 3.800). Generally the results show that consultants considered (8.00%) of the delay causes as very high, (36.00%) of the delay causes as highly and medium important for each and rest of them is low important.

According to contractor consideration on the result shows Table (4.13). Financial difficulties faced by contractors to be the top significant causes of project delay Score of (RIIS = 4.526), delay in approving interim payments of completed works and delay in response to decision making process is the second causes of project delay with a score of (RIIS = 4.368 and RIIS = 4.368) each and also type of project bidding and award of contract (the lowest bidder), delay to handover and delivering the site (right of way problem) and Lack of project management system on those parties third position with a score of (RIIS = 4.211, RIIS = 4.211 and RIIS = 4.211) for each. Generally the results show that contractors considered (32.00%) of the delay causes as very high and highly important for each and rest of them is low important.

Table 4.14: The relative importance index (RIIS) and rank managerial causes for quality problem among those target groups

No	LIST OF FACTOR	OWNER		CONSULTANTS		CONTRACTOR	
		RIIS	RANK	RIIS	RANK	RIIS	RANK
1	Project Fund and project budget is small	2.556	8	2.500	9	3.158	9
2	Awarding of contracts to the lowest bidder	3.222	5	4.400	2	4.158	3
3	Poor planning and scheduling of the project during & per-construction phase	2.333	9	2.200	11	2.737	11
4	Inappropriate method of consultant & contractor selecting	1.444	13	2.500	9	2.579	12
5	Low effective quality management system and Lack of commitment.	2.667	7	4.000	4	3.158	9
6	Inappropriate construction methods as per design & Specification	4.556	1	2.400	10	4.053	4
7	poor technical & managerial efficiency assign to construction project site	2.222	10	2.000	13	2.895	10

No	LIST OF FACTOR	OWNER		CONSULTANTS		CONTRACTOR	
		RIIS	RANK	RIIS	RANK	RIIS	RANK
8	Lack of frequent quality meeting	3.667	3	2.600	8	2.579	12
9	Use of improper equipment or machine for construction process	3.000	6	2.200	11	2.421	13
10	Improper material selection & low quality construction material use	3.556	4	3.400	6	3.947	5
11	Financial difficulties faced by contractors	3.667	3	4.600	1	4.316	1
12	Lack of Quality training	1.889	12	1.800	14	2.737	11
13	Delay in response to decision making process	2.000	11	2.400	10	2.579	12
14	Lack of timely supervision/inspection at construction site	3.000	6	2.100	12	3.158	9
15	Insufficient coordination/Lack of communication between those parties of the project.	2.333	9	2.400	10	2.421	13
16	Lack of quality control and assurance system	4.444	2	2.600	8	3.947	5
17	Insufficient number of management staffs on those parties	3.222	5	2.900	7	3.474	8
18	Lack of Proper drainage during construction	2.667	7	4.300	3	4.211	2
19	Delay in response to decision making process	2.556	8	2.400	10	3.737	7
20	Road Operation above design limits (Unrestricted traffic load control)	3.333	4	3.600	5	4.053	4
21	Un proper use of community for complete road work	1.889	12	2.500	9	3.474	8
22	Poor maintenance system during & after construction	2.667	7	4.400	2	3.895	6
23	Government policy and strategy	2.222	10	2.900	7	2.421	13

Table (4.14) shows all causes of quality problem on cobblestone road construction project for in jimma Town included in the questionnaire and ranked in according to their weight from the owner's, consultant's and contractor's perspective based on the data in Table (4.14). The result shows that on jimma Town cobblestone road construction project owners considered Inappropriate construction methods as per design & Specification to be the top significant managerial causes of quality problem Score of (RIIS = 4.556). Moreover, Lack of quality control and assurance system is the second significant factor with a score of (RIIS = 4.444), then the third causes affecting quality problem ranked by the owners respondents was lack of frequent quality meeting and financial difficulties faced by contractors with a score of (RIIS = 3.667 and RIIS = 3.667) each and Improper material selection & low quality construction



material use and road operation above design limits (Unrestricted traffic load control) was the fourth position with a score of (RIIS = 3.556 and RIIS = 3.556) for each. Generally the results show that client considered (8.70%) of the quality causes as very high important, (34.78%) of the quality causes as highly important, (31.13%) of them as medium important and rest of them is low important.

According to consultants consideration on the result shows Table (4.14). Financial difficulties faced by contractors to be the top significant causes of quality problem Score of (RIIS = 4.600). Moreover, awarding of contracts to the lowest bidder and poor maintenance system after construction was second significant causes with a score of (RIIS = 4.400 and RIIS = 4.400), then the third causes of quality problem ranked by the consultants respondents was lack of Proper drainage during construction with a score of (RIIS = 4.300) and low effective quality management system and lack of commitment was the fourth position with a score of (RIIS = 4.000). Generally the results show that consultants considered (21.37%) of the quality causes as very high important, (8.70%) of the quality causes as highly important, (60.87%) of them as medium important and rest of them is low important.

According to contractors consideration on the result shows Table (4.14). Financial difficulties faced by contractors to be the top significant causes of quality problem Score of (RIIS = 4.316). Moreover, lack of Proper derange during construction was second significant factor with a score of (RIIS = 4.211), then the third causes of quality problem ranked by the contractors respondents was awarding of contracts to the lowest bid with a score of (RIIS = 4.158) and inappropriate construction methods as per design & Specification and road operation above design limits (Unrestricted traffic load control) was the fourth causes of quality problem with a Score of (RIIS = 4.053 and RIIS = 4.053) each. Generally the results show that contractors considered (26.10%) of causes of quality problem is very high, (31.13%) of causes of quality problem is high and (34.78%) of them as medium.

#### **4.3.3.2. Test for agreement on managerial causes of project delay and quality problem among respondents**

The agreement of project participants was ranking managerial causes of project delay and quality problem. The rank for the causes of project delay and quality problem based on cumulative value for their relative importance index as identified by each party are listed in Table 4.13 and 4.14 above. The agreement in ranking of the causes between respondents in each category: clients, consultants and contractors need to be tested. As discussed in section

3.5 of this research, Spearman rank correlation coefficient applied to test the agreements and uses p-value for testing significance.

Table 4.15 presents the spearman correlation coefficient for delay causes among the three respondents group such as client, consultant and contractor. For this correlation group, the coefficient between client and contractor equals to 0.831 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a significant relationship between client and contractor. The correlation coefficient between consultant and contractor equals to 0.855 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a significant relationship between consultant and contractor. In addition, the correlation coefficient between client and consultant equals to 0.893 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is an insignificant relationship between client and consultant.

Table 4.15: Correlation test of managerial causes of project delay group among client, consultant and contractor

Group	Client and Contractor	P-Value	Consultant and Contractor	P-Value	Client and Consultant	P-Value
	Correlation Coefficient		Correlation Coefficient		Correlation Coefficient	
Time factor	0.831	0.000*	0.855	0.000*	0.893	0.000*

Correlation is significant at 0.05 significances level

Similarly Table 4.16 presents the spearman correlation coefficient for quality causes among the three respondents group such as client, consultant and contractor. For this correlation group, the coefficient between client and contractor equals to 0.578 with P-value (Sig.) = 0.004. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a significant relationship between client and contractor. The correlation coefficient between consultant and contractor equals to 0.589 with P-value (Sig.) = 0.003. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a significant relationship between consultant and contractor.

In addition, the correlation coefficient between client and consultant equals to 0.429 with P-value (Sig.) = 0.04. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is an insignificant relationship between client and consultant.

Table 4.16: Correlation test of managerial causes of quality problem group among, client, consultant and contractor

Group	Client and Contractor	P-Value	Consultant and Contractor	P-Value	Client and Consultant	P-Value
	Correlation Coefficient		Correlation Coefficient		Correlation Coefficient	
Quality factor	0.578	0.004.	0.589	0.003	0.429	0.041

\* Correlation is significant at 0.05 significances level

From Table 4.15 and 4.16 above, it can be concluded that there is a good correlation between the attitudes of the respondents in project delay and quality factor groups. This means that most of the respondents have similar perception on project delay and quality problem causes. Results also indicated that there is a strong agreement between client, consultant and contractors.

#### 4.3.3.3. Managerial causes of project delay and quality problem from all respondents group

Table 4.17 and 4.18 shows the rank of all managerial causes of project delay and quality problem that have been investigated in this research from owner, consultant and contractor point views. The ranking of twenty-five causes of project delay and twenty-three causes quality problem on cobblestone road projects in Jimma town as shown in table 4.17 and 4.18 below. The rank is based on importance index values.

Table 4.17: Overall relative importance index (RIIS) and rank managerial causes of project delay by all respondents group

No	LIST OF FACTOR	OVERALL	
		RIIS	RANK
1	financial difficulties faced by contractors	4.395	1
2	Type of project bidding and award of contract (the lowest bidder)	4.184	2
3	Lack of project management system of those parties	4.184	2
4	Poor planning and scheduling of the project	4.079	4
5	Delay to handover and delivering the site (right of way problem)	3.895	5
6	Delay in response to decision making process	3.895	5
7	Poor site management/ Insufficient coordination	3.895	7
8	Delay in approving interim payments of completed works	3.816	8
9	Shortage of construction materials	3.816	8
10	Rework due to errors during construction	3.500	10
11	Delay in provisional and final acceptance of completed project	3.500	10
12	Use low productivity and efficiency equipment or machine	3.211	12
13	Insufficient number of management staffs by parties	3.211	12
14	Lack of frequent meeting	2.947	14
15	Lack of communication between those parties of the project	2.947	13
16	Inflation of construction material	2.842	14
17	Lack of personnel training and management support	2.658	15
18	Contractual claims, such as, extension of time with cost claims	2.658	15
19	Inadequate duration of contract period	2.500	17
20	Poor supervision	2.500	17
21	Improper construction technical and methods	2.079	19
22	Variations orders due to (design changes/ extra work)	2.079	19
23	Improper technical selection of contractor and during the bidding stage	1.842	21
24	Changes in laws and regulations	1.500	22
25	Lack of practicing contract administration (liquidated damage rule)	1.447	23

Results indicated that out of the identified 25 causes of project delay 3 (12.0%) causes were rated as low relative importance score, 9 (36.0 %) causes were rated as medium and higher relative importance score for each and 4 (16 %) causes were rated as very high importance score.

In general, the analysis result revealed that more than half of the causes (76.00%) are medium to higher importance range regarding in contributing to project delay on cobblestone roads construction projects in Jimma town; and hence it needs to be minimize through appropriate delay management system by the concerned stakeholders.

Table 4.18: Overall relative importance index (RIIS) and rank managerial causes for quality problem by all respondents group

No	LIST OF FACTOR	OVERALL	
		RIIS	RANK
1	Financial difficulties faced by contractors	4.237	1
2	Awarding of contracts to the lowest bidder	4.000	2
3	Inappropriate construction methods as per design & Specification	3.868	3
4	Lack of Proper drainage during construction	3.763	4
5	Lack of quality control and assurance system	3.737	5
6	Poor maintenance system during & after construction	3.737	5
7	Improper material selection & low quality construction material use	3.711	7
8	Road Operation above design limits (Unrestricted traffic load control)	3.711	7
9	Low effective quality management system and Lack of commitment.	3.263	9
10	Delay in response to decision making process	3.263	9
11	Un proper use of community for complete road work	3.105	11
12	Poor planning and scheduling of the project during & per-construction phase	2.842	12
13	poor technical & managerial efficiency assign to construction project site	2.842	12
14	Insufficient number of management staffs on those parties	2.842	12
15	Government policy and strategy	2.842	12
16	Lack of frequent quality meeting	2.500	16
17	Use of improper equipment or machine	2.500	16
18	Lack of timely supervision/inspection at construction site	2.500	16
19	Project Fund and project budget is small	2.500	16
20	Change order during construction	2.395	20
21	Lack of Quality training	2.395	20
22	Insufficient coordination/Lack of communication between those parties of the project.	2.289	22
23	Inappropriate method of consultant & contractor selecting	2.289	22

Results indicated that out of the identified 23 causes quality problem 11 (47.83%) causes were rated as medium relative importance score, 10 (43.48 %) causes were rated as higher relative importance score and 2 (8.70%) causes were rated as very high importance score.

In general, the analysis result revealed that more than half of the causes (100%) are medium to higher importance range regarding in contributing to quality problem on cobblestone roads construction projects in Jimma town; and hence needs to minimize through appropriate quality management system by the concerned stakeholders.

#### 4.3.3.4. Summary of Questionnaire Survey on the most important causes for project delay and quality problem by all respondents group

The next step in the research process was to rank the most important managerial causes for project delay and quality problem based on the higher relative importance index value. To this end, only the first ten causes selected for further analysis. However, the first ten causes were selected for further analysis based on the explanations given on the preceding pages, as more causes need to be minimized, although only the top ten most important causes that need to be considered as suggested in literature.

Accordingly, the analysis result of the respondents' response on ranking of the causes for the selected the most important ten causes for project delay and quality problem summarized in Table 4.19 and 4.20 below. The ranking of the overall project delay and quality problem presented in Table 4.17 and 4.18 above.

Table 4.19: Overall most important managerial causes for project delay by all respondent groups

No	LIST OF FACTOR	OVERALL	
		RIIS	Rank
1	financial difficulties faced by contractors	4.395	1
2	Type of project bidding and award of contract (the lowest bidder)	4.184	2
3	Lack of project management system of those parties	4.184	2
4	Poor planning and scheduling of the project	4.079	4
5	Delay to handover and delivering the site (right of way problem)	3.895	5
6	Delay in response to decision making process	3.895	5
7	Poor site management/ Insufficient coordination	3.895	7
8	Delay in approving interim payments of completed works	3.816	8
9	Shortage of construction materials	3.816	8
10	Rework due to errors during construction	3.500	10

Table 4.20: Overall most important managerial causes for quality problem by all respondents group

No	LIST OF FACTOR	OVERALL	
		RIIS	Rank
1	Financial difficulties faced by contractors	4.237	1
2	Awarding of contracts to the lowest bidder	4.000	2
3	Inappropriate construction methods as per design & Specification	3.868	3
4	Lack of Proper drainage during construction	3.763	4
5	Lack of quality control and assurance system	3.737	5
6	Poor maintenance system after construction	3.737	5
7	Improper material selection & low quality construction material use	3.711	7
8	Road Operation above design limits (Unrestricted traffic load control)	3.711	7
9	Low effective quality management system and Lack of commitment.	3.263	9
10	Delay in response to decision making process	3.263	9

#### 4.3.3.5. Comparison of results from Case Study and Questionnaire Survey

As it was described in the previous sections that the assessment of the causes that led to managerial causes for project delay and quality problem on cobblestone road construction projects in Jimma town were investigated by applying in the two methods such as case study and questionnaire survey. An attempt made to identify the most prevalent causes that led to the project delay and quality problem investigated in the study in Jimma town.

After a thorough investigation of the causes, the computation of the frequency of occurrence, percentage of occurrence as well as the ranking of the causes identified by each method carried out. Then, the identification and listing of the top ten prevalent or frequently occurring causes made for both methods. The result so obtained has paved the way to compare the outcome of the two methods.

In general, the most prevalent cases investigated through case study and questionnaire survey were analyzed and checked for agreement. Table 4.21 and 4.22 shows the analysis of the agreement of most prevalent causes identified through case study and questionnaire survey. As can be seen from Table 4.21 and 4.22 of the top ten causes identified by both methods, eight causes for project delay and seven causes for quality problem were found to be in agreement where as two causes for project delay and three causes for quality problem were not. This shows that there is 80% for project delay and 70% for quality problem was the agreement between the two methods.

Table 4.21: Summary of potential managerial causes that occurred both on case study and questionnaire survey for the project delay

No.	Managerial causes of project delay investigated from case study and questionnaire survey	Causes Occurring in case study tick ( ✓ )	Causes occurred in questionnaire survey tick ( ✓ )	Agreement between the two methods
1	Financial difficulties faced by contractors	✓	✓	Agreed
2	Type of project bidding and award of contract (to the lowest bidder)	Not Occurred	✓	Not Agreed
3	Lack of project management system of those parties	✓	✓	Agreed
4	Poor planning and scheduling of the project	✓	✓	Agreed
5	Delay to handover and delivering the site (right of way problem)	✓	✓	Agreed
6	Delay in response to decision making process	✓	✓	Agreed
7	Poor site management/ Insufficient coordination	Not Occurred	✓	Not Agreed
8	Delay in approving interim payments of completed works	✓	✓	Agreed
9	Shortage of construction materials	✓	✓	Agreed
10	Rework due to errors during construction	✓	✓	Agreed
11	Poor technical & managerial efficiency assign to construction project site	✓	Not Occurred	Not Agreed
12	Delay in provisional and final acceptance of completed project	✓	Not Occurred	Not Agreed



Table 4.22: Summery of potential causes that occurred both on case study and questionnaire survey for quality problem

No.	Managerial causes of quality problem investigated from case study and questionnaire survey	Causes Occurring in case study tick (✓)	Causes Occurred in questionnaire survey tick (✓)	Agreement between the two methods
1	Financial difficulties faced by contractors	✓	✓	Agreed
2	Awarding of contracts to the lowest bidder	Not Occurred	✓	Not Agreed
3	Inappropriate construction methods as per design & Specification	✓	✓	Agreed
4	Lack of Proper drainage during construction	✓	✓	Agreed
5	Lack of quality control and assurance system	✓	✓	Agreed
6	Poor maintenance system after construction	✓	✓	Agreed
7	Improper material selection & low quality construction material use	✓	✓	Agreed
8	Road Operation above design limits (Unrestricted traffic load control)	✓	✓	Agreed
9	Low effective quality management system and Lack of commitment.	Not Occurred	✓	Not Agreed
10	Delay in response to decision making process	Not Occurred	✓	Not Agreed
11	poor technical & managerial efficiency assign to construction project site	✓	Not Occurred	Not Agreed
12	Lack of engineering capacity building training program	✓	Not Occurred	Not Agreed
13	Un proper use of community for complete road work	✓	Not Occurred	Not Agreed

#### **4.3.3.6. Discussions of results on the project delay and quality problem**

##### **❖ For project delay:**

##### **➤ Financial difficulties faced by contractors**

“Financial difficulties faced by contractors” in the first position in Questionnaire Survey and fourth position in case studies many of the contracting firms not financially sound; they are highly depending on progress payments to pay the works’ expenses and bid award for lowest price. When the payments delay by the owner, the contractor faces difficulties to pay these expenses, which may lead him, in many cases, to suspend the works until he get his payments and also SMEC contractors are not skill on estimated the unit rate at the time of bid document preparation . [33, 24, 35, 39, and 41] support this result.

##### **➤ Lack of project management system of those parties**

“Lack of project management system of those parties” the project management system on all organization are not wall organized in those party because of this there is a management gap in all of the construction work.

The lack of sound project management by owners or contractors on projects leads to construction delay and extra costs for both parties. In addition to the problems that occur during construction, poor project management can also result in a competed facility that to meet the specified quality and suitability of materials, fails to produce the intended products, or cannot be operated for its intended life. This result is supported by [40 and 60].

##### **➤ Poor planning and scheduling of the project**

“Poor planning and scheduling of the project” in the fourth position in Questionnaire Survey and first position in case studies poor planning and scheduling the main problem in many construction industry this problem also observed in Jimma town cobblestone construction project specially in the client and contractors side. This result is supported by [33, 35, 38, 40, 42 and 60]

##### **➤ Delay to handover and delivering the site to the contractor (i.e. Right of way problem)**

“Delay in furnishing and delivering the site to the contractor (i.e. Right of way problem)” in the fifth position in Questionnaire Survey and third position in case study. Improper design

cases, unclear specification and Clearing of obstructions within the right of way was the main causes of time overrun in construction industry that means if improper design cases in project execution time it takes for such design to be reviewed, amended and accepted for construction works, when errors are observed in the design, works are temporary suspended until such errors are removed and also right of way problem in Jimma town has become a serious problem on the progress of works due to the non-removal of houses in Jimma town different sections, Belong to different government agencies such as (removal of electric poles, telephone Poles, water lines and sewerage Lines). Other researchers strengthen this finding for the causes of project delay [38, 39, 60, and 42].

➤ **Delay in response to decision making process**

“Delay in response to decision making process” was the six position in Questionnaire Survey and seventh position in case study. Clients are the project Owners. When they do not make decisions on time regarding project matters, they slow down activities at the project sites. An organization’s internal bureaucracy or wrong channels of communication could cause slow decision-making. Usually, Consultants and Clients’ staff tasked with the responsibility of coordinating such exercises. [38, 42, and 60] support this result.

➤ **Delay in approving interim payments of completed Works**

“Delay in approving interim payments” was in the eight positions in Questionnaire Survey and ninth position in case study. Payment delays by the owner and consultant: construction works involve high daily expenses that met by the contractors when progress payments by owners delayed. This affects the completion of works on time since many of the contracting firms in the cobblestone road construction are small with very limited cash reserves. Construction works involve huge amounts of money. Work progress can be delayed due to the late payments from the clients because there is inadequate cash flow to support construction expenses especially for those contractors who are not financially sound. Most of the contractors find it very difficult to bear the heavy daily construction expenses when the payments are delayed. Many researchers [35, 37, 39, 40, 42 and 43] support this result.

➤ **Shortage of construction materials**

“Shortage of construction materials” was the ninth position in questionnaire survey and fifth position in case study. This results in slowed activities and sometimes-temporary abandonment of sites. During periods of high development where the level of construction activity is usually high in a particular region, there may be shortages of some construction

materials. Sometimes the local market may not be able to supply the full demand of these construction materials; hence, there may be a need to import these construction materials from abroad. Since Ethiopia is a country that is, developing very fast, frequently times demand exceeds the supply and this causes prices to increase. The contractors postpone the purchase activities until the prices decrease. In the same line [35, 37, 42 and 60] strengthen this finding for the causes of project delay.

➤ **Rework due to errors during construction**

“Rework due to errors during construction” was in the tenth positions in both Questionnaire Survey and case study. In the same line [35] strengthen this finding for the causes of project delay.

❖ **For quality problem:**

➤ **Financial difficulties faced by contractors**

“Financial difficulties faced by contractors” was the first position in Questionnaire Survey and fourth position in case studies. Regarding to this factor the consultants and contractors agreed greatly but the clients’ respondents were not. Many of the contracting firms working in Jimma town cobblestone projects are small and not financially sound; they are highly depending on delay on progress payments, financial management and awarding of contracts to the lowest bidder because of those point monition on the is the main causes of contracting party work quality of work. [52, 53 and 56] Was Supported this result.

➤ **Inappropriate construction methods as per design & Specification**

“Inappropriate construction methods as per design & Specification” in the third position in Questionnaire Survey and forth position in case studies. During the construction financial problem caused by bid award for lowest price and delay on progress payments was the main things for the contractors to perform the work as per design and specification in addition to this starting form production site the quality of construction material such as size and shape of paved stone, amount or quantity of crush stone on the sub base, the way the Cobblestones are paved, the sometimes unskilled members of the contractors are deployed on the pavement are one of the causes, the curb stones laid on the right and left edge of the roads are not tightly fixed by cement or other materials, it may be one reason for the problem. [50, 51, 53 and 56] Was Supported this result.

➤ **Lack of proper drainage during construction**

“Lack of Proper drainage during construction” was fourth position in both questionnaire Survey and case studies. Regarding to this factor the consultants and contractors agreed almost similar perception but the clients’ respondents were not. The construction of drainage system not well designed and constructed before the sub base is constructed and drainages was not in lined with the purpose and design of the roads and also the upper side of the finished drainage should also be closed with a big stone in order to protect any dry waste materials thrown in the tube of the drainage this causes the overflow of water lied on paved cobblestone surface and affect the quality this is a practical problem observed on open drainages in many areas of the case study during the observation of the site. [53 and 57] was Supported this result.

➤ **Lack of quality control and assurance system during construction**

“Lack of quality control and assurance system during construction” was the fifth position in questionnaire Survey and first position in case studies. Quality assurance in construction includes quality control, acceptance sampling and testing process, and independent assurance. The acceptance sampling and testing is done to determine whether or not the quality of produced material or construction is acceptable in terms of the specifications. The independent assurance is a management tool that requires a third party to provide an independent assessment of the product and/or the reliability of test results obtained from process control and acceptance testing. [50, 53 and 56] Was Supported this result.

➤ **Poor maintenance system during & after construction**

“Poor maintenance system during & after construction” was the fifth position in questionnaire Survey and eight position in case studies. The purpose of maintenance is to ensure that the road remains serviceable throughout its design life and the main two reasons of its importance are: (i) Prolongs the life of the road by reducing the rate of deterioration, thereby safeguarding previous investments in construction and rehabilitation, and (ii) Sustains social and economic benefits of improved road access(ILO, 2013).. The cost of a road construction over its service life is a function of the design, quality of construction, maintenance strategies and maintenance operations. Unfortunately, designers often neglect a very important aspect which is the possibility to perform future maintenance activities (Kerim, 2008). There are different types of maintenance: routine maintenance, periodic

maintenance, reconstruction and emergence maintenance based on the nature of each activity and the frequency at which they should be carried out. [57, 48 and 59] Was Supported this result.

➤ **Improper material selection & low quality construction material use**

“Improper material selection & low quality construction material use in accordance with specifications in contract” was seventh position in Questionnaire Survey and sixth position in case studies. Regarding to this factor the consultants usually want materials used in supervised project with a good quality and according to specification. [50, 51, 53, 56 and 57] Was Supported this result.

➤ **Road Operation above design limits (Unrestricted traffic load control)**

“Road Operation above design limits (Unrestricted traffic load control)” was the eighth position in Questionnaire Survey and seventh position in case studies. The main question raised here is that what types of vehicles should be allowed to pass through these roads. This is actually related to the bearing capacity of the roads and needs a directive. An impressive point that has been raised by almost all key informants during the interview is that these Cobblestone roads are not considered as a part of the urban roads because they don't have any sign posts erected that can indicate the load that the Cobblestone roads can bear. It can prevent those vehicles which are above the bearing capacity of the roads. As observed on the field, no sign posts are seen anywhere. [57] Was Supported this result.

#### **4.4. Remedial measures of managerial causes of project delay and quality problem**

In this section, a list of 15 remedial measures of project delay and quality problem minimizing factors were presented to the respondents to rank and score them according to rate of importance on the scale of 1 to 5. The relative importance index (RIIS) for each potential project delay and quality problem minimizing method were calculated using equation (1) – section 3.5 of this thesis; and the correlation between the rank of the contractor, consultant and client were computed using equation (2) to rank the causes based on the overall remedial measure.

#### 4.4.1. For project delay

Table 4.27 shows the rank of all causes of remedial measures for project delay that have been investigated in this research from client, consultant and contractor point views. Fifty managerial causes for project delay - minimizing methods that identified from the literature review have been shown below. The ranking was based on importance index values.

Table 4.23: Relative importance index and rank for remedial measures to minimize managerial causes for project delay by all respondent groups

NO	Proposed Mitigation Measures	Overall	
		RIIS	Rank
1	Effective strategic planning and good scheduling programmed based the tasks and resources of the project by all parties	4.21	1
2	While selecting the contractors, clients have to make sure that the contractors are not selected based only on the lowest bid or others. The emphasis on selecting contractors based on least cost needs to be reviewed carefully.	4.14	2
3	The management system in those organization are wall organized	4.14	2
4	Before awarding the bid, the client should complete proper design at the right time with detailed specification to hand over of the site and/or contractual commencement in addition to this take action to solve the right of way problem.	4.14	2
5	Pay progress payments to the contractor on time because it impairs the contractor ability to finance the work and motivate him to continue working in high rate.	4.10	5
6	Clients and consultants must make quick decisions to solve any problem that arise during the execution	4.10	5
7	Mange to ensuring adequate and available sources of finance at each phase until project completion.	4.02	7
8	Use well qualified construction materials from approved source.	4.02	7
9	While selecting the consultant, the clients employ the consultants firm not only for the design phase only but also on construction phase this help the consultant to take the risk for any design defect and also to take quick decisions in order to prepare and approve drawings on time for any design change	3.82	9
10	All party must employ competent manager; multidisciplinary/competent project team	3.73	10
11	The government should take Engineering Capacity Building training Program to all parties participate on the project.	3.73	10
12	Proper Site management and frequent supervision by all parties during construction must be needed to minimize frequent rework due to errors during construction.	3.68	12

NO	Proposed Mitigation Measures	Overall	
		RIIS	Rank
13	Minimize change orders as possible during the construction phase by preparation of a detailed pre site investigation reports and detailed drawings and documents to minimize project delays	3.60	13
14	Project team committed to achieving common objectives, who work well together and who relate directly and openly with one another to get things done. Generally Develop Clear information and communication channels	3.51	14
15	Use effective productivity and efficiency equipment or machine	3.51	14

Table 4.27 above shows ranking of effective methods of minimizing project delay based on relative importance index from the viewpoint of clients, contractors and consultants.

Results indicated that out of the identified 15 factors of remedial measures for minimizing project delay, 7 (46.67%) were rated as high importance and affectivity in mitigate the project delay causes and 8 (53.33%) were rated as very high importance or effective.

#### 4.4.2. For quality problem

Table 4.28 shows the rank of all causes of remedial measures for quality problem that have been investigated in this research from client, consultant and contractor point views. Fifty quality problem - minimizing methods that were identified from the literature review have been shown below. The ranking was based on importance index values.

Table 4.24: Relative importance index and rank for remedial measures to minimize quality problem by all respondent groups

NO	Proposed Mitigation Measures	Overall	
		RIIS	Rank
1	Give Frequent training to small micro enterprise contractor on Engineering Capacity Building Program (ECBP)	4.37	1
2	While selecting the contractors, clients have to make sure that the contractors are not selected based only on the lowest bid but also considered experience, technical capability, past performance and sufficient manpower to execute the project and also emphasis on least cost needs to be reviewed carefully.	4.37	1
3	Use appropriate construction methods as per design & Specification	4.37	1
4	The drainage system should be well designed and constructed before the sub base is constructed.	4.20	4



NO	Proposed Mitigation Measures	Overall	
		RIIS	Rank
5	Quality assurance and control to ensure conformance to drawings and specifications.	4.20	4
6	Traffic Sign Posts are very important to erect on some parts of the entry and exit.	4.13	6
7	While selecting the consultant, the clients employ the consultants firm not only for the design phase only but also on bid preparation and construction phase that means it use (Design-Bid-Build delivery system) this help the consultant to take the risk for any design defect.	4.02	7
8	The contractor use well qualified and quality construction material in accordance with specifications in contract	4.02	7
9	The city government give attention to frequent routing and spot maintenance	4.02	7
10	All construction firm form technically, effective and commitment project management system.	3.90	10
11	Proper Site management and frequent timely supervision by all parties during construction must be needed to improve the quality of construction work and minimize frequent rework due to errors during construction.	3.81	11
12	Client and Consultants must make quick decisions to solve any problem that arise during the execution.	3.81	11
13	The government has created awareness to make the community to participate preserving, managing and maintaining the roads	3.81	11
14	The government police considered not only aim to reduce the number of unemployment but also concerned quality of work.	3.76	14
15	Frequently Quality meeting must be needed	3.63	15

Table 4.28 above shows ranking of effective methods of minimizing quality problem based on relative importance index from the viewpoint of clients, contractors and consultants.

Results indicated that out of the identified 15 factors of remedial measures for minimizing quality problem, 6 (40.00%) were rated as high importance and affectivity in mitigate the occurrence of quality problem and 9 (60.00%) were rated as very high importance or effective.

## CHAPTER FIVE

### CONCLUSIONS AND RECOMMENDATIONS

#### 5.1. Introduction

This chapter includes the conclusions and recommendations that would help in solving the problem of project delay and quality problem on cobblestone roads construction projects in Jimma town. The first objective was investigating the extent of project delay and quality problem on cobblestone roads construction projects in Jimma town by case study. The second objective was to identify managerial causes of project delay and quality problem on cobblestone roads construction projects in Jimma town; and the third objective was Propose remedial measures to improve project delay and quality problem in future cobblestone road construction projects in Jimma town.

#### 5.2. Conclusions

Literatures revealed that project delay and quality problem is a very frequent phenomenon and is almost associated with nearly all projects in the construction industry; stating that the trend is more severe in developing countries where these delay sometimes exceed 100% of the anticipated time of the project and also quality problem is not less than project delay observed in many developing countries projects. The review annual Jimma city infrastructure asset management plan report (July 2007 E.c) an average of 23.48 % of project delay and 26.88% of main cobblestone road and 10.33% of pedestrian sidewalk of quality problem of cobblestone road construction project in Jimma town.

Therefore, identify and analyze of managerial causes of delay and propose remedial measures to improve, project delay and quality problem in future cobblestone road construction projects is the main important point. To achieve these objectives, the researcher used case study and questionnaire survey as research instruments. The information gathered from the survey was analyzed by Excl and R-statistical software using the relative importance index method and correlated using Spearman's rank correlation coefficients for structured part of the questionnaires. The analysis of results from the case study and structured part of the questionnaires was carried out using descriptive statistics methods including percentages and RIIS scores. The analyzed result obtained in this processes had been discussed and presented

in the previous chapter. Therefore, based on the results from the analysis, the following major conclusions have been derived and summarized in accordance with the objectives of the research.

1. The result of the case study indicated that out of eight new cobblestone road projects investigated, all suffered with project delay and quality problem in their execution. For these cobblestone road construction projects, an average time overrun was found to be 80.61% of the contract time, the actual delay ranging from 53.33% to 130%, similarly the average defect area or area which has a quality problem was found to be 23.75% of the existing finished cobblestone road construction found in each project site, the actual quality problem directly measuring the project site was ranging from 10% to 41%. The result of the questionnaire survey also strengthens the finding that delay and quality problem are the most common problem, it indicated that more than half of the factors 52.00% and 52.18% are in the higher importance range in contributing to project delay and quality problem of projects respectively.
2. The second objective of this research was identification and analysis of the main managerial cases leading to construction project delay and quality problem. To achieve this objective, a questionnaire survey containing 25 potential managerial causes of project delay and 23 potential managerial causes of quality problem identified from literatures was made and they were ranked by respondents based on the relative importance index value of frequency of occurrence and the agreement between the most top causes on case study and questionnaire survey for project delay and quality problem in order of decreasing rank, the result shown.

➤ **For project delay**

- ✓ Financial difficulties faced by contractors
- ✓ Lack of project management system of those parties
- ✓ Poor planning and scheduling of the project
- ✓ Delay to handover in furnishing and delivering the site to the contractor (i.e. Right of way problem)
- ✓ Delay in response to decision making process
- ✓ Delay in approving interim payments of completed Works
- ✓ Shortage of construction materials
- ✓ Rework due to errors during construction

➤ **quality problem**

- ✓ financial difficulties faced by contractors
- ✓ Inappropriate construction methods as per design & Specification
- ✓ Lack of Proper drainage during construction
- ✓ Lack of quality control and assurance system during construction
- ✓ Poor maintenance system during & after construction
- ✓ Improper material selection & low quality construction material use in accordance with specifications in contract
- ✓ Road Operation above design limits (Unrestricted traffic load control)

3. The research has also identifying the most effective and applicable remedial measure of minimizing causes of project delay and quality problem. To achieve this objective, a questionnaire survey was made containing 15 potential project delay and quality problem mitigation measures that were identified from literatures and they were ranked by respondents based on the relative importance index value for their effectiveness in decreasing order of rank, the result showed :

➤ **For project delay**

- ✓ Using proper project planning and scheduling by all parties
- ✓ While selecting the contractors, clients have to make sure that the contractors are not selected based only on the lowest bid.
- ✓ The management system in those organization are well organized
- ✓ Before awarding the bid, the client should complete proper design at the right time with detailed specification to hand over of the site
- ✓ Pay progress payments to the contractor on time
- ✓ Clients and consultants must make quick decisions to solve any problem that arise during the execution.

➤ **For quality problem**

- ✓ Give Frequent training to small micro enterprise contractor on Engineering Capacity Building Program (ECBP)
- ✓ While selecting the contractors, clients have to make sure that the contractors are not selected based only on the lowest bid.
- ✓ Use appropriate construction methods as per design & Specification
- ✓ The drainage system should be well designed and constructed before the sub base is constructed.
- ✓ Quality assurance and control to ensure conformance to drawings and specifications.
- ✓ Traffic Sign Posts are very important to erect on some parts of the entry and exit.

### **5.3. Recommendations**

Based on the findings of the research, the following improvements were recommended to the minimization and management of construction project delay and quality problem and reducing of project delay and quality problem factors to alleviate the problem by parties on cobblestone road construction projects in Jimma town:

- ✓ Therefore, capacity building for MSEs should focus on the following points: Skill development and upgrading (Technical Skills (Quarrying, chiseling and paving as well as earth work), construction management Skills), finance/contracts/Standards(Standards documents, financial resources, contracting documents and bid preparation and participation in tenders) and management (Quality management awareness creation, resources management)
- ✓ While selecting the contractors, clients have to make sure that the contractors are not selected based only on the lowest bid but also considered experience, technical capability, past performance and sufficient manpower to execute the project and also emphasis on least cost needs to be reviewed carefully.

- ✓ The contractor can be paid on time if a clause is introduced in the contract whereby the client is required to pay the contractor the amount certified in an interim payment certificate within seven calendar days of the date of issue of the payment certificate because it motivate him to continue working in high rate.
- ✓ The pre bid design phases of the projects need to include a detailed analysis of rights of way problems and the client should take action accordingly to solve the right of way problem before awarding the bid.
- ✓ Client and Consultant should make quick decisions to solve any problem that arise during the execution the works.
- ✓ Traffic Sign Posts are very important to erect on some parts of the entry and exit of cobblestone roads and curves in order to protect these roads from being damaged by different huge vehicles. And these sign posts are expected to be erected in collaboration with the concerned governmental bodies or offices.
- ✓ The government has created awareness to make the community to participate on the construction of the roads. But still a problem is observed on the part of the government in creating awareness, space and opportunity to the community and other stakeholders to participate fully in preserving, managing and maintaining the roads. It is expected to mobilize the community to evaluate and monitor the roads.
- ✓ While selecting the consultant, the clients employ the consultants firm not only for the design phase only but also on bid preparation and construction phase that means it use (Design-Bid-Build delivery system) this help the consultant to take the risk for any design defect.
- ✓ Government police considered not only aim to reduce the number of unemployment but also concerned quality of work.
- ✓ Detailed study can be done design related factors affecting time and quality performance of cobblestone road construction project.
- ✓ Detailed study can be done to assess the effects of delay and quality problem in the cobblestone road construction projects within each construction project site.
- ✓ Further research is needed to investigate the most affected stakeholder from project delay and quality problem.

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## APPENDIXES

### Appendix A – Questionnaire

**JIMMA UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**  
**INSTITUTE OF TECHNOLOGY**  
**SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING**

QUESTIONNAIRE

ON

ASSESSMENT OF MANAGERIAL CAUSES OF PROJECT DELAY  
AND QUALITY PROBLEM ON COBBLESTONE ROAD  
CONSTRUCTION PROJECTS IN JIMMA TOWN

BY:

YONAS MEKONNEN CHKOL

ADVISOR: Eng. Bien Maunahan

CO – ADVISOR: Eng. Murad Mohammed

FOR THE PARTIAL FULFILLMENT OF MSc. DEGREE IN CIVIL  
ENGINEERING (MAJOR CONSTRUCTION ENGINEERING AND  
MANAGEMENT)

April 2016

Jimma, Ethiopia

## QUESTIONNAIRE

**Dear Sir**

The researcher is a graduate student of MSC in civil engineering, in CEM at JIT. JU, the requirement of the program is to come up with a research related the field of study.

The aim of this questioner is to study the managerial causes of project delay and quality problem on cobblestone road construction projects in Jimma town and recommends possible remedial measures that minimized the problem project delay and quality problem. This questionnaire is required to be filled with exact relevant facts as much as possible. All data included in this questionnaire will be used only for academic research and will be strictly confidential.

Your response, in this regard, is highly valuable and contributory to the outcome of the research.

Regards,

Yonas mekonnen

Post Graduate Student, Jimma University, School Of Graduate Studies, Institute Of Technology, and Civil Engineering Department.

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Jimma

**Part One: General information (Respondent Background):**

**1. Company and respondent profile**

Please tick with “✓” when appropriate and fill in the blanks if you select others

**1.1. Company Name (optional):** .....

**1.2. Type of Organization:**

<input type="checkbox"/> Owner	<input type="checkbox"/> Contractor	<input type="checkbox"/> Consultant
--------------------------------	-------------------------------------	-------------------------------------

**1.3. Job title in your organization :**

<input type="checkbox"/> Project Manager/deputy	<input type="checkbox"/> Site Engineer / Office engineer	
<input type="checkbox"/> Organization Manager/Deputy	<input type="checkbox"/> Surveyor	<input type="checkbox"/> Others (specify)...

If others in what position you work-----

**1.4. Year of experience of the road construction project:**

<input type="checkbox"/> 1 up to 5	<input type="checkbox"/> 5 up to 10	<input type="checkbox"/> More than 10
------------------------------------	-------------------------------------	---------------------------------------

**1.5. In how many road construction projects have you been involved:**

<input type="checkbox"/> Less than 5	<input type="checkbox"/> 6-10 projects	<input type="checkbox"/> More than 10
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**2. Basic information on Road Construction Project Delay**

Is quality problem is a problem in Jimma Town cobblestone road construction projects?

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Disagree	<input type="checkbox"/> Very strongly disagree
-----------------------------------------	--------------------------------	-----------------------------------	-------------------------------------------------

Is quality problem is a problem in Jimma Town cobblestone road construction projects?

<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Disagree	<input type="checkbox"/> Very strongly disagree
-----------------------------------------	--------------------------------	-----------------------------------	-------------------------------------------------

## **Part Two: Managerial causes of project delay and quality problem on of Cobblestone road project in Jimma Town**

The following table consists of list of possible causes that affect project delay and quality problem on construction road projects identified from literatures and desk study. Based on your experience what is the likely contribution of those causes that affect the project delay and quality problem on cobblestone road construction projects in Jimma town that you have involved in? Pleas indicate the degree to which these cusses that affecting the project delay and quality problem on cobblestone road construction projects in Jimma town.

Please rank the frequency of occurrence for the following listed managerial causes of project delay and quality problem and also remedial measures for the Corresponding cause by ticking

“✓”Each scale represents the following rating:

(5) Very high      (4) High      (3) Medium      (2) Low      (1) Very Low



List of possible causes of project delay and quality problem on road construction project		Rate of occurrence				
		(1) Very Low	(2) Low	(3) Medium	(4) High	(5) Very High
<b>No</b>	<b>A. Causes of project delay</b>					
1	Type of project bidding and award of contract (the lowest bidder)					
2	Improper technical selection of contractor and during the bidding stage					
3	Inadequate duration of contract period					
4	Delay to handover and delivering the site ( right of way problem)					
5	Delay in approving interim payments of completed works					
6	Poor planning and scheduling of the project					
7	Improper construction technical and methods					
8	Rework due to errors during construction					
9	Lack of frequent meeting					
10	financial difficulties faced by contractors					
11	Shortage of construction materials					
12	Use low productivity and efficiency equipment or machine					

List of possible causes of project delay and quality problem on road construction project		Rate of occurrence				
		(1) Very Low	(2) Low	(3) Medium	(4) High	(5) Very High
<b>No</b>	<b>A. Causes of project delay</b>					
13	Delay in response to decision making process					
14	Lack of practicing contract administration(liquidated damage rule ,etc)					
15	Variations orders due to(design changes/ extra work)					
16	Lack of communication between those parties of the project					
17	Poor site management/ Insufficient coordination					
18	Poor supervision					
19	Lack of project management system on those parties					
20	Insufficient number of management staffs on those parties					
21	Inflation of construction material					
22	Delay in provisional and final acceptance of completed project					
23	Lack of personnel training and management support					
24	Changes in laws and regulations					
25	Contractual claims, such as, extension of time with cost claims					

List of possible causes of project delay and quality problem on road construction project		Rate of occurrence				
		(1) Very Low	(2) Low	(3) Medium	(4) High	(5) Very High
<b>No</b>	<b>B. Causes of quality problem</b>					
1	Project Fund and project budget is small					
2	Awarding of contracts to the lowest bidder					
3	Poor planning and scheduling of the project during & per-construction phase					
4	Inappropriate method of consultant & contractor selecting					
5	Low effective project management system and Lack of commitment.					
6	Inappropriate construction methods as per design & Specification					
7	Poor technical & managerial efficiency assign to construction project					
8	Lack of frequent quality meeting					
9	Use of improper equipment or machine for construction process					
10	Improper material selection & low quality construction material use					
11	financial difficulties faced by contractors					
12	Lack of Quality training					

List of possible causes of project delay and quality problem on road construction project		Rate of occurrence				
		(1) Very Low	(2) Low	(3) Medium	(4) High	(5) Very High
<b>No</b>	<b>B. Causes of quality problem</b>					
13	Change order during construction					
14	Lack of timely supervision/inspection at construction site					
15	Insufficient coordination/Lack of communication between those parties of the project					
16	Lack of quality control and assurance system					
17	Insufficient number of management staffs on those parties					
18	Lack of Proper drainage construction					
19	Delay in response to decision making process					
20	Road Operation above design limits (Unrestricted traffic load control)					
21	Un proper use of community for complete road work					
22	Poor maintenance system after construction					
23	Government policy and strategy					

**Part Three: To formulate remedial measures to improve project delay and quality problem in Jimma town cobblestone road project**

Put a tick mark (✓) under the choices below. Where, 5 = Very high important, 4 = High important, 3 = Medium important, 2 = Low important, 1 = Very low important

List of proposed remedial measure to improve project delay and quality problem on cobblestone road construction project in Jimma town		Rate of occurrence				
		(1) Very Low	(2) Low	(3) Medium	(4) High	(5) Very High
<b>No.</b>	<b>A. Remedial measure time overrun</b>					
1	Effective strategic planning and good scheduling programmed based the tasks and resources of the project by all parties					
2	While selecting the contractors, clients have to make sure that the contractors are not selected based only on the lowest bid or others. The emphasis on selecting contractors based on least cost needs to be reviewed carefully.					
3	The management system in those organization are wall organized					
4	Before awarding the bid, the client should complete proper design at the right time with detailed specification to hand over of the site and/or contractual commencement in addition to this take action to solve the right of way problem.					
5	Pay progress payments to the contractor on time because it impairs the contractor ability to finance the work and motivate him to continue working in high rate.					
6	Clients and consultants must make quick decisions to solve any problem that arise during the execution					
7	Mange to ensuring adequate and available sources of finance at each phase until project completion.					

List of proposed remedial measure to improve project delay and quality problem on cobblestone road construction project in Jimma town		Rate of occurrence				
		(1) Very Low	(2) Low	(3) Medium	(4) High	(5) Very High
<b>No.</b>	<b>A. Remedial measure time overrun</b>					
8	Use well qualified construction materials from approved source.					
9	While selecting the consultant, the clients employ the consultants firm not only for the design phase only but also on construction phase this help the consultant to take the risk for any design defect and also to take quick decisions in order to prepare and approve drawings on time for any design change					
10	All party must employ competent manager; multidisciplinary/ competent project team					
11	The government should take Engineering Capacity Building training Program to all parties participate on the project.					
12	Proper Site management and frequent supervision by all parties during construction must be needed to minimize frequent rework due to errors during construction.					
13	Minimize change orders as possible during the construction phase by preparation of a detailed pre site investigation reports and detailed drawings and documents to minimize project delays					
14	Project team committed to achieving common objectives, who work well together and who relate directly and openly with one another to get things done. Generally Develop Clear information and communication channels					
15	Use effective productivity and efficiency equipment or machine for construction process					

List of proposed remedial measure to improve project delay and quality problem on cobblestone road construction project in Jimma town		Rate of occurrence				
		(1) Very Low	(2) Low	(3) Medium	(4) High	(5) Very High
No.	<b>B. Remedial measure quality problem</b>					
1	Give Frequent training to small micro enterprise contractor on Engineering Capacity Building Program (ECBP)					
2	While selecting the contractors, clients have to make sure that the contractors are not selected based only on the lowest bid but also considered experience, technical capability, past performance and sufficient manpower to execute the project and also emphasis on least cost needs to be reviewed carefully.					
3	Use appropriate construction methods as per design & Specification					
4	The drainage system should be well designed and constructed before the sub base is constructed.					
5	Quality assurance and control to ensure conformance to drawings and specifications.					
6	Traffic Sign Posts are very important to erect on some parts of the entry and exit.					
7	While selecting the consultant, the clients employ the consultants firm not only for the design phase only but also on bid preparation and construction phase that means it use (Design-Bid-Build delivery system) this help the consultant to take the risk for any design defect.					

List of proposed remedial measure to improve project delay and quality problem on cobblestone road construction project in Jimma town		Rate of occurrence				
		(1) Very Low	(2) Low	(3) Medium	(4) High	(5) Very High
No.	B. Remedial measure quality problem					
8	The contractor use well qualified and quality construction material in accordance with specifications in contract					
9	The city government give attention to frequent routing and spot maintenance					
10	All construction firm form technically, effective and commitment project management system.					
11	Proper Site management and frequent timely supervision by all parties during construction must be needed to improve the quality of construction work and minimize frequent rework due to errors during construction.					
12	Client and Consultants must make quick decisions to solve any problem that arise during the execution.					
13	The government has created awareness to make the community to participate preserving, managing and maintaining the roads					
14	The government police considered not only aim to reduce the number of unemployment but also concerned quality of work.					
15	Frequently quality meeting must be needed					



## Appendix B

### Case Study Information of the cobblestone road construction projects

Case studies were conducted on eight Jimma Town cobblestone road project constructed 2004 E.c budget year until now. Which were delayed and quality problem? The documents referred during the case study include progress and completion reports, contract documents and claim submittal, variation orders and other important documents of the projects in addition to this direct observation of site condition, correspondences from discussion and interview for criterion based selected projects. These cases discussed in depth by organizing information and focusing on factors affecting time and quality performance of Jimma Town cobblestone projects and to illustrate the link between the result obtained by questionnaire and result in case study.

For this research, ‘‘factor affecting time overrun and quality problem in Jimma town cobblestone road construction projects’’ eight cobblestone Road projects were selected for case study. The lists of these projects described hereunder.

1. Back side of Jimma zone police office – west region EELPA office 0.649km
2. Mars bakery – Sala bakery & Tirunesh hotel – Gibe clinic 0.305km
3. Eyob clinic – Umer mosque cobble junction & Boni hotel – zone office asphalt junction 0.402km
4. Nur restaurant asphalt junction - Infront of Arinet church cobble junction & Ato Nasir Residence - Hayat Bakery 0.625km
5. JU kolober – Arinet church 1km with some masonry retaining around the river bank.
6. Jimma University Asphalt junction to prison office & Kedir shop to Protestant church. Contract 0.470km
7. Higher 02 Clinic - Bishishe Asphalt Junction and Dina Wood work A jip Shell Fuel Station. Contract 0.923km
8. Green Hotel Asphalt Junction – Ato Bahiru Residence New Gravel Road. Contract 0.750km

4.25: Case information of Jimma town cobblestone road project. (Project site No-1)

<b>Feature</b>	<b>Data</b>
Project Name	Back side of Jimma zone police office -west region EELPA office
Client	Jimma Town Local Urban Government
Consultant	Jimma Town Local Urban Government
Contractor	Takaliny Micro & Small Enterprise
Funded by	The Regional Government of Oromia, Jimma Town Local Urban Government and ULGDP\IDA
Type of Contract	(Admeasurements' contract )
Date of signing of contract	Jan 23, 2015
Date of commencement	Feb 7, 2015
Original project cost	1,765,672.97
Original contract period	150 calendar days
Time elapsed from original	270 calendar days (180%)
% age of project accomplished	100% until Nov10, 2015
% age of project delay	80% from original

Table 4.26: Case information of Jimma town cobblestone road project.(Project site No-2)

<b>Feature</b>	<b>Data</b>
Project Name	Mars Bakery – Sala bakery & Tirunesh hotel – Gibe Clinic
Client	Jimma Town Local Urban Government
Consultant	Jimma Town Local Urban Government
Contractor	Hojanee Midhagna Micro & Small Enterprise
Funded by	The Regional Government of Oromia, Jimma Town Local Urban Government and ULGDP\IDA
Type of Contract	(Admeasurements' contract)
Date of signing of contract	Apr 22, 2015
Date of commencement	may 7, 2015
Original project cost	776,048.52
Original contract period	90 calendar days
Time elapsed from original	207 calendar days (230%) until Nov 10, 2015
% age of project accomplished	84.83% until Nov 10, 2015
Project condition	On going
% age of project delay	130% from original

Table 4.27: Case information of Jimma town cobblestone road project.(Project site No-3)

<b>Feature</b>	<b>Data</b>
Project Name	Eyob clinic – Umer mosque cobble junction & Boni hotel – zone office asphalt junction
Client	Jimma Town Local Urban Government
Consultant	Jimma Town Local Urban Government
Contractor	Argee Micro & Small Enterprise
Funded by	The Regional Government of Oromia, Jimma Town Local Urban Government and ULGDP\IDA
Type of Contract	(Admeasurements' contract)
Date of signing of contract	Apr 17/2015
Date of commencement	May 2/2015
Original project cost	1,036,057.26
Original contract period	90 calendar days
Time elapsed from original	186 calendar days (206.67%) until Nov 10, 2015
% age of project accomplished	87% until Nov 10, 2015
Project condition	On going
% age of project delay	107% from original

Table 4.28: Case information of Jimma town cobblestone road project.(Project site No-4)

<b>Feature</b>	<b>Data</b>
Project Name	Nur restaurant asphalt junction – In front of Arinet church cobble junction & Ato Nasir Residence - Hayat Bakery
Client	Jimma Town Local Urban Government
Consultant	MCE JV IDCON
Contractor	Gudina Biyyaa Micro & Small Enterprise
Funded by	The Regional Government of Oromia, Jimma Town Local Urban Government and ULGDP\IDA
Type of Contract	(Admeasurements' contract)
Date of signing of contract	Jan 23, 2015
Date of commencement	Feb 8, 2015
Original project cost	1, 779, 898.13
Original contract period	150 calendar days
Time elapsed from original	230 calendar days (153.33%) until Oct 8, 2015
% age of project accomplished	100% until Nov 10, 2015
% age of project delay	53.33% from original

Table 4.29: Case information of Jimma town cobblestone road project.(Project site No-5)

<b>Feature</b>	<b>Data</b>
Project Name	JU kolober – Arinet church
Client	Jimma Town Local Urban Government
Consultant	Jimma Town Local Urban Government
Contractor	Arjo Guddattuu Micro & Small Enterprise
Funded by	The Regional Government of Oromia, Jimma Town Local Urban Government and ULGDP\IDA
Type of Contract	(Admeasurements' contract)
Date of signing of contract	Feb 2, 2015
Date of commencement	Feb 24, 2015
Original project cost	3,335,799.25
Original contract period	150 calendar days
Time elapsed from original	256 calendar days (170.67 %)
% age of project accomplished	89% until Nov 10, 2015
% age of project delay	70.67% from original

Table 4.30: Case information of Jimma Town cobblestone road project.(Project site No-6)

<b>Feature</b>	<b>Data</b>
Project Name	Jimma University Asphalt junction to prison office & Kedir shop to Protestant church
Client	Jimma Town Local Urban Government
Consultant	Jimma Town Local Urban Government
Contractor	Muleta Jimma Micro & Small Enterprise
Funded by	The Regional Government of Oromia, Jimma Town Local Urban Government and ULGDP\IDA
Type of Contract	(Admeasurements' contract)
Date of signing of contract	Mar 23, 2013
Date of commencement	Apr 7, 2013
Original project cost	2,251,431.14
Original contract period	360 calendar days
Time elapsed from original	570 calendar days (158.30 %)
% age of project accomplished	100% until Nov 10, 2015
% age of project delay	58.30% from original

Table 4.31: Case information of Jimma Town cobblestone road project.(Project site No-7)

<b>Feature</b>	<b>Data</b>
Project Name	Higher 02 Clinic - Bishishe Asphalt Junction, Dina Wood work – Ajip Shell Fuel Station
Client	Jimma Town Local Urban Government
Consultant	Jimma Town Local Urban Government
Contractor	Lencaa Micro & small enterprise
Funded by	The Regional Government of Oromia, Jimma Town Local Urban Government and ULGDP\IDA
Type of Contract	(Admeasurements' contract)
Date of signing of contract	Dec 9, 2011
Date of commencement	Feb 24, 2015
Original project cost	3,335,799.25
Original contract period	150 calendar days
Time elapsed from original	256 calendar days (170.67 %)
% age of project accomplished	100% until Nov 10, 2015
% age of project delay	70.67% from original

Table 4.32: Case information of Jimma Town cobblestone road project.(Project site No-8)

<b>Feature</b>	<b>Data</b>
Project Name	Green Hotel Asphalt Junction – Ato Bahiru Residence New Gravel Road.
Client	Jimma Town Local Urban Government
Consultant	Jimma Town Local Urban Government
Contractor	Hidase Micro & Small Enterprise
Funded by	The Regional Government of Oromia, Jimma Town Local Urban Government and ULGDP\IDA
Type of Contract	(Admeasurements' contract)
Date of signing of contract	Feb 2, 2015
Date of commencement	Feb 17, 2015
Original project cost	2,194,385.15
Original contract period	150 calendar days
Time elapsed from original	260 calendar days (173.30 %)
% age of project accomplished	100% until Nov 10, 2015
% age of project delay	73.30% from original

Table 4.33: Time overrun on Jimma Towne cobblestone construction project on 2007 E.c budget year

No	Name of the project	Contractor	Planned Duration( Day)	Actual Duration (Day)	Time Overruns Status		Status
					Day	%	
1	Nur restourant asphalt junction – In front of Arinet church cobble junction &Ato Nasir Residence - Hayat Bakery	Gudina Biyyaa	150	186	36	24.00	On progress
2	Shenen Gibe – Bosakito kebele – Aba buna high school Side Walk Degitu Hotel - Agri. College) & Mariyam church – welda cemetery	Laliftuu	150	170	20	13.33	Completed
3	Back side of Jimma zone police office – west region EELPA office	Takaliny	150	186	36	24.00	On progress
4	Eyob clinic – Umer mosque cobble junction &Boni hotel – zone office asphalt junction	Argee	90	113	23	25.56	On progress
5	Behind Feti mosque aba Nega Residence – Mame Aba Jihad residence & its junction to bishishe asphalt. & Hikmama hiber building – Gali Building	Salaam	150	186	36	24.00	On progress
6	Green hotel asphalt junction – Ato Beharu residence new gravel road junction. With one side masonry drainage.	Hidaasee	150	175	25	16.67	Completed
7	Mars bakery – Sala bakery &Tirunesh hotel – Gibe clinic.	Hojjennee Midhagna	90	170	20	22.22	On progress
8	Gibe hall asphalt junction – Immigration cobble stone junction. &Totot café – Agri. Research center guest house	Abeekoo	90	107	17	18.89	Completed
9	Immigration – Anti AIDS resource	Hawwii Ginjoo	90	140	50	55.56	On progress
10	Preparatory kotebe ber – mentina kebele - Temam Residence	Siket	150	165	15	10.00	Completed
11	JU kolober – Arinet church with some masonry retaining around the river bank.	Arjo Guddattuu	150	186	36	24.00	On progress

Source: Jimma City infrastructure asset management plan (IAMP) Report

Table 4.34: Road condition and estimation of maintenance budget of existing road on 2007 E.c budget year

Road Category	Inventory Data	Total length (km)	Total Area(m <sup>2</sup> )	Road condition	Type of maintenance	Area to be maintained		Unit Rate		Maintenance Cost <sup>^</sup>	
Cobble stone Road	13.41	5.145	36015	Good	Expecting maintenance	180	08	10	00	1,800	80
		4.66	32620	Moderate	Routine maintenance	6,524	00	65	00	424,060	00
		3.605	25235	Severe	Rehabilitation/up grading	15,345	00	100	00	1,534,500	00
Cobble Pedestrian sidewalks	3	2.43	4860	Good	Expecting maintenance	165	05	10	00	1650	50
		0.26	520	Moderate	Routine maintenance	364	00	65	00	23,660	00
		0.31	620	Severe	Rehabilitation/up grading	620	00	100	00	62,000	00
<b>TOTAL</b>										<b>2,047,671</b>	<b>30</b>

## Appendix C

### Critical Values of Spearman's Rank Correlation Coefficients for Different Number of Data Set

Source: Jimma City infrastructure asset management plan (IAMP) Report

Table: critical values of  $r_s$  (Spearman rank correlation coefficient), at various levels of probability For any  $n$  observed value of data set,  $r_s$  is significant at a given level of significance if it is equal to or larger than the critical values shown in the table Critical Values of the Spearman's Ranked Correlation Coefficient ( $r_s$ )

Taken from Zar, 1984 Table B.19

n (number of pairs)	Probability that your result occurred by chance				
	0.1	0.05	0.025	0.01	0.005
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	0.7000	0.9000	0.9000	1.0000	1.0000
6	0.6571	0.7714	0.8286	0.9429	0.9429
7	0.5714	0.6786	0.7857	0.8571	0.8929
8	0.5476	0.6429	0.7381	0.8095	0.8571
9	0.4833	0.6000	0.6833	0.7667	0.8167
10	0.4424	0.5636	0.6485	0.7333	0.7818
11	0.4182	0.5273	0.6091	0.7000	0.7545
12	0.3986	0.5035	0.5874	0.6713	0.7273
13	0.3791	0.4780	0.5604	0.6484	0.6978
14	0.3670	0.4593	0.5385	0.6220	0.6747
15	0.3500	0.4429	0.5179	0.6000	0.6536
16	0.3382	0.4265	0.5029	0.5824	0.6324
17	0.3271	0.4124	0.4821	0.5577	0.6055
18	0.3170	0.4000	0.4683	0.5425	0.5897
19	0.3077	0.3887	0.4555	0.5285	0.5751
20	0.2992	0.3783	0.4438	0.5155	0.5614
21	0.2914	0.3687	0.4329	0.5034	0.5487
22	0.2841	0.3598	0.4227	0.4921	0.5368
23	0.2774	0.3515	0.4132	0.4815	0.5256
24	0.2711	0.3438	0.4044	0.4716	0.5151
25	0.2653	0.3365	0.3961	0.4622	0.5052
26	0.2598	0.3297	0.3882	0.4534	0.4958
27	0.2546	0.3233	0.3809	0.4451	0.4869
28	0.2497	0.3172	0.3739	0.4372	0.4785
29	0.2451	0.3115	0.3673	0.4297	0.4705
30	0.2407	0.3061	0.3610	0.4226	0.4629