JIMMA UNIVERSITY

JIMMA INSTITUTE OF TECHNOLOGY

SCHOOL OF GRADUATE STUDIES

FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING

CONSTRUCTION ENGINEERING AND MANAGEMENT CHAIR

ASSESSMENT OF QUALITY CONTROL IMPLEMENTATION ON UNPAVED ROADS CONSTRUCTION PROJECTS OF GAMBELLA RURAL ROAD AUTHORITY

A Thesis submitted to School of Graduate Studies, Jimma University, Jimma Institute of Technology, Faculty of Civil and Environmental Engineering in Partial Fulfillment of the Requirements for the Degree Master of Science in Construction Engineering and Management

By

KOANG   MALUTH   GOACH

October, 2021

Jimma, Ethiopia

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Advisor: Dr. Lucy Feleke   Signature _____   Date_____

Co-Advisor: Engr. Dawit Ketema (M.Sc.)   Signature_____   Date_____

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By

Koang Maluth Goach

Approved by board of examiners

1. Dr.Lucy Feleke _____ ____/_____/_____

    Advisor   Signature   Date

2. Dawit Ketema _____ ____/_____/_____

    Co-Advisor   Signature   Date

3. _____ _____ ____/_____/_____

    External examiner   Signature   Date

4. _____ _____ ____/_____/_____

    Internal examiner   Signature   Date

5. _____ _____ ____/_____/_____

    Chairperson   Signature   Date

DECLARATION

I declare that this research study entitled "Assessment of Quality control implementation on Unpaved roads construction Projects of Gambella rural road authority" is my original work and has not been submitted and presented as a requirement for the award of any degree or Master level in Jimma University or elsewhere.

Koang Maluth Goach   _____   _____

NAME   SIGNATURE   DATE

As research Advisor, I hereby certify that I have read and evaluated this thesis paper prepared under my guidance, by Koang Maluth Goach entitled "ASSESSMENT OF QUALITY CONTROL IMPLEMENTATION ON UNPAVED ROADS CONSTRUCTION PROJECTS OF GAMBELLA RURAL ROAD AUTHORITY" and recommend and would be accepted as a fulfilling requirement for the Degree Master of Science in Construction Engineering and Management.

Advisor: Dr. Lucy Feleke   _____   _____
NAME   SIGNATURE   DATE

Co - Advisor: Engr. Dawit Ketema (M.Sc.)   _____   _____
NAME   SIGNATURE   DATE

ABSTRACT

Construction project such as roads represent a unique set of activities that necessitates good quality control management practice and it is the backbone for economic development especially for developing country like Ethiopia. This study was mainly set out with a general purpose to assess the quality control implementation practices , identifying the major factors affecting road construction quality, major quality management challenges and identifying impact factors affecting quality control of unpaved road construction.

To achieve its objectives, the study employed both descriptive and explanatory research and both primary and secondary data were used. Questionnaires, interview,desk study and document review were, therefore, used as data collection tools. Furthermore,both Qualitative and Quntitative methods of data collection were also applied. Data were collected from individuals and project team implementation involved with in the construction of unpaved roads, those includes Clents,Consultants, and Contractors as well as stakeholders. The participants/respondents were selected by Purposive sampling method and the data gathered through the questionnaire was analyzed by Micro-soft Excel(version 2013). For this research,three on going projects were selected and 50 Questionaires of the study were distributed to the stakeholders.

The finding of the study indicated that Gambella rural road authority does not employ all stages of quality management process, tools and techniques. Since they use only inspection and statistical sampling , were found to be the major quality management tools and techniques used to control quality of project. Relative Importance Index (RII) was used to determine and rank the challenges and impacts factors faced and affects the quality and shows the relationship level of professionals in unpaved construction projects. The relationship level among professionals was found good, clients have a strong relationship with the contractors and consultants, but contractors and consultants each have a weak relationship.Technology adaption with RII value of 0.652,delay of cash flow(0.622), poor communication (0.597),Inadequate safety (0.551) and lack of collaboration and professionalism (0.532) were identified as challenging factors affecting quality control. From the investigation made on the identification of impact factors affecting quality control includes decrease of productivity with RII value of 0.748, delay of completion of tasks(0.729), redesign(0.71), complicate the process of work(0.695),material wastage(0.683) , and low profit(0.671) were identified as the impact factors affecting quality. The study also concluded and recommended that GRRA had to have separate quality management policy in order to undertake complete project quality management process, enhance management involvement, capacity building on project management skills for successful implementation of road construction projects.

Keywords: *Quality assessment, Quality assurance, Quality Control, Quality management processes and Total quality management (TQM).*

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ACRONMYS

ASQ	American Society for Quality
CM	Construction Manager
CPM	Construction Project Managment
ERA	Ethiopia Road Authority
FHA	Federal Highway Administration
GDP	Growth Domestic Product
GOE	Government of Ethiopia
GRRA	Gambella rural roads authority
GTP	Growth and Transformation Program
ISO	International standard Organization
JIT	Jimma Institute of Technology
KII	Key Informant Interview
MOWUD	Minister of Work and UrbanDevelopment
NPO	Non-participant Observation
PAF	Prevention ,Appraisal Failure
PCM	Project cost Management
PPA	Public Prourement Agency
PQM	Project Quality Management
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management Sysem
RII	Relative Importance Index
URRAP	Universal Rural Road Acess Program
WBS	Work Breakdown Structures

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Quality is a universal phenomenon that has been a matter of great concern throughout recorded history. It was always the determination of builders and makers of products to ensure that their products meet the customer's desire. With the advent of globalization and the competitive market, the emphasis on quality management has increased. Quality has become the most important single factor for the survival and success of today's companies. Customer demands for better products and services at the lowest possible costs have put tremendous pressure on firms to improve the quality of products, services, and processes to compete in the market and improve business results.

It became important that construction projects be more qualitative, competitive, and economical to meet owner's expectations (Abdulrazzak Rumane, 2011). Construction projects have the involvement of many participants including the owner, designer, contractor, and many other professionals from construction-related industries. Each of these participants is involved in implementing quality in construction projects. Therefore, the construction projects have become more complex and technical, and extensive efforts are required to reduce rework and costs associated with time, materials, and engineering (Abdul Razzak Rumania, 2011). In order to meet customer requirements, and do so on time and within budget, the project manager must incorporate sound quality management practices. The qualityhas concerned with the following: the product/service/process that is the deliverable from the project, and the project management process itself (Robert Wysocki, 2014).

The concept of quality management is to ensure efforts to achieve the required level of quality for the product/services which are well planned and organized. From the perspective of a construction company, quality management in construction projects should mean maintaining the quality of construction works at the required standard so as to obtain customers' satisfaction that would bring long term competitiveness and business survival for the companies (United State Department of Transportation, 2015). Quality management is critically required for a construction company to sustain in current construction market which is highly challenging and competitive. A successfully managed project is completed

at the specified level of quality, on or before the deadline, and within the planned budget. Client satisfaction also indicates success and opportunity for sustainability (UNCRD, 2000).

The best quality, time and cost are the important aspects of successfully managed construction project which fulfills the main goal of construction projects. Acknowledging the quality issues in construction and increasing demand for quality products and services, specific regulations to the implementation of the QMS have been framed. The quality management has to provide the environment within which related tools, techniques and procedures can be deployed effectively leading to operational success for a construction project. Quality is one of the main factors in the success of construction projects. Quality of construction projects, as well as project success, can be regarded as the fulfillment of expectations of the project stakeholder. Quality, cost and time have been recognized as the main factors concerning the client.

However, for the majority of projects, the cost and time parameters are the main pre-occupying factors for construction project. The quality in the construction industry is linked with client's satisfaction and the implementation of a quality management is a key tool in consistently and reliably managing the construction (Mane, 2015).

Generally, managing customer satisfaction is one of the basic success of the project "The customer, or the recipient of the project's deliverables, expects a certain level of functionality and quality from the project" (Robert Wysocki, 2014). QMS has many applications in the construction project. It could be implemented either at the company level or at the project level.. The construction project has increased rapidly in the recent years, reflecting the interest of private and public sector investing more funds into development in developing countries like Ethiopia. Moreover attention is given to basic social sector infrastructure in public sectors particularly roads, health, education, water and other projects. Now, quality management has become an integral part of construction projects (Birhanu, 2014). The role of quality management for a construction company is not an isolated activity, but intertwined with all the operational and managerial processes of the company.

As for the implementation of quality management in project management, the concepts of quality planning (identification of quality standards), quality assurance (evaluation of

overall project performance) and quality control (monitoring of specific project results) in the quality management processes were defined by Project Management Institue (2013).

Roads are among the most important public assets in many countries. Road improvements bring crucial benefits to road users through improved access to hospitals, schools, markets and overall economic development to the nation.(Shtayat *et al.*, 2020). Project implementation and management focuses on three basic parameters: Quality, cost and time.

Therefore, this research study aims to improve road quality control implementation and maintenance management practices by assessing the current condition, identifying the weakness and proposing effective approaches to improve the road quality control and maintenance management system in Gambella rural road authority.

1.2 Statement of the Problem

Project quality management involves both quality assurance (planning to meet quality requirements) and quality control (steps taken to control results to see if they conform to requirements). Quality can be defined as the level of conformance of the final deliverable to the customer's requirements. One cause of usual project failure is that quality is overlooked or scarified so that a tight deadline can be met. It is very helpful to complete a project on time, only to discover that the thing delivered will not work properly Project Management Institute (2013).

Quality cost, mismanagement ,design and technical specfiation,materials quality,workmanship and project period all affects engineering and construction activities, with its services, personnel, client, contractors and end users, (Saha and Ksaibati, 2017). Unpaved roads in seasonally frozen climate regions are frequently subjected to freeze-thaws cycles, which could lead to severe damage of roads including rutting, potholes, corrugations, and frost boils which were considered for both on going and finised roads.

The main freeze-thaws cycles related to damage are caused by combination of several factors including frost-susceptible sub-grade, sub-base and base materials,degraded surface materials, source of water, poor sub-surface drainage and heavy traffic loading on unpaved roads (White and Vennapusa, 2013).

From the perspective of a construction company, quality management in construction projects should mean maintaining the quality of construction works at the required standard so as to obtain customers' satisfaction that would bring long term competitiveness and

business survival for the companies (Abdulrazzak Rumane, 2011). Quality management is critically required for a construction company to sustain in current construction market which is highly challenging and competitive.

(Amadi *et al.*, 2018) explained that quality management has to provide the environment within which related tools, techniques and procedures can be deployed effectively leading to operational success for a company. The role of quality management in construction project is not an isolated activity, but integrated with all the operational and managerial processes of the company. It is accomplished through an integrated effort between all levels of a company to increase customers' satisfaction by continuously improving current performance.

In order to control quality management in construction projects, several tools and techniques were identified as part of the implementation process, including, benefit/cost analysis, benchmarking, flow-charting, design of experiments, cost of quality, quality audits, inspection, control charts, praetor diagrams, statistical sampling, and trend analysis (Abdulrazzak Rumane, 2011) and found that the project manager's competence and top management support are found to contribute significantly in enhancing the quality performance of a construction project. Lack of contractor experienced topped the quality related cause of project failure. (Amadi *et al.*, 2018) on this part described good quality in the context of projects and programs as being to meet the customer requirement, meet the specifications, solve the problem, fit the purpose and satisfy the customer in this case the community who are served by the project.

Most of the scholars agree that project quality in construction sector is affected by various internal and external factors. (Management, 2019) of Ethiopia noticed concerns in the areas of bureaucracy, cost, time consumption and interpretation in relation to the implementation of ISO-9000 standards in United Kingdom (UK) construction industry. (Tougwa, 2018) stated that the three most significant negative outcomes encountered by Hong Kong contractors on ISO-9000 certification are, more paperwork, more time spent in management, and increase of bureaucracy.

(Abdulrazzak Rumane, 2011) observed several shortcomings related to the quality management implementation in UK, i.e., QA and QM are not implemented on a full scale, the degree of commitment is different between top management and site employees, and

quality management was limited to the construction stage only. (Taylor et al, 2010) concluded that senior managers' involvement, understanding and customer focus are essential antecedents of TQM success. (Chin-Keng, 2011) found that top management commitment is the most critical factor for the successful implementation of ISO-9000.

(Birhanu,2014) in Ethiopia , identified that lack of effective supervision, communication, management of commitment, proper equipment and materials available for use, quality assurance team lead the process, staff turnover, skilled turnover, inefficient resource management and problems with contractors are some of the challenges identified to the attainment of project quality.

Furthermore;(Demeke and Gebissa, 2016) in Ethiopia study, identified three major problems related to unsuccessful projects and that contribute to failures of projects in Ethiopia public sectors; the first is resource problem that includes shortage of adequately trained and skilled human, financial and material resources. Second involves, management problems such as weak sharing of responsibility during planning, weak follow-up, poor coordination and third, technical problems which include loose linkages with sectorial policy and strategy, weak technical skill and poor project design are some of the identified problems.

1.3 Research Questions

Research questions are formulate in order to form the research direction and to set its demarcation and explaination.The research questions that kept in mind are the following:

1. What are the quality control systems,tools and techniques on unpaved road construction in Gambella rural road authority?

2. What are the major factors affecting quality of unpaved road construction in the area?

3. What are the impact of factors affecting quality of unpaved road construction in the area?

1.4 Objectives of the Study

1.4.1 General objectives

The main objective of this research study is to assess quality control on unpaved road construction project in Gambella rural road authority.

1.4.2 Specific objectives

The specific objectives of this research study are the following:

1. To assess quality control system,tools and techniques on unpaved road construction projects in the area.

2. To identify the major factors affecting quality of unpaved road construction in the area.

3. To identify the impact of factors affecting quality control of unpaved road construction in the area.

4. To assess the Quality management System and Quality condition survey on unpaved road construction segnments in the study area.

1.5 The Scope of the Study

This study had been focused on the assessment of quality control, quality assurance, quality plan and quality management and its implementation on unpaved road construction and maintenance in Gambella town, focusing on project works of Gambella rural road authority. The study also covered major aspects with those parties (client, contractors, consultants and others have been followed on how they perceived implementation of activities in order to achieve the best quality works on unpaved roads construction and maintenance.

This study is limited to quality management practices and problems of construction projects limited to Gambella road road Authority. Generally, the study is limited to examining the nature of process quality management in the project management process, tools and techniques, top management commitment, identification of impact factors affecting quality, and challenges to implement Quality management in Gambella rural road Authority. This study is also limited to project owners/clients and consultant while actors in project implementation and management are also contractors, project team workers, and beneficiaries(community) among others, only assessed due to limited personal ,financial capacity, and shortage of time.

This research study was dealing with three on going woredas road construction projects such as Bonga-Siri majang kebele road, Duchay kebele- Meti zone and Itang special woreda-Pol kebele road segment,the method applied here was Purposive smapling methods.

1.6 Significance of the Study

Successfully managed and implemented qualified projects play a key role in the improvement human Safety, contribute to improved productivity, and increase sustainability. Project management in general and quality management in particular, have been at its infant stage of development as a profession especially in Ethiopia. This research findings was aimed to improve quality problems through successful implementation and management of projects. Therefore, this research work has contributed to the development of Gambella rural road authority organization and adds to the project management body of knowledge by providing additional experiences to the organization on how to control quality.

The study findings also has relevant input to the management of the case company- Gambella rural road Authority in identifying the existing strength and weakness of quality management system of construction projects in order to apply the existing projects and to similar projects in the future.

Likewise, other development projects can also use the result of the work to improve the quality related problems in construction projects. Moreover, it is believed to provide insight to development policy makers, development program/project designers, donors and non-governmental organizations.

Furthermore; this study served as a starting point towards further studies in the area at regional levels, national levels, for communityor end user, for government agencies and generally for scientific society as well as client satisfaction. The basic importance of this study is directing problems cause by quality defects and related issues that result in reworks with possible suggestion of solution,to improve quality management system, quality planning and quality control implementation processes, specifically in the area of onstruction projects such as unpaved roads.

CHAPTER TWO

LITERATURE REVIEW

2.1 Project and Project Management

This chapter covers review of literatures from different scholars and authors that have been reviewed in the area of project management with special focus on project quality management. It deals with both theoretical, empirical, and conceptual findings of various researchers concepts related to projects, project management, project quality management practices, top management commitment for project implementation, and management challenges. It deals with the review of related literature gathered from different secondary sources such as published books, articles, journals and related websites. In this regard, efforts were exerted to include as much significantly related literatures as possible by reviewing available documents that exhibits points, targeting at the attainment of the research objectives.

The main topics in this chapter outlined are quality in general (with concept of construction quality),with concept of quality control in construction projects, characteristics of gravel (unpaved) roads construction and maintenance and its quality control implementation (Liu, 2016).Errors, defects, risks and failures are common in unpaved roads construction activities and maintenance processes.

2.1.1 Projects

A project can be defined in various ways since some writers and practitioners of project management state the meaning of projects as undertaking task that has a beginning and an end; requires budget and resources, and has a goal or objective to achieve, that may range from simple activities to mega projects that require many years and huge amount of budget.

A project is a task that is performed by a temporary organization in order to achieve predetermined result. Projects are not limited in size or in persons involved but are always temporal and have a clear start and end. Projects can be used for different kinds of purpose, but most commonly they are used for realizing organizational goals (Lund, 2011).

Moreover, one of the most commonly accepted definition of project is that a sequence of unique, complex, and connected activities that have one goal or purpose and that must be

completed by specific time, within budget, and according to specification (Robert K.Wysocki, 2014).

Contractors

Provision of contract plans ,specifications, and other documents prepared in sufficient details;timely decision by the owner and design professional; fair and timely interpretation of contract requirements from field design and inspection staff; contract for performance of work on a reasonal schedule.

Regulatory agencies

Public safety and helath, environmental considerations, protection of public propery,conformance with applicable laws,regulation, codes

Project requirements

Owner/Client

Functional adequacy ,completion on time and with in budget,lifecycle costs,operaton and maintenance costs.

Design professional/Consultant

Provision of well defined scope of work,budget to assemble and use a qualified, trained and experienced staff, budget to obtain adequate filed information prior to design, provision for timely decision by owner and design professional,contract to perform necessary work at a fair fee with adequate time allowance.

Figure: 2.1 Project requirements

Source: (Nyakala et.al, 2019), Quality in the construction project.

2.1.2 Project Management

Over the years, several authors' definitions of project management were published. One of the most significant definition is given in PMBOK, which defines project management as "the application of knowledge, skills, tools and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project" (PMOK, 2013).

It is about creating an environment and conditions in which desired objective and goals can be achieved in a controlled manner by a team of people and accomplished through the application and integration of the project management processes i.e., initiating, planning, executing, monitoring, controlling and closing. Project management has become a scientific field with its own professional associations, the Project Management Institute (PMI) and the International Project Management association (IPMA). These associations are known as promoters of the standardization of project management and certification programs for project managers (Lawrence et.al, 2021).

 Proper management of project as stated in PMOBK includes but not limited to the requirement identification, addressing stakeholders concerns, needs and expectations in planning and implementation of projects, maintain internal and external stakeholders' management and communication. Moreover, balancing of project competing constraints mainly scope, Quality, schedule, budget, resources and risks which are the most common factors (PMBOK,2013). To this end there is strong relationship among each factor since there is interdependence to influence each other for example if there is time or cost overrun on the projects it has direct impact on targeted quality (Nader, 2011).

The PMBOK guide is process based on describing project management as being accomplished through the application and integration of the project management processes of initiating, planning, executing, monitoring and controlling, and closing. Further, it assumes that all project management practices fall into ten knowledge areas, which are project integration management, project scope management, project time management, project cost management, project quality management, project resource management, project communications management, project risk management, project stakeholder management, and project procurement management.

2.2 Overview of Quality management

Quality has been characterized by many authors as something that relates to the results of an ongoing improvement that includes products, services, processes and people to fulfill customer expectations and customer satisfaction. Formal writing on the concept of quality can be found from quality gurus such as (Deming cycle,2010),and (Crosby, 2016). As literature indicate that Gurus have laid the foundation for understanding most concepts of quality management such as TQM, Total Quality Control and Quality Management systems.

2.2.1 What is Quality?

Quality has been defined from various perspectives. According to Shen Quality as satisfying or exceeding customers' requirements and expectations, and consequently to some extent it is the customer who eventually judges the quality of a product (Wawak and Ljevo, 2020). Moreover,the major contributors to quality improvements has four components of absolute quality these are; conformance to requirements, prevention, and performance standard is "zero defects" and measured by the cost of non-conformance.

Furthermore, the Kodak definition of quality is those products and services that are perceived to meet or exceed the needs and expectations of the customer at a cost that represents outstanding value. Additionally, the ISO 9000 define quality as "the totality of feature and characteristics of a product or service that bears on its ability to satisfy stated or implied needs"(Townshend, 2019). Additionally, (Robert K.Wysocki,2014) identified two types of quality as part of every project; the first is product quality which refers to the quality of the deliverable from the project. The second type of quality is process quality, which is the quality of the project management process itself. The later mainly focus on how well the project management process works and how can it be improved (Robert K.Wysocki, 2014).

Moreover, projects with the following constraints: scope, cost, time, resources, quality and risk. Except for risk these constraints are connected, a change in one constraint will affect at least another constraint. The scope triangle clearly illustrate variables of the project and there interdependence. Similarly, PMI illustrates project quality through the concept of the triple constraint project scope, time and cost. Project quality is affected by balancing these three interrelated factors. "The relationship among these factors is such that if any one of

the three factors changes, at least one other factor is likely to be affected" (PMBOK, 2013). The following scope triangle clearly illustrate variables of the project and their interdependence as shown in figure 2.2: Triple triangle or Iron triangle.
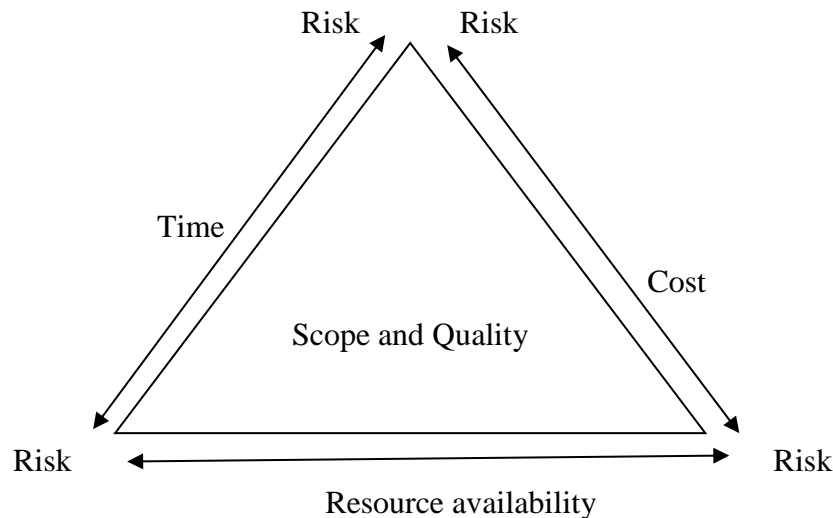
Figure: 2.2 Triple triangle or Iron triangleFigure

Source: (Robert K.Wysocki, 2014)

According to (Wawak and Ljevo, 2020) field work (Quality Control, a Practical approach, 7th edition, stated that Quality can be expressed as: $Q = P / E$ Where: Q = Quality, P = Performance E = Expectation, if Q is greater than 1.0, then the customer has a feeling of great satisfaction about the product or service rendered. The determination of Q is based on perception, with the contractor determining performance and the customer determining expectations. The customer expectations are continually becoming more demanding.

2.3 Project quality management

As scholars justify that project quality management as a process, and according to Dereje Bitew literature review, the overall aim of quality management is to satisfy the customer, conform to requirements, ensure fitness for purpose, and to ensure the product for use. Project model looks at quality management as set of activities or tasks that are required to ensure the project satisfies all the needs for which it was undertaken based on documented in the state of work and includes a focus on quality management from the perspective of product, processes, and the people needed to make quality an effective and efficient aspect of successful project completion (Dereje Bitew,2019).

Moreover, (Robert K.Wysocki,2014) effective project management book states that: A sound quality management programs with processes in place that monitor the work in a project is a good investment.

It is not only contributes to customer satisfaction, but also it helps organizations use their resources more effectively and efficiently by reducing waste and rework. Furthermore, described "Quality management is one area that should not be compromised. The payoff is a higher probability of successfully completing the project and satisfying the customer" (Robert K.Wysocki, 2014).

PMBOK guide explains that "Project Quality Management includes the processes and activities of the performing organization that determine quality policies, objectives and responsibilities so that the project will satisfy the needs for which it was undertaken. It implements the quality management system through policy and procedures with continuous process improvement activities conducted throughout, as appropriate" (PMBOK, 2008).

Furthermore,the PMI states that project quality management include:
 -To identify all the quality standards relevant for the project and plan how to satisfy them.
- To evaluate the project to ensure that the relevant quality standards will be met
- To monitor, to compare with the relevant quality standards, and to correct the product and the processes.

The concept of quality has existed for many years, but its meaning and perception has changed and evolved over time. Before the early twentieth century, quality management meant inspecting products to ensure that they met specifications (Reid and Sanders, 2007) and cited by (Sabah, 2011). Similarly,(Chin-Keng, 2011) descried the changing view of quality generally in the past and present as follows, in table 2.1:

Table: 2.1 Changing views of Quality

№	Past	Present
1	Quality is the responsibility of blue-collar and direct labor employees the floor and the overhead staff used	Quality is everyone's responsibility, including workers working on white-collar workers, the indirect labor force
2	Quality defects should be hidden from the customers (and possibly management)	Defects should be high-lighted and brought to the surface for corrective action
3	Quality problems lead to blame, faulty justification, and excuses	Quality problems lead to cooperative solutions
4	Corrections-to-quality problems should be accomplished with minimum documentation	Documentation is essential for "lessons learned"so that mistakes are not repeated
5	Increased quality will increase project costs	Improved quality saves money and increase business
6	Quality is internally focused	Quality is customer focused
7	Quality will not occur without close supervision	People want to produce quality products of people
8	Quality occurs during project execution	Quality occurs at project initiation and must be planned for within the project

Source: (Chin-Keng, 2011), Study of Quality management in construction projects.

From the Chin-Keng, changing view of comparing the previous and current, shows that quality as the process and dynamic concept which changes from individual based to collective, hidden to remedial solution, complain to two-way, rather than documentation to learn to improve, from incurring cost to minimize and enlarge the company, from internal to customer centered by producing quality product by focusing on the whole process of the project cycle rather than focusing only on the quality during implementation only. Therefore, this may inferred that quality is dynamic concept for improvement of the business from one person to group for improvement of the business to meet organizational goals.

2.3.1 Quality policy

As different scholars state quality policy is considered as a guide for improving quality of products and services. As (Wawak and Ljevo, 2020) stated that an organization's quality policy is part of its strategic planning process, which includes setting the direction for the company to improve its situation for long-term prosperity and ending the means to achieve that direction. The main idea is to communicate throughout the company that something should be done in terms of quality if the company is to survive and compete in the future.

The Japanese approach known as 'Hoshin Kanri', or policy deployment, can be adopted when defining a company's quality policy (Thwala and Aigbavboa, 2019), described its major elements). The main advantages of this approach over conventional planning systems are that it combines strategic objectives with tactical daily management, covers all functions in a company and increases quality goals' consensus. Moreover,(Chin-Keng, 2011) defined quality policy as " a document that is typically created by quality experts and fully supported by top management. The policy should state the quality objectives, the level of quality acceptable to the organization, and the responsibility of the organization's members for executing the policy and ensuring quality. The quality policy is instrumental in creating the organization's reputation and quality image" (Chin, 2011: P.771). Described good quality policy as:

- Statement of principles stating what, not how.

- Promote consistency throughout the organization and cross projects.
- Provide an explanation to outsiders of how the organization views quality.
- Provide specific guidelines for important quality matters.
- Provide provisions for changing/updating the policy.

Table: 2.2 Underlining principles for effective Quality policy development from UNIDO, Vienna, 2018

Quality Policy guiding principles	
Coherence	Align internationally, Ensure legal and regulatory coherence, Separate voluntary and mandatory work, & Apply and align approaches with good regulatory practices.
Ownership	Ensure government responsibility and leadership, Promote transparency, nondiscrimination, independence and competence, & Define clear roles and responsibilities.
Inclusiveness	Engage private sector and consumers, Make full use of stakeholder engagement, & Embrace diversity including gender balance.
Sustainability	Follow demand-driven approach, Ensure financial and resource sustainability, Periodically monitor and review, Ensure effective implementation, & Promoting information and awareness.
Optimization	Don't reinvent the wheel, Encourage innovative approaches, Consider dynamics and evolution, Exploit regional economies of scale and scope, Prioritize and focus, Follow evidence and risk based approach, & fit for purpose and forward looking.

Source: UNIDO (United Nation`s Industrial Development Organization, 2018)

2.3.2 Principles of Quality and Quality management system (QMS)

Kodak identified five principles of quality these are leadership, customer focus, analytical approach, teamwork/team spirit and continuous improvement which is the center of his principle. In addition, according to Evans and Lindsay Quality Management is based on three fundamental principles (Evans and Lindsay, 2008) cited in by (Sabah ,2011); these are: i) Focus on customer and stakeholders; ii) Participation and teamwork by everyone in the organization; iii) A process focus supported by continuous improvement and learning.

Furthermore, the British Standards Institute (BSI, 2008) as the extent to which planned activities are realized and planned results are achieved. The term "effectiveness" is particularly pertinent to quality management system implementation, as companies that adopt a QMP must meet their specified quality requirements and prescribed quality objectives without any shortfalls, in order to be seen to have successfully implemented their QMPS (Willar,2012). Effective implementation of a quality management system (QMS),

and espousing quality values or adopting a high-level quality philosophy, whether by virtue of operating a QMS ISO 9001 or applying a TQM approach, potentially provides benefits that are needed, even in the most competitive construction environments. Five clauses and eight principles of ISO-9001 were shown in table 2.5.

2.3.3 Project quality management processes and steps

As defined in the PMBOK guide, Project quality management processes flow provides an overview of the processes which include: Quality plan management, Perform Quality Assurance, and Control Quality as shown in figure 2.3:
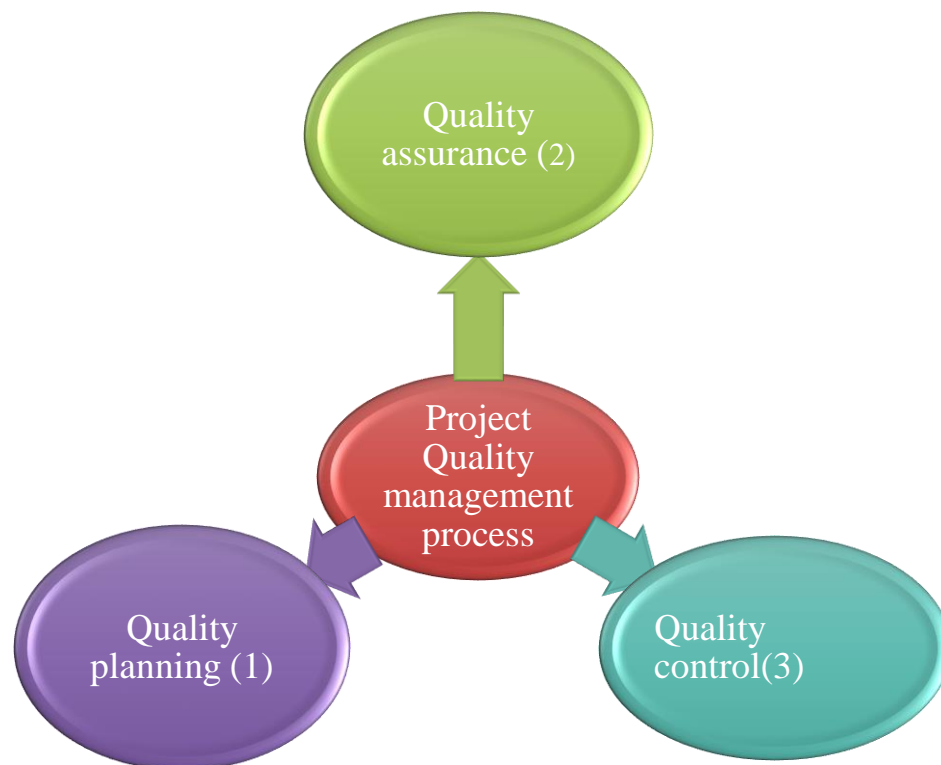
Figure: 2.3 Project Quality management proces

Source: Quality management for delivering sustainable construction project in South Africa rural area: (The construction project manager`s perspective 2010, page 5).

Step 1: Quality planning

As per project management for development (PMD4), the first step in quality management is to define quality which is under taken by the project manager and the team to identify what quality standards will be in the project from perspectives of key stakeholders of the

project depending upon the area of specialization of the projects for instance, road construction may have some standard definitions of quality that can be used by the project. Identifying the quality standards that are relevant to the project and determining how to meet them. It is one of the key facilitating processes during the project planning. Quality planning is usually involved during preparation phase, design phase, and pre-construction phase. Quality planning should be performed regularly and parallel with the other project planning processes.

According to (Lydia ,2010),stated the guidelines to ensure the quality in planning are: (i) Ensure that all relevant parties involved including consultants, subcontractors and suppliers are included in the task of quality planning for the project; (ii) Establish and define the purpose of the quality system; (iii) minimize the effort required to amend copies of documents; (iv) Set up a quality system development team, so that the team can produce an effective plan; (v) Ensure that throughout the quality planning task constantly focused on the customer requirements. (Thwala and Aigbavboa, 2019) defined quality planning as a set of activities whose purpose is to define quality system policies, objectives, and requirements, and to explain how these policies will be applied, how these objectives will be achieved, and how these requirements will be met. Subsequent to this definition, (Kim et.al, 2019) stressed that quality plan is different from a test plan.

The study continued that quality plan defines the quality goals, is realistic about where defects come from, Selects appropriate detection and prevention methods, and has means not to "go dark". The Project Management Book of Knowledge "PMBOK" for also addressed quality planning from a different position to enhance the thoughts earlier expressed. It said that quality planning has a process input generated by predecessor processes referred to as the Project Scope Statement and Project Management Plan. These processes are introduced by external units like Enterprise Environmental Factors and Organizational Process Assets. PMBOK for further defined quality planning as the process for "identifying which quality standards are relevant to a project and determining how to satisfy them": In other words, it means planning how to fulfill process and product (deliverable) quality requirements: "Quality is the degree to which a set of inherent characteristics fulfill requirements". By planning the quality one has to respect some principles, and these are:

Customer satisfaction comes first: Quality is defined by the requirements of the customer.

Prevention over inspection: It's better to avoid mistakes than to inspect the result and repair the defects.

Management responsibility: Costs of quality must be approved by the management.

Continuous improvement: Becoming better is an iteratively structured process.

Table: 2.3 Quality planning steps

Steps	Descriptions
Step 1	Establish the project.
Step 2	Identify the customers.
Step 3	Identify the needs of those customers
Step 4	Analyze and prioritize customer needs.
Step 5	Develop a product that can respond to customer needs.
Step 6	Optimize the product features so as to meet the organization's product range as well as customer needs.
Step 7	Identify process and goals
Step 8	Develop a process that is able to produce the product.
Step 9	Optimize the process features and goals.
Step 10	Prove that the process can produce the product under operating conditions.
Step 11	Identify control needs.
Step 12	Transfer the process to operations.

Source :(Abdul Razzak Rumane, 2011)

Step 2: Quality assurance

(Thwala and Aigbavboa, 2019) defined quality assurance as a set of activities whose purpose is to demonstrate that an entity meets all quality requirements. Quality assurance activities are carried out in order to inspire the confidence of both customers and managers, confidence that all quality requirements are being met.

 Moreover, the main objective of quality assurance measures in information processes is to fulfill a required quality level. In general quality assurance is a process to provide confirmation based on evidence to ensure to the donor, beneficiaries, organization

management and other stakeholders that product meet needs, expectations, and other requirements. It assures the existence and effectiveness of process and procedures tools, and safeguards are in place to make sure that the expected levels of quality will be reached to produce quality outputs. Therefore, quality assurance occurs during the implementation phase of the project and includes the evaluation of the overall performance of the project on a regular basis to provide confidence that the project will satisfy the quality standards defined by the project.

Step 3: Quality control

Quality control is the use of techniques and activities that compare actual quality performance with goals and define appropriate action in response to a shortfall. It is the process that monitors specific project results to determine if they comply with relevant standards and identifies different approaches to eliminate the causes for the unsatisfactory performance. The goal of quality control is to improve quality and involves monitoring the project outputs to determine if they meet the quality standards or definitions based on the project stakeholder's expectations. Quality control also includes how the project performs in its efforts to manage scope, budget and schedule (PDEM, 2014).

The PMBOK refers to quality control as the technical aspect of quality management. Project team members who have specific technical expertise on the various aspects of the project play an active role in quality control. They set up the technical processes and procedures that ensure that each step of the project provides a quality output from design and development through implementation and maintenance. Each step's output must conform to the overall quality standards and quality plans, thus ensuring that quality is achieved (PMI, 2008).

According to (Saha and Ksaibati, 2017) a good quality control system will; "Select what to control, set standards that provide the basis for decisions regarding possible corrective action, establish the measurement methods used, compare the actual results to the quality standards, act to bring nonconforming processes and material back to the standard based on the information collected, monitor and calibrate measuring devices and include detailed documentation for all processes".

Similarly, (JICA, 2015) quality control relies on five basics: a clear definition of quality; a target, a clear goal; a sensor, a way to measure actual performance; a way to interpret the

measurement and compare with the target; and a way to take action, to adjust the process if necessary .

Additionally, investopedia explains as cited by Agbenyega 'Quality Control' as a process through which a business seeks to ensure that product quality is maintained or improved and manufacturing errors are reduced or eliminated. Quality control requires the business to create an environment in which both management and employees strive for perfection. This is done by training personnel, creating benchmarks for product quality, and testing products to check for statistically significant variations. A major aspect of quality control is the establishment of well-defined controls (Agbenyega, 2014).

Table: 2.4 Quality control steps

Steps	Descriptions
Step 1	Choose control subject
Step 2	Establish standards/objectives
Step 3	Monitor actual performance
Step 4	Compare objectives with achievements
Step 5	Take corrective action to reduce the differences

Source: (JICA, 2015)

Step 4: Quality Improvements actions

Quality improvement refers to the application of methods and tools to close the gap between current and expected levels of quality by understanding and addressing system deficiencies and strengths to improve, or in some cases, re-design project processes.

A variety of quality improvement approaches exists, ranging from individual performance improvement to redesign of entire project processes. These approaches differ in terms of time, resources, and complexity, but share the four steps in quality improvement: identify, analyze, develop and test.

 In general, quality improvement is the systematic approach to the processes of work that looks to remove waste, loss, rework, frustration, etc. in order to make the processes of work more effective, efficient, and appropriate.

Shewhart who was the developer of control charts and the continuous cycle of process improvement was popularized by Deming who was also disciple of Shewhart, popularized the Shewhart Cycle as the Plan-Do-Check-Act (PDCA) cycle or PDCA model.
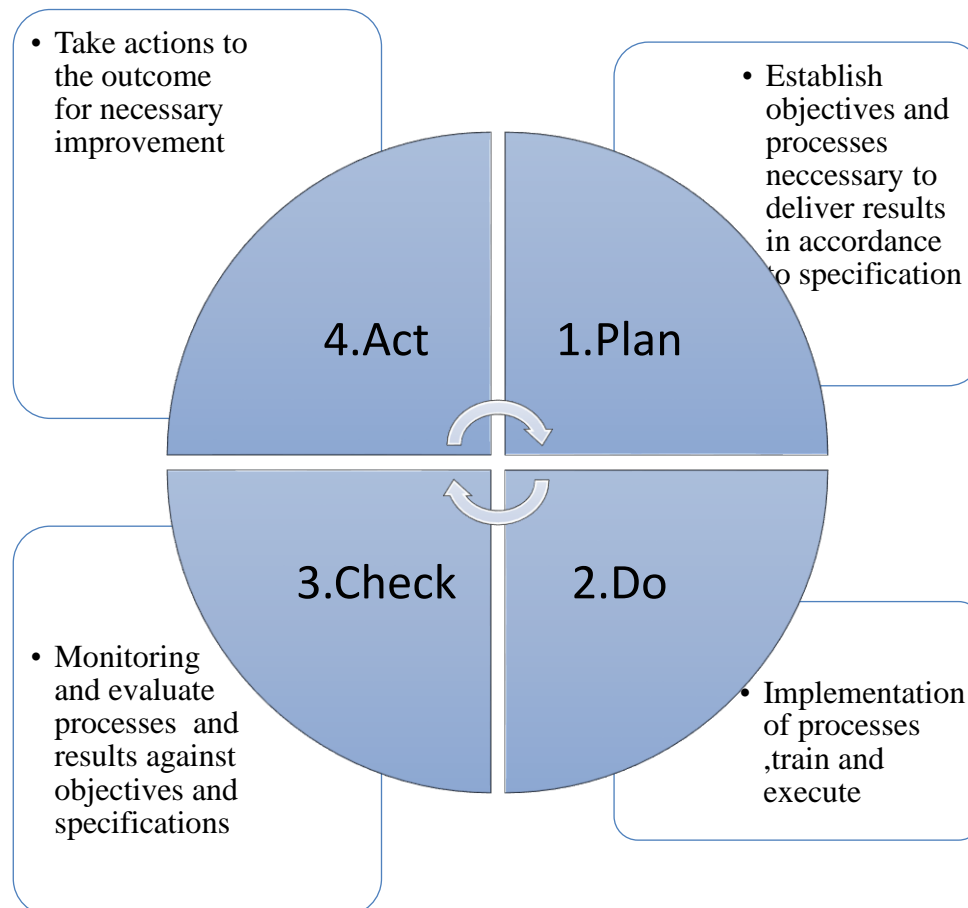
Figure: 2.4 The Deming cycle for improvements

Source: Huemann.M, improving quality in projects and programs, chapter 37 in Morris P.W and Pinto J.K(eds),The Wiley guideline to managing projects ,Wiley and sons,2004.

Plan: is to design or revise the business process components that improve the results.

Do: Is implementing the plan and measuring its performance.

Check: This is to assess the measurements and report results to decision makers.

Act: Changes needed will be decided in order to improve the process.

2.4 Total Quality management in Construction projects

Total quality management (TQM) is often defined as a complete management philosophy that permeates every aspect of a company and place quality as a strategic issue. It is accomplished through an integrated effort between all levels of a company to increase customers' satisfaction by continuously improving current performance.

The adoption of TQM in construction industry has been promoted in some literatures (Haupt and Whiteman,2013). ISO certification is nowadays a trend in most industries including construction industry. The five clauses for its implementation are quality management system, management responsibility, resource management, product realization, and measurement, analysis, and improvement. The application of ISO standards has received much attention from researchers.

(Bagga and Haque, 2020) argued that the ISO 9000 standards series can form and have formed the basis for an efficient and advantageous quality management system in the construction industry. (Okine and Kissi,2018) stressed that the motivators behind the implementation of ISO 9000-certified quality systems for Hong Kong constructors appear to be to qualify for public works tenders, to meet clients'/customers' expectations and to improve the quality of work done.

(Liu, 2016) commented that ISO 9000 certification is not an option but rather a reality for construction companies that wish to retain and sustain their competitiveness in today's highly competitive markets. (Liu, 2016) stated that it is indicative that ISO 9000 has an impact on the contractors 'attitude towards quality. The summary of ISO 9001 Series quality practices are shown in figure 2.5. This an international standard for QMS (in comparison with other quality standards and awards Six Sigma, Malcolm Bald ridge National Quality Award Criteria, The European Foundation for Quality Management Excellence Model-EFQM EM (Willar, 2012).

TQM uses strategy, data and effective communication to integrate the quality principles into the cultural and activities of the organization (Abdul Razzak Rumane, 2011). The following are some of the advantages of implementing TQM in the organization such as:

- Achieving customer satisfaction
- Continuous improvement
- Developing teamwork

- ☐ Establishing vision for the employees
- ☐ Setting standards and goals for the employees
- ☐ Building motivation within the organization
- ☐ Developing corporate culture
- ☐ Construction projects have project managers who are responsible for personnel, cost control, time management, and quality control.

Table: 2.5 Matrix of the five clauses and eight management principles of ISO 9001 standard

ISO 9001 Clauses \ ISO 9001 Principles	Customer focus	Leadership	People involvement	Process approach	System approach	Continual improvement	Factual approach to decision making	Mutual beneficial supplier
Quality management system								
General requirements			■	■	■	■		■
Documentation requirements			■	■	■	■		■
Management responsibility								
Management commitment	■	■	■			■		
Customer focus	■	■						
Quality policy	■	■	■		■	■	■	
Planning		■		■	■	■	■	
Responsibility, authority,& communication	■	■	■			■		
Management review	■	■		■		■	■	
Resource management								
Provision of resources			■					
Human resources	■		■				■	
Infrastructure								
Work environment			■					
Product realization								
Planning of product realization				■	■		■	

	1	2	3	4	5	6	7	8
Customer related processes	■		■					
Design and development			■			■	■	
Purchasing							■	■
Production & service provision	■			■			■	
Control of monitoring & measuring devices							■	
Measurement, analysis, and improvement								
General	■			■		■	■	
Monitoring & measurement	■			■		■	■	
Control of nonconforming product	■							
Analysis of data	■					■	■	
Improvement				■		■	■	

Source: (Willar, 2012), Malcolm Bald ridge National quality award criteria.
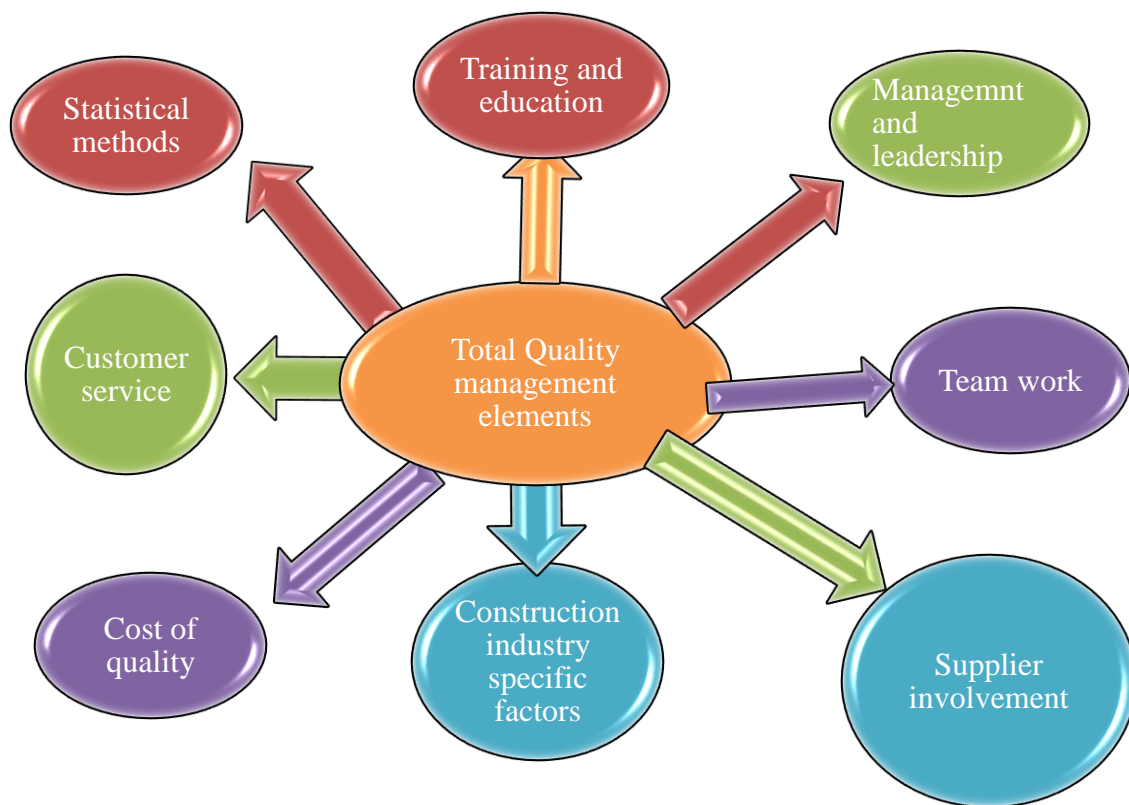
Figure: 2.5 Elements of TQM in the construction processes

Source: (Arditi & Gunaydin,*et al.*, 2018)

2.5 Quality management in Construction project

Defining quality of construction is more difficult due to the uniqueness of the project. (Chang,2010) stated that "the product is usually not a repetitive unit but a unique piece of work with specific characteristics. Secondly, the needs to be satisfied include not only those of the client but also the expectations of the community into which the completed building will integrate. The construction cost and time of delivery are also important characteristics of quality." (Saini, 2016).

(Abdul Razzak Rumane, 2011) construction project quality management is defined as the fulfillment of owner's needs per defined scope of works within a budget and specified schedule to satisfy the owner's / user's requirements. The phenomenon of these three components can be the construction project trilogy (Abdul Razzak Rumane, 2011). Construction projects are custom oriented and custom designed, having specific requirements set by the customer to be completed within a finite duration and assigned budget.

Every project has elements that are unique that means no two projects are identical. It is always the owner's desire that the project be unique and better. To a great extent, each project has to be designed and built to serve a specified need. Construction projects are more customized than a routine and repetitive business (Abdul Razzak Rumane, 2011).

A Quality management system consists of set of processes. These processes will ensure that the attainment of defined quality standards for the provision of provided services and products by the project or a construction company (Ngezahayo et.al.,2019). Quality management is considered to be based upon three pillars which are time, cost and needs or expectations. Quality management is all about defining the need of the customer within the given time and cost (Chen, 2019). A Quality management system consists of two main components, the first being the framework for guiding quality related actions by all employees (design of quality system) and the second, means of assessing how well these actions will be carried out (delivery of quality system). Companies are increasingly being persuaded to adopt quality management systems in order to meet the globalized marked demands (Boyer *et al.*, 2016).

Construction quality can be illustrated as one part of a construction triangle as shown in figure 2.6.The contractor has to attain the cost level as planned; meet the scheduled deadlines while achieving the required quality level. There must be a balance amongst those three aspects because they define the project scope. Quality must be involved in all phases and stages of construction, such as scope of work, time/duration of work and cost breakdown of the work as construction projects requirement and quality are inseparable to each other.
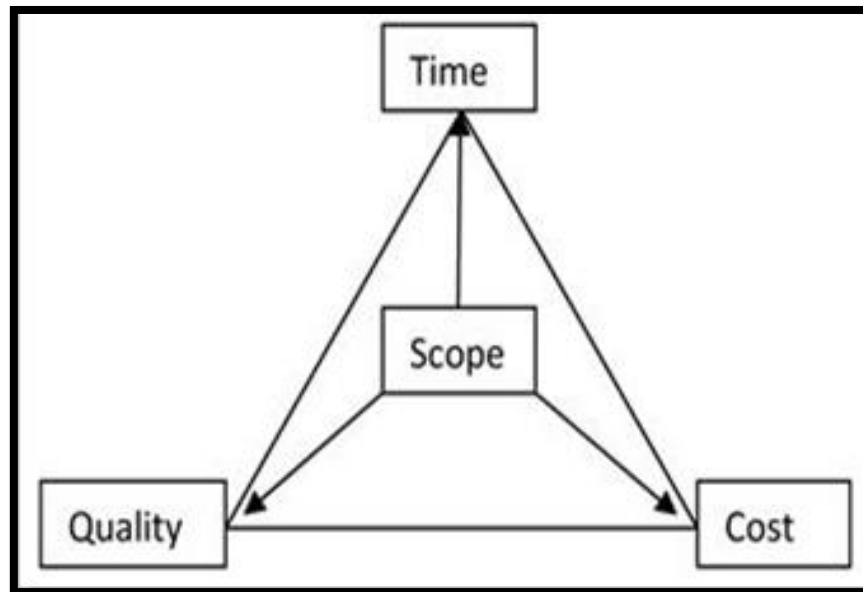
Figure: 2.6 Construction triangle

Source: (M, SH and IA, 2017)

2.6 Quality planning in Construction project

According to Chang typical quality planning contains most of components, if not all, of the following: (Chang, 2010).

- ✓ Brief description of the project;
  - ✓ List of contract documents and drawings;
  - ✓ Project quality objectives;
  - ✓ Site organization chart, with named personnel if known;
  - ✓ Responsibilities and authorities of project staff;
  - ✓ Site layout plan;
  - ✓ Construction programs and sub-programs;
  - ✓ Schedules of subcontractor nomination, material and equipment;
  - ✓ Procurement, based on the construction programme;
  - ✓ List(s) of materials and appliances used for the project, showing the verification requirement of each;
  - ✓ Inspection and test plans, or list thereof;
  - ✓ List of quality procedures and work instructions applicable to project by making reference to the company's Quality Manual and Procedures;
  - ✓ List of project-specific procedures, work instructions and inspection checklists, or target dates for their provision;

✓ Check list, or target dates for their provision;

✓ List of quality records to be kept, including pertinent quality records from subcontractors;

✓ Frequency (or provisional dates if possible) of internal quality audits;

✓ Frequency of updating the quality plan.

2.7 Quality assurance in Construction project of unpaved roads

Quality assurance "is oriented towards prevention of quality deficiencies. It aims at minimizing the risk of making mistakes in the first place, thereby avoiding the necessity for rework, repair or reject"(Bagga and Haque, 2020). It also stated factors that staffs at organizational levels must know, these are; to have appropriate organization structure, clear lines of responsibility and communication, clear definition and description of duties, correct specifications and drawings, proper training, appropriate procedures, and ready access to necessary instructions, motivation, have the right resources, plant and materials; appropriate checking, measurement or testing of products and keeping proper records(Bagga and Haque, 2020).

Quality assurance (QA) is one of the main elements of total quality management that focuses on a systematic process of checking, verifying or determining whether a product or service being produced is meeting specified requirements, standards and customers' expectations. Quality assurance in construction projects covers all activities performed by the consultant, contractor, sub-contractor and suppliers to meet clients' objectives as specified and to ensure that the project is fully functional to the satisfaction of the client or end users. Quality assurance is important in construction industry because of the risk involved in any projects.

2.8 Quality control in construction projects

Quality control in construction is the process of verifying that the project is built to plan, that the tolerances allowable by industry standard and engineering practices have been met and that the finished project meets with quality standards of the project as inspected by the involved stakeholders. According to (Baral *et al.*, 2020), Quality control (QC) is a process of inspecting and confirming that the finished installation or works has indeed met the design specifications enumerated in the contract documents.

A good quality control system should have to consider; select what to control, set standards that provide the basis for decisions regarding possible corrective action, establish the measurement methods used, compare the actual results to the quality standards, act to bring nonconforming processes and material back to the standard based on the information collected, monitor and standardize measuring devices, include detailed documentation for all processes (Bagga and Haque, 2020).

Quality control (QC) is a procedure or set of procedures intended to ensure that a manufactured product or performed service adheres to a defined set of quality criteria or meets the requirements of the client or customer. Quality control refers to the process, most often implemented in manufacturing, of monitoring the quality of finished products through statistical measures and an overall corporate commitment to producing defect-free products. Quality control ensures the completion of the project according to the plans, specifications. In construction activities, conditions of contracts address the concept of quality control knowing that it is a very important concept for the construction industry and to give emphasis on quality of works in order to reach the intended purpose. For instance, the Public Procurement Agency (PPA) condition of contract of the Federal Democratic Republic of Ethiopia under sub-clause 33.1 states the following:

''The Engineer should check the Contractor's work and notify the Contractor of any defects that are found. Such checking should not affect the contractor's responsibilities.

The Engineer may instruct the contractor to search for a defect and to uncover and test any work that the Engineer considers may have a defect.''

According to Ethiopian Roads Authority (ERA, 2012) quality policy, the consultant is responsible for professional quality, technical accuracy and coordination of all surveys, designs, drawings, and specifications and other services furnished by the Consultant under its contract. A comprehensive review of construction quality framework model is show in figure 2.7. Quality is the red thread that goes through all stages and aspects of the construction process, whether, it's at the corporate level or project level.
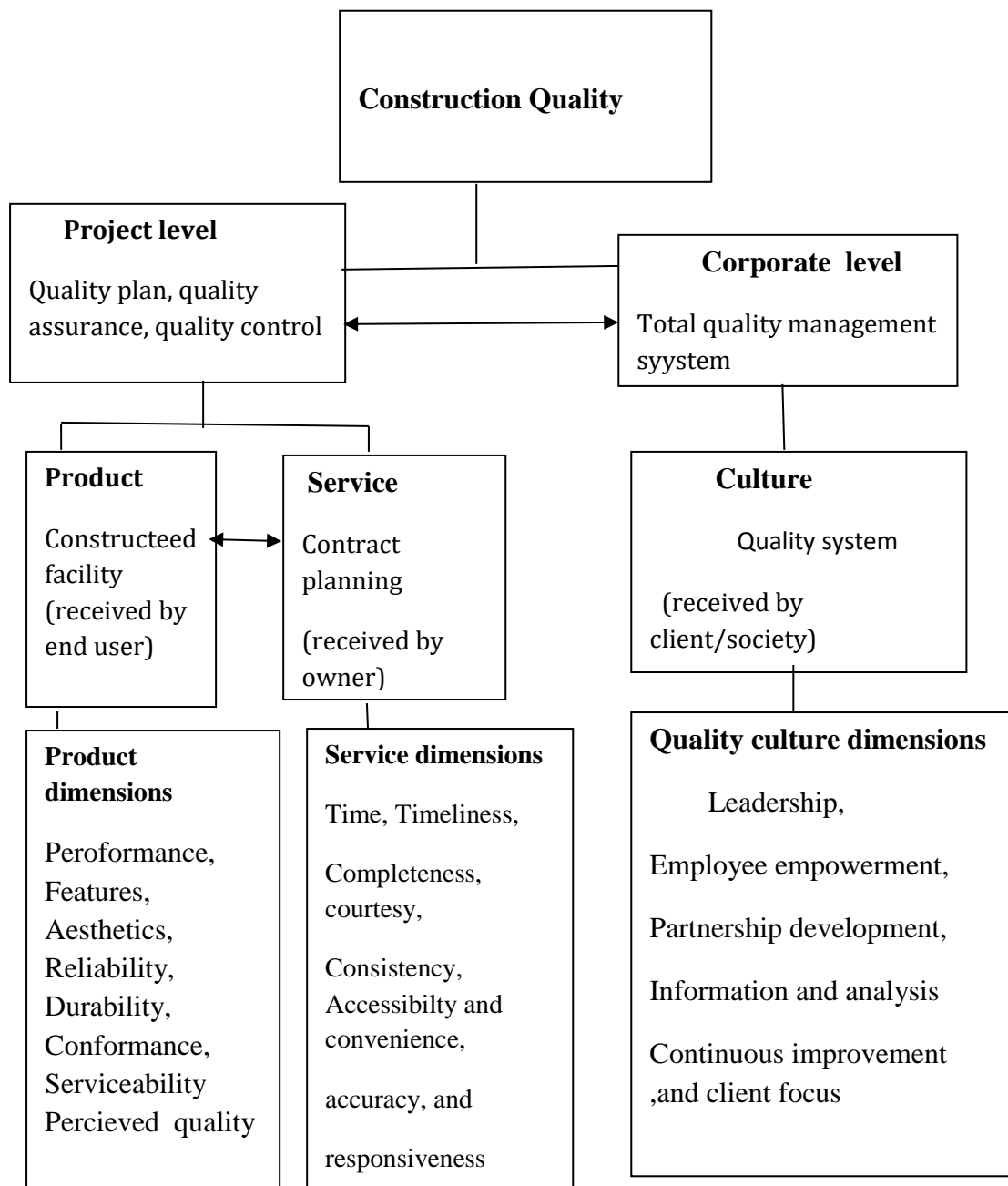
Figure: 2.7 Construction Quality framework model

Source: (Construction quality management, (Chin-Keng, 2011)

2.9 Factors affecting Quality

(Lepartobiko ,2012) stated that quality can be assured by identifying and eliminating the factors that cause poor project performance. (Wawak and Ljevo, 2020) found that the project manager's competence and top management support are found to contribute significantly in enhancing the quality performance of a construction project. Lack of contractor experienced topped the quality related cause of project failure.

(Shtayat *et al.*, 2020) on this part described good quality in the context of projects and programs as being to meet the customer requirement, meet the specifications, solve the problem, fit the purpose and satisfy the customer in this case the community who are served by the project. Most of the scholars agree that project quality in construction sector is affected by various internal and external factors.

2.10 Quality management tools and techniques

As for the implementation of quality management in project management, the concepts of quality planning (identification of quality standards), quality assurance (evaluation of overall project performance) and quality control (monitoring of specific project results) in the quality management processes were defined by (PMI,2013). (Nkomo, et.al, 2016) divided quality tools and techniques that are in support of quality programs into three main types, i.e., hard quality tools, mixing methods and soft methods.

Hard quality tools are formal quality systems, documented quality systems, quality costs, control charts, and statistical sampling standards. Mixing methods are strategy and action plans review, flexibility of organization structure, control charts, quality circles, and quality planning tools. Soft methods are training, customer satisfaction surveys, regular contact with vendors and external organizations, actions to optimize environment impact, empowerment, self-assessment, and benchmarking. According to project management body of knowledge project, quality management tools and techniques are: Benefit/ cost analysis, Benchmarking, flowcharting, Design of experiments, cost of quality, quality audits, inspection, control charts, Pareto diagrams, statistical sampling, and trend analysis. Each techniques has been defined based on PMBOK as:

Benefit/ cost analysis: The primary benefits of meeting quality requirements include less rework, higher productivity, lower costs, increased stakeholder satisfaction, and increased

profitability. A cost-benefit analysis for each quality activity compares the cost of the quality step to the expected benefit.

Benchmarking: Benchmarking involves comparing actual or planned project practices to those of comparable projects to identify best practices, generate ideas for improvement, and provide a basis for measuring performance; Benchmarked projects may exist within the performing organization or outside of it, or can be within the same application area. Benchmarking allows for analogies from projects in a different application area to be made.

Flowcharting: which are also referred to as process maps because they display the sequence of steps and the branching possibilities that exist for a process that transforms one or more inputs into one or more outputs. Flowcharts show the activities, decision points, branching loops, parallel paths, and the overall order of processing by mapping the operational details of procedures.

Design of experiments: Design of experiments (DOE) is a statistical method for identifying which factors may influence specific variables of a product or process under development or in production. Is an analytical technique which helps identify which variables have the most influence on the overall outcome? DOE may be used during the plan quality management process to determine the number and type of tests and their impact on cost of quality.

Cost of quality: Cost of quality includes all costs incurred over the life of the product by investment in preventing nonconformance to requirements, appraising the product or service for conformance to requirements, and failing to meet requirements (rework). Failure costs are often categorized into internal (found by the project) and external (found by the customer). Failure costs are also called cost of poor quality.

Quality audits: A quality audit is a structured, independent process to determine if project activities comply with organizational and project policies, processes, and procedures. Quality audits can confirm the implementation of approved change requests including updates, corrective actions, defect repairs, and preventive actions.

Inspection: An inspection is the examination of a work product to determine if it conforms to documented standards. The results of an inspection generally include measurements and may be conducted at any level. For example, the results of a single activity can be inspected,

or the final product of the project can be inspected. Inspections may be called reviews, peer reviews, audits, or walkthroughs. In some application areas, these terms have narrow and specific meanings. Inspections also are used to validate defect repairs.

Control charts: are used to determine whether or not a process is stable or has predictable performance. Upper and lower specification limits are based on requirements of the agreement. They reflect the maximum and minimum values allowed.

Pareto diagrams: a Pareto diagram is a histogram, ordered by frequency of occurrence that shows how many results were generated by type or category of identified cause. Rank ordering is used to guide corrective action the project team should take action to fix the problems that are causing the great number of defects first. Pareto diagrams are conceptually related to Pareto's law, which holds that a relatively small number of causes will typically produce large majority of the problems or defects. This is commonly referred to as the 80/20 principle, where 80% of the problems are due to 20% of the causes.

Statistical sampling: Statistical sampling involves choosing part of a population of interest for inspection (for example, selecting ten engineering drawings at random from a list of seventy-five). Sample frequency and sizes should be determined during the plan quality management process so the cost of quality will include the number of tests, expected scrap, etc. There is a substantial body of knowledge on statistical sampling. In some application areas, it may be necessary for the project management team to be familiar with a variety of sampling techniques to assure the sample selected represents the population of interest.

Trend analysis: it involves using mathematical techniques to forecast future outcomes based on historical results. Trend analysis is often used to monitor:

Technical performance: - how many errors or defects have been identified and how many remain uncorrected.

Cost and schedule performance: - how many activities per period were completed with significant variances.

2.11 Quality management problems in Construction project

Quality is one of the main concerns in project management depending on the nature of the project especially in developing countries like Ethiopia. The research done by (Birhanu,2014) in Ethiopia stated Fish-bone diagram, the root causes of quality problems

which contributed to weak quality management practices in Ethiopia are leadership problems, lack of policy and strategy, inefficient resources management, inefficient process management, lack of customer focus and weak business performance. Furthermore, quality problems should be taken as an opportunity for improvement; problems can help identify more fundamental or systemic root causes and help develop ways to improve the process.

2.12 Problems in Quality management Implementation

According to Tan Chin-Keng, and Abdul-Rahman, Hamzah literatures certain problems have been observed in relation to quality management implementation.

 (Haupt et al.2013) noticed several hindrances for implementing TQM on construction sites, i.e., too much paperwork, transient nature of workforce, field employees regard TQM as irrelevant, difficulty in measuring results, low bid subcontracting, and subcontractors and suppliers not interested in TQM.

(Chin-Keng, 2011) found that the most difficult task in implementing ISO 9001 in engineering consultancies in Hong Kong is to make engineers understand and accept the system, followed by the lack of strong support from the management, and lack of effective communication. Based on interview conducted in Sweden, (M, SH and IA, 2017) argued that in construction process, many of the concepts in ISO 9001 are experienced as being too abstract and too difficult to comprehend. Also argued that it appears difficult for a company to improve its competitiveness and be more efficient by the use of ISO 9001 alone in view of the many stages of the construction process encompassed and the diverging interests represented.

(Okine and Kissi, 2018) noticed concerns in the areas of bureaucracy, cost, time consumption and interpretation in relation to the implementation of ISO 9000 standards in United Kingdom (UK) construction industry.(Saini,2016)stated that the three most significant negative outcomes encountered by Hong Kong contractors on ISO 9000 certification were, more paperwork, more time spent in management, and increase of bureaucracy.

(Abdul-Rahman,2011) observed several shortcomings related to the quality management implementation in UK, i.e., QA and QM are not implemented on a full scale, the degree of commitment is different between top management and site employees, and quality management was limited to the construction stage only. (Saha and Ksaibati, 2017) found

that most contractors in Singapore consider human-related problems are most critical in implementing quality assurance (QA).

(Saeed *et al.*, 2020) observed cultural and operational barriers in quality system implementation. In a study of quality management of a large-scale infrastructure construction project in Hong Kong, (Au and Yu, 1999) found problems in the areas of documentation, control of quality inspection and process procedures.

(Kim et.al, 2016) noticed there are weaknesses in the implementation of quality management for construction industry in Hong Kong in respect of the communication of improvement information, and teamwork structures for quality improvement. (Amadi *et al.*, 2018) argued that the construction industry is lacking open communications and mutual support that derived from trust-based relationships among project participants to effect substantive quality improvement.

Table: 2.6 Factors affecting on Quality of construction projects of unpaved road

Main factors	Description of factors
Delay in construction projects	Poor site management and supervision, unseen ground conditions
For site related factors	Waste control during material usage, Lack of site storage space, Operation limitation within site, and Existence of unnecessary material
For affecting cost performance	Conflict among project participants, Ignorance and lack of knowledge, Reluctance in timely decision, Aggressive competition at tender stage, Presence of poor project specific attributes and non-existence of cooperation
For improper materials used in construction related factors	Lack of material sources and availability Inflated specification of items over specified code Inadequate preconstruction survey on material

For poor leadership	Improper supervision at site and control, Improper construction methods, improper planning and errors during construction, and Fraudulent activities of subcontractors
For labor and equipment related factors	Obsolete or unsuitable construction equipment, Improper handling of materials at site, and Engaging inadequate skill on labor
Communication	Lack of strong management, lack of communication Miscommunication between contractor and labor

Source: Harshil Shah., "A critical literature review on quality management for Infrastructure Projects, International journal of Engineering research and development, Vol.14, 2018.''

2.13 Management Commitment in Quality management implementation

From the literature review of (Abdul-Rahman,and Chen,2019) concluded that senior managers' involvement, understanding and customer focus are essential antecedents of TQM success.(Demeke and Gebissa, 2016) described that leadership and human resources management are among strong predictors of performance TQM practices. On construction related research, (Saeed *et al.*, 2020) commented that top management commitment as one of the elements that would reflect TQM performance measures in construction firms.

(Chin-Keng, 2011) found that top management commitment is the most critical factor for the successful implementation of ISO 9000. (Haupt et al. 2013) argued that high levels of management actions would lead to reduced prevalence of the problems as TQM is deployed on construction sites.emphasized that management commitment to quality and to continuous quality improvement is very important in each phase of the construction process.

(Lawrence et.al, 2021) recommended that management must fully understand and support the TQM process and actively participate in its implementation rather than delegate it. One of the issues arises in discussing the management commitment is the conceptualization of the term. The key elements in conceptual definition for Top management commitment in construction projects were the following:

❖ Goal setting ,feedback ,participation

❖ Top priority and leadership

❖ Common goal setting , management review and continuous improvement, management involvement and leadership, management attitude to change

❖ Allocation of budget, planning for change , providing methods for monitoring progress of construction works,

❖ Initiative for successful implementation and support, etc.

In addition to the above, ISO 9001:2000 requires the following in relation to Quality management system commitment and they were considered as the research gaps to identify the problem in the construction industry

➢ Communicating about the importance of meeting customer as well as statutory and regulatory requirements;

➢ Establishing the quality policy or Quality guide line.

➢ Ensuring that quality objectives are established;

➢ Conducting management reviews; and

➢ Ensuring the availability of resources mateerials.

➢ Poor communication among stakeholders.

The basic contribution of the researcher here is to identify the quality management system tools and techniques, inoder to control quality on the construction projects was by identifying major factors affecting quality control in the construction site such as poor site management, waste control during materials usage, lack of site storage,lack of contrators experience and to improve quality control by quality planning, quality policy, quality assurance system, quality status,safety and quality implementation methods need to be improve. (Kim et al, 2016) noticed that,there were weakness in the implementation of quality management for construction industry in Hong Kong in respect of the communication problems and team work to improve quality performance .

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Description of the Study Area and Map of the area

The study area was conducted in Gambella town; which is located in South-western part of Ethiopia, at a distance of about 766 km from the capital city of Ethiopia, Addis Ababa. And it has temperature of 36–40 ċ during dry season (winter season) and about 25-30℃ temperature during rainy season (summer season) with an average elevation of 2484 m, (526m) above mean sea level.

The study location was conducted in Gambella rural road authority, under Gambella region. This town has three administrative zones (Anyuak Zone, Nuer Zone, and Majang zone and twevle woredas such as (Abobo woreda, Akobo woreda, Dimma woreda, Gambella woreda, Godere woreda, Gog woreda. Itang special woreda, Jikow woreda, Jor woreda, Lare woreda, Makuey woreda, and Wanthoa woreda).
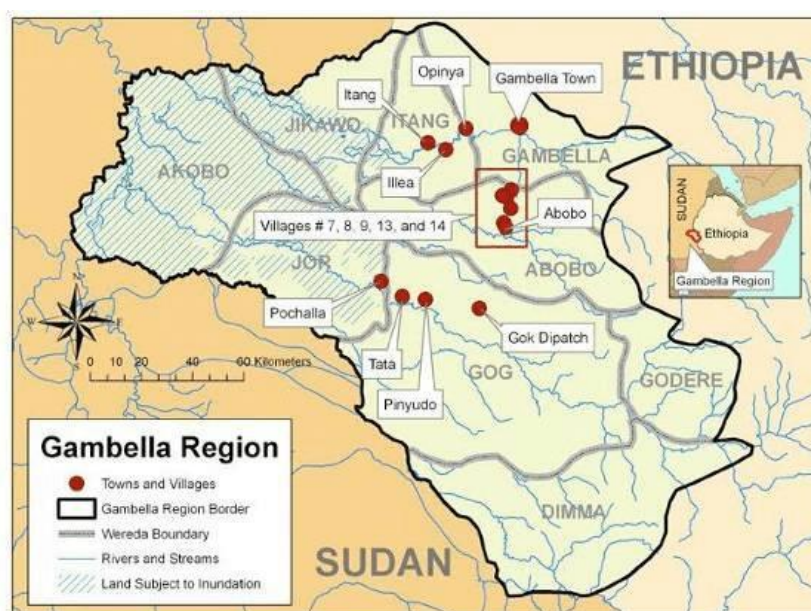
Figure: 3.1 Map of Gambella region

The Gambella rural road authority is responsible for Constructing, developing, managing and maintaining most of gravel (unpaved roads) construction network to support economic development, growth and poverty reduction in the region, using the budgets allocated from the Government of Ethiopia for the Roads infrastructure development program.

According to sources from information and communication department of Gambella rural

road authority, it`s organizational structure started at regional level and distributed to zonal administration and woreda (district level) as it`s mentioned in figure 3.2.
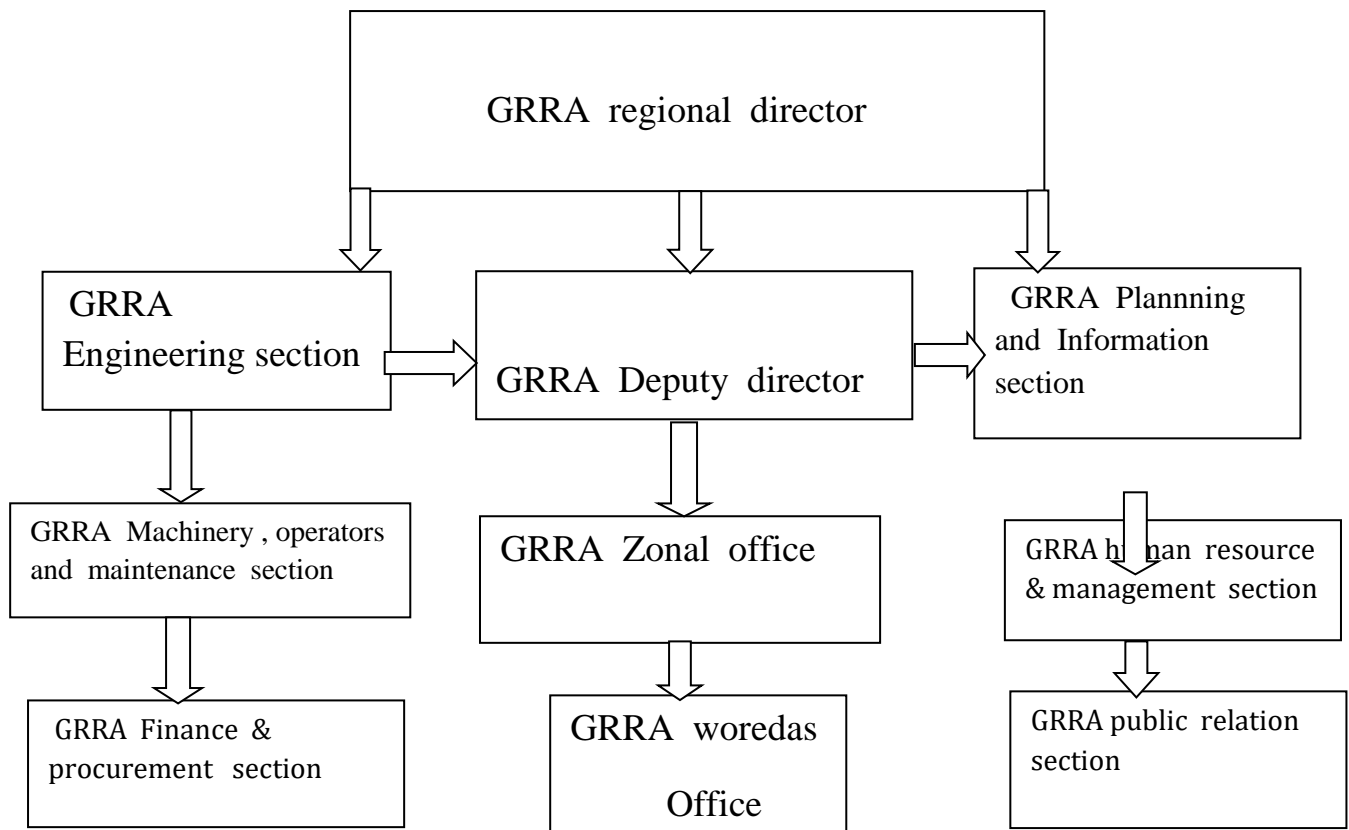
Figure: 3.2 Organizational structures of Gambella rural road authority (GRRA)

3.2 Research Design and Approach

In light of the research objectives, this study preferred and employed both descriptive and explanatory research method which qualifies and makes use of qualitative data since the method enables to easily be an instrument to analyze, tabulate the frequency and percentage, correlation and described the context. The study adopts mixed research approach both qualitative and quantitative.

According to (Mark, 2009), as cited by (Aida, 2015), mixing qualitative and quantitative approaches gives the potential to cover each method's weaknesses with strengthens from the other methods. The study were employed descriptive research methods, since the method enables to easily be an instrument to tabulates, analyses and describe the context. The study was developed ideas by reviewing literature related to the study and data was collected by structure questionnaires, observation, in–depth interview and face to face discussion to assess the knowledge and practices. While explaining the collected data, use the visual aids such as

graphs and charts are used so as to make the reader understand the data. After collected the necessary data, thus they was analyzed by using Microsoft excel (version 2013).

3.3 Study variables

There are different research methodologies such as qualitative, quantitative, and quasi experimental were used in scientific researches methodology.

Using principles of survey and co-relational research design was adopted for this research study. This is because gathering, describing, tabulating and interpreting data as well as establishing relationship between two or more variables would be involved.

3.3.1 Dependent variable

The dependent variable (DV) in this research study entails:

➢ Quality control implementation on unpaved road construction projects.

3.3.2 Independent variables

The independent variable (IDV) that is going to make up in this research study entails the following:

✓ Defects /errors and rework

✓ Technical specification and designs

✓ defect liabilities and

✓ Quality product for end users (society) of unpaved roads construction project.

3.4 Population and Sampling Method

3.4.1 Study Population

The main study population were three woreda road projects on unpaved road construction related issues such as Bonga-siri majang kebele road project, Itang special woreda- Pol kebele road project and Metic zone-Duchay kebele road projects, as well as local community participants, project manager, resource and equipment, village leaders who were taken part on unpaved roads construction and maintenances project during the research study period were included. But, the target populations were from various participants of the road construction projects mainly from the client or owner side of the project; such as project manager from owner, project manager from consultancy (PMC), project manager from contractors, project engineer, and project contract administrator, project supervisor, Engineers, Contractors, consultants and various professional teams of the construction project

from GRRA. The questionnaires were distributed, and interview was conducted with concerned participants of project which was started from general director up to deputy directors from the client side, contractor's side and consultant's side.

3.4.2 Sampling Methods

For the successful project quality management and practices, almost all members of the organization were responsible since they were involved directly or indirectly in the process. But, due to limited time, the sample was limited to three ongoing unpaved road construction projects by the region (such as Bonga-Siri majang unpaved road construction size, Itang-pol unpaved road construction size, and Metic-Duchay unpaved road construction size) and study sample should be free from bias. Otherwise, the sort of selected sample would substantially affect the reliability and validity of the research data. Therefore, the primary data for sampling was focus on the ongoing three road projects, since the project management team were assigned to provide information. Sampling techniques are categorized in to main group that is non-probability and probability. But, this research study employed non-probability sampling methods and purposive sampling techniques were used in the study as stated previously in the literature review.

3.5 Sources of Data (Data source)

In order to achieve the stated objectives of the research, primary and secondary data were utilized in this research study and the study used both primary and secondary data.

To obtain sufficient and relevant data that helps to answer the research questions and achieve research objectives, both quantitative and qualitative data were collected from different primary and secondary sources. The primary sources of data were employees (professionals) on projects and at organizational level of GRRA selected for the study.

The primary data were generated mainly by the tools such as, questionnaires survey, in-depth interview, desk study,and observations. Apart from primary data, secondary data were also exploited to conduct the study and documents review and analysis of secondary data from various sources were used as useful source of information for the study such as relevant books, textbooks, journals,, article review and organization's past and current written documents on the relevant issues were used as a key tools of secondary data source. Moreover, available organizational documents such as structure, accessible project documents including agreement project profile, plans and reports were also reviewed.

The secondary data source were also collected from different materials such as, books,

journals, magazines, published and unpublished materials, selected materials laboratory test and online sources. Data gathered from primary source should be further substantiate and triangulate by secondary data sources (Shtayat *et al.*, 2020).

3.6 Design of research instruments and method of data collection procedures (techniques)

3.6.1 Data collection tools/Instruments

The survey method was chosen by the researcher because of its popularity as a means of gathering much data in cost-effective way (M, SH and IA, 2017). Therefore, semi-structured interview and questionnaires were administrated as survey instruments to the project manager of owners, project managers of consultants and contractors, and internal team workers. The main tools used to gather the primary data from the primary sources mainly include questionnaire, interview guides and experiences of the researcher. Regarding the questionnaire, primary data were collected using self-administered semi-structured questionnaire composed of close-ended and open-ended questions.

3.6.2 Procedures of data collection techniques

In order to collect relevant data for the purpose of this study, the above mentioned major instruments were applied. Accordingly the researcher has chosen this methods assuming that this is cost and time effective, data were analyzed and reduces biases since similar questions were distributed to each respondents. Secondly, interviews are considered as chosen instrument incase respondents misunderstand relevant questionnaires.

The methodology for the work consists of project quality management system and processes, Quality management tools and techniques, Top management commitment, challenges (factors) to implement project quality control management and the impacts of factors affecting quality control implementation in construction. Questionnaires have been prepared considering quality aspects and problems of unpaved road construction projects in Gambella town and the interviews of top project manager was conducted since the responses contributes to the understanding of current project quality management practices and problems of the unpaved road construction projects encountered.

The first phase of data collection was the establishment of the study framework which includes the survey and secondary data. The survey framework includes the identification of all relevant documentation and formulation of questions for the interviews and questioners.

The second phase introduces about the quality management practice in construction projects, and also introduces the four steps as stated in the literature review, the first step is quality planning, the second steps is quality control, the third step is quality assurance and the last step is quality improvement action. The third phase is to introduce pilot test done on the questionnaires by distributing questions to verify the clarity and include any comments before distributing to the total target. And the final version of questioner distributed to respondents and finally collected the data. Likewise, interview were used in gather more of in-depth qualitative data from the key informant of the construction project.

3.7 Data measurement

To select a suitable method of data analysis, the level of measurement must be understood. For each type of measurement, there is/are an appropriate methods that can be functional and not others. In this research study, ordinal scales were used. Ordinal scales as shown in the following tables are by rating data that normally been collected. The words describe or indicate the absolute measures of the problem stated.

The Nominal ordinal scale was used for the measurement of the demographic profile of the respondents (general information of respondents), skills and coordination of professionals of unpaved road construction projects, Quality management system, Challenges (factors) to implement quality control, Impact factors affecting quality control implementation and others related problems. During data analysis, the words are changed by numbers as written, on the below of the words by rating scale.

Table: 3.1 shows the rating scale of professionals and skills on unpaved roads construction

Very good	Good	Moderate	Poor	Very poor
5	4	3	2	1

Table: 3.2 shows the rating scale of challenges (factors) affecting quality control

Extremely high	Very high	High	Moderate	Low
5	4	3	2	1

Table: 3.3 The rating scale or Impact factors of poor quality control

Very high	High	Moderate	Low	Very Low
5	4	3	2	1
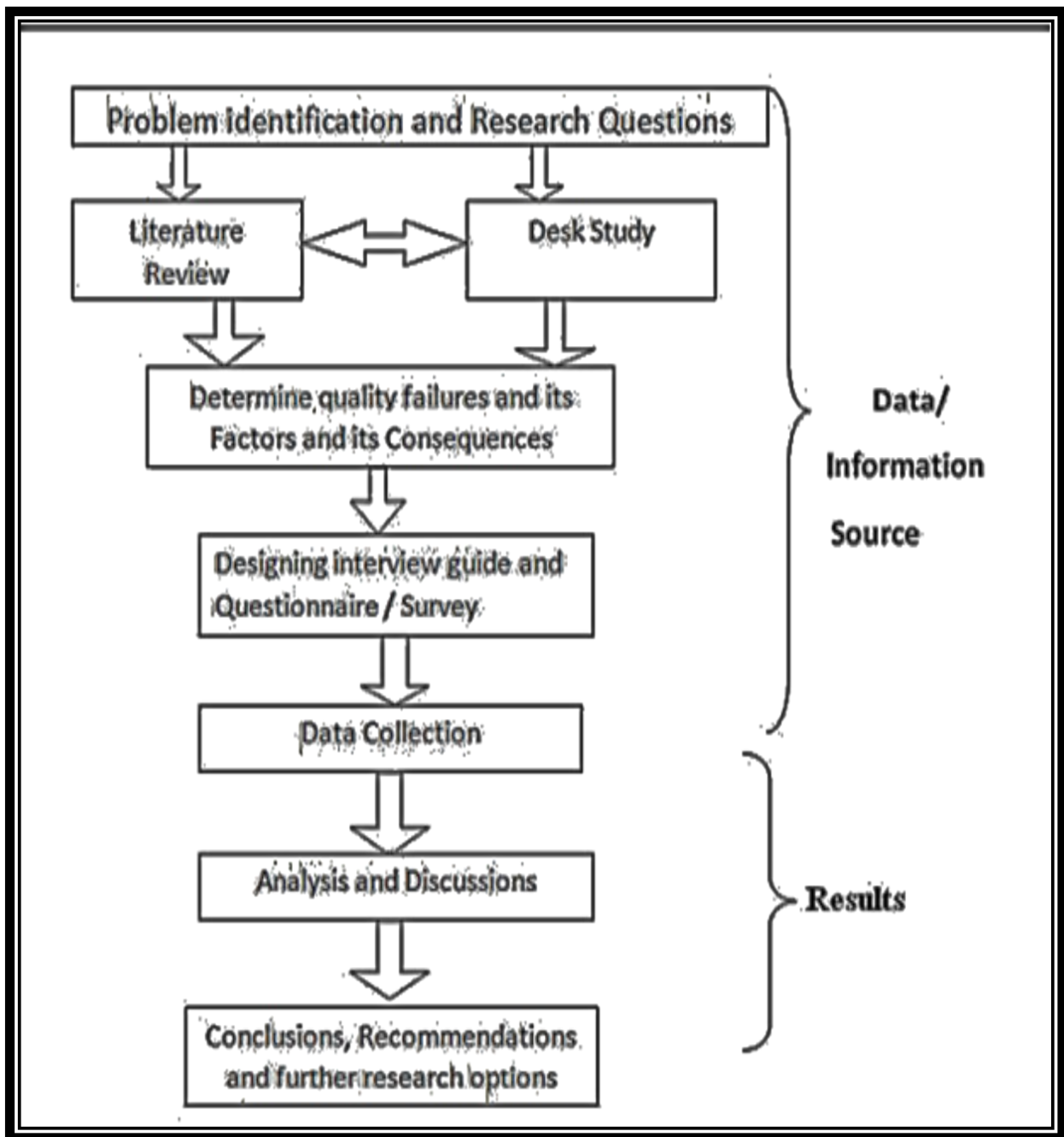
Figure: 3.3 Research structure

3.8 Data Quality assurance and management

During the data collection process, strict data collection methods shall be following in order to be accurate and conscious. In addition to this data, they need to be neat, clear and ensure with confidentiality according to Jimma University's   ethical consideration.

3.9 Data presentation, processes and Methods of data analysis

The questionnaires was presented to the respondents based on the literature review presented in chapter two. In most of the questionnaires, respondents were asked to give their responses rate against a five-point Likert scale (1-5), so that participants would be able to specify their level of agreement or disagreement with a statement. Another version used in this research study, was Likert scale going from poor to excellent, extremely high to low.

The Likert scale was proved to be very useful process in measuring whether respondents should have a positive or negative attitude towards an object or a statement, and is therefore suitable for this research study. After collecting all required data using the above mentioned (Survey methods) instruments from the identified sources, both qualitative and quantitative methods of data analyses were applied. The data obtained from the questionnaire respondents used to assess the quality management practices and problems was analyzed using Micro-soft excel (version 2013). After organizing, coding, and defining variables, responses of the cases were entered into the software. Then for analysis, both descriptive and explanatory statistical methods were used. And results were presented using graphs, charts, frequency, ranks, tables and figures.

The relative important index method (RII) was also used to determine and rank the challenges factors affecting quality control implementation, impact factors faced and affecting quality control implementation and quality management practices of unpaved road construction projects. And all was analyzed by the program MS-Excel (Version 2013).

The Relative Importance Index(RII) method and Likert scale techniques were used to determine the relative importance of the various factors and calculated by using the following formula:-

$$RII = \Sigma W / (A*N)$$ -----------Equation 3.1 Relative Importance Index equation.

Where;

　　RII= Relative importance index

　　A= the highest weight of respondents=5

N= total number of respondents

n= the weight given by the respondent for each factors

3.10 Validity and reliability of Instruments

3.10.1 Validity of questionnaires data

The researcher checked the validity of questioners developed for this study. Before distributing the final questionnaires to the respondents, it was checked and commented by friends and project personnel and the advisor of the researcher and pilots test was done to check the valid. The final version of the questioners was distributed after incorporating all the comments and feedbacks obtained from different professionals.

3.10.2 Reliability of data

In addition to RII method, some variables should be checked. The study is checked for reliability or internal consistency by Cronbach's alpha method.

According to (Taherdoost, 2018) reliability is the repeatability of findings. Reliability analysis was carried out on different parts for internal consistency with regard to respondent's data on project quality management rating using Cronbach's alpha and in principle, Cronbach's alpha of 0.7 is acceptable for internal consistency of data obtained from respondents.

Therefore, it is expressed as a number between 0 and 1 where the higher the score of Cronbach alpha, the more reliable the generated scale, when the closer the alpha coefficient is to 1.0, the grater the internal consistency and the reverse is true. Therefore, the reliability is checked based on the data process on SPSS.

Table: 3.4 Reliability statistics

Cronbach`s alpha	No of questions (k)
0.827	12

The above table shows the computed result for reliability test which is 0.827 of quality managementation implementation challenges factors indicates that there was a high degree of internal constancy among the test items. Therefore, Cronbach's alpha value is 82%, well above acceptable level and fit as reliable for data analysis.

3.11 Ethical consideration

Interaction with participants would be done after prior appointment and written letter from the University to GRRA. Questionnaires were not being forced upon them to answer, rather the purpose of the study would be explained to them to make them more comfortable to reply. The researcher has declared that all participants were voluntarily participated in the data collection by collaborating in filling of the questionnaire. By doing so, the respondents are free of any harm and more importantly their views were very confidential and anonymous. Moreover, the questionnaire does not have any connection with the respondents since it is done for education purpose.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Results from Questionnaires administration

The research results or findings showed that, data were collected through questionnaire, desk study and interview to perform this research work. And also, presented the result of the analysis and discussion on the collected data to answer the research questions and derived to the specific objectives that the study was set to achieve and the result of the survey was discussed by triangulating the different source results such as questionnaire results, interview and document review results of the study area.

A total sample of 50 questionnaires were distributed to various respondents of interest for the study. Out of the covered population, 35 were responsive representing a response rate of 70%. This showed that a response rate above 50% contributes towards gathering of sufficient data that could be generalized to represent the opinions of respondents about the study problem in the target population.

Quantitative data was analyzed by employing descriptive and explanatory statistics using Micro-soft Excel(version 2013) in relation with Relative Importatnce Index (RII) methods. The qualitative data was analyzed by the use of content analysis, descriptive statistics such as measures of central tendency and dispersion along with frequencies, and percentages will be used to organize and summarize numerical data whose results will be presented in tables for easy interpretation of the findings. The response rate was 38% amongst the engineering firm's employees and 62% amongst the contractor firm's employees. Most of the questionaires were answered by all the respondents.

Table: 4.1 Number of responded questionnaires and respondents rate in %

Firms	Sample of Questionnaires	No of Questionaries responded	Respondent rate in %
Engineering / consultant firm	15	10	28.57%
Client/Owner	15	10	28.57%
Contractors	20	15	42.86%
Total	50	35	100

The questionnaire were divided into four parts depending on the nature of the research. The first part concerned on the general information and professional of respondents , the second part covers existence or non-existence of a quality control and quality management system within the organization, while third part addresses the challenges or factors affecting quality control implementation and opinions about quality in general particularly with consultants, contractors and clients. The fourth and last part, addresses about impact factors of poor quality control implementation on unpaved road construction & maintenances project as well as the general factors observed on jobsite or worksite.

4.2 General information of the respondents

Respondents were asked about their background.These questions included participants' educational background, length of work experience in the construction of unpaved roads and maintenances, as well as their field of work/study. Figure 4-2 shows participants` educational background and Figure 4-3 shows the length of their work experience related to unpaved road construction.

4.2 .1 The educational level of respondents

From the analysis on educational background of respondents, participants were asked on their educational background and this was done by indicating their highest educational level.

From analysis, Civil engineers with B.Sc. degree were those who mainly responded to the questionnaires survey (25.7%) for contractors and (14.28%) for engineering or consulting firms). 28.57% of the correspondents from both firms were other engineering B.Sc such as architecture engineer, water resource and irrigation engineer, hydrologist engineers, hydraulics engineers and geologist, etc. More details can be seen from chart below.
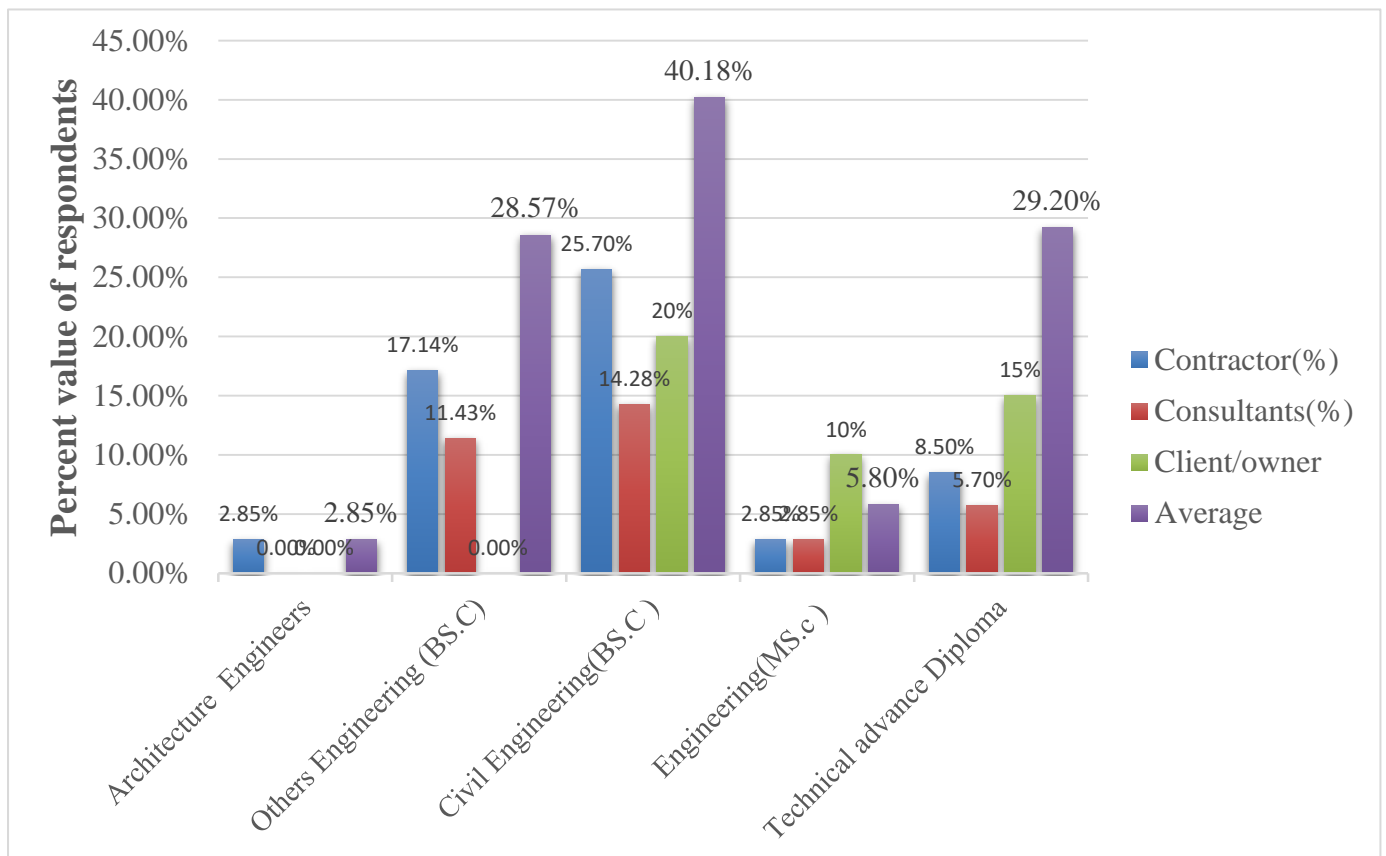
Figure: 4.1 Educational background of respondents

4.2.2 Work experience of respondents in the construction of unpaved roads project

The work Experience of the respondents in unpaved construction and maintenance project was also assessed in the study and found 17% of the respondents have experience for 1-2 years, 30% of respondents have an experience for 2-4 years, 35% of respondents have an experience for 4-6 years, and 18% of respondents for above 6 years of experience.

This is directly related to the capacity of the country to produce engineering professionals in the past years.
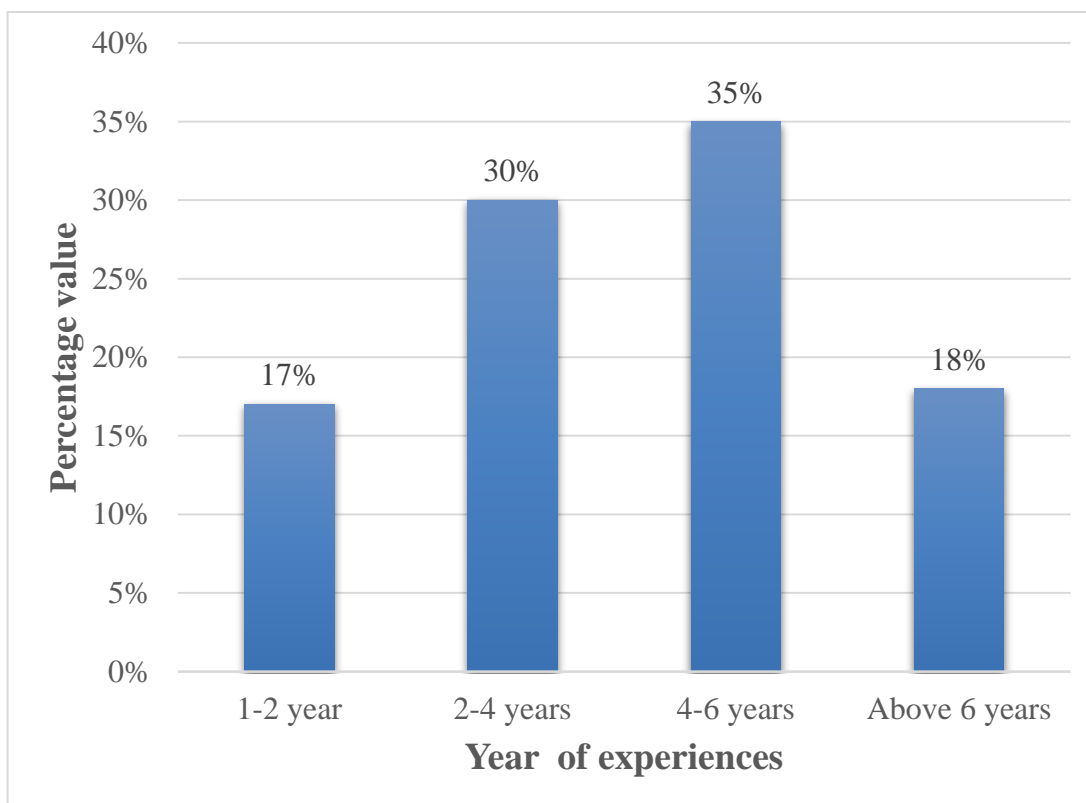
Figure: 4.2 Work experience of respondents

This value of analysis indicates that, most of the unpaved road construction workers have adequate experience and develop skills in the construction of road projects. This also helps the construction industry to go forward and facilitate the construction and by avoiding the same mistakes and risks faced during their year of work.

4.2.3 Field of work, title and position of respondents

Participants were also asked about their title (position)/field of work in their organization. The distribution can be seen in Figure 4-3. Most of the respondents were Construction/Site/Office engineer (31.5%) for both contractor and consultant, next were those involved in Project management/Supervisor/resident engineer (20.2%), Owner/organization head (19.9%), Superintendent/foreman(8.5%), Material engineer/Quality controller (8.5%), Surveyor/technical persons and others (11.4%).

Those participants and stake holder in the construction of unpaved road construction and maintenance projects includes Contractor, Engineering firms/consultants as well as clients firm of work title and position in their organization.
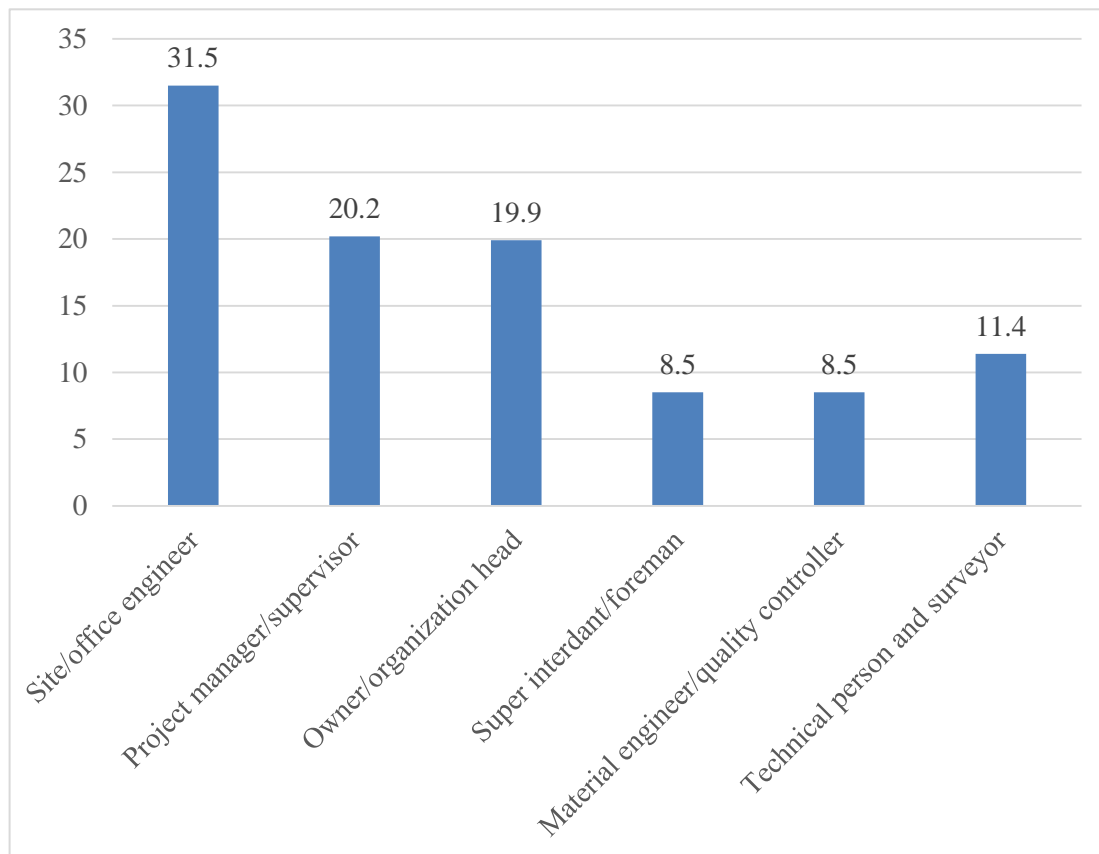
Figure: 4.3 Work position of respondents

4.2.4 Professional's skill and traits in the construction of unpaved road projects

Construction professionals' workers need effective written and verbal communication skills that, they Constructs and maintain unpaved road construction project, business offices, and other construction industry. Therefore, they have different skills of professionalism, they are listed in the figure 4.4 and discussed one by one using Likert scale(1-5) and legends from very good (5), good(4),moderate(3),poor(2) and very poor (1).
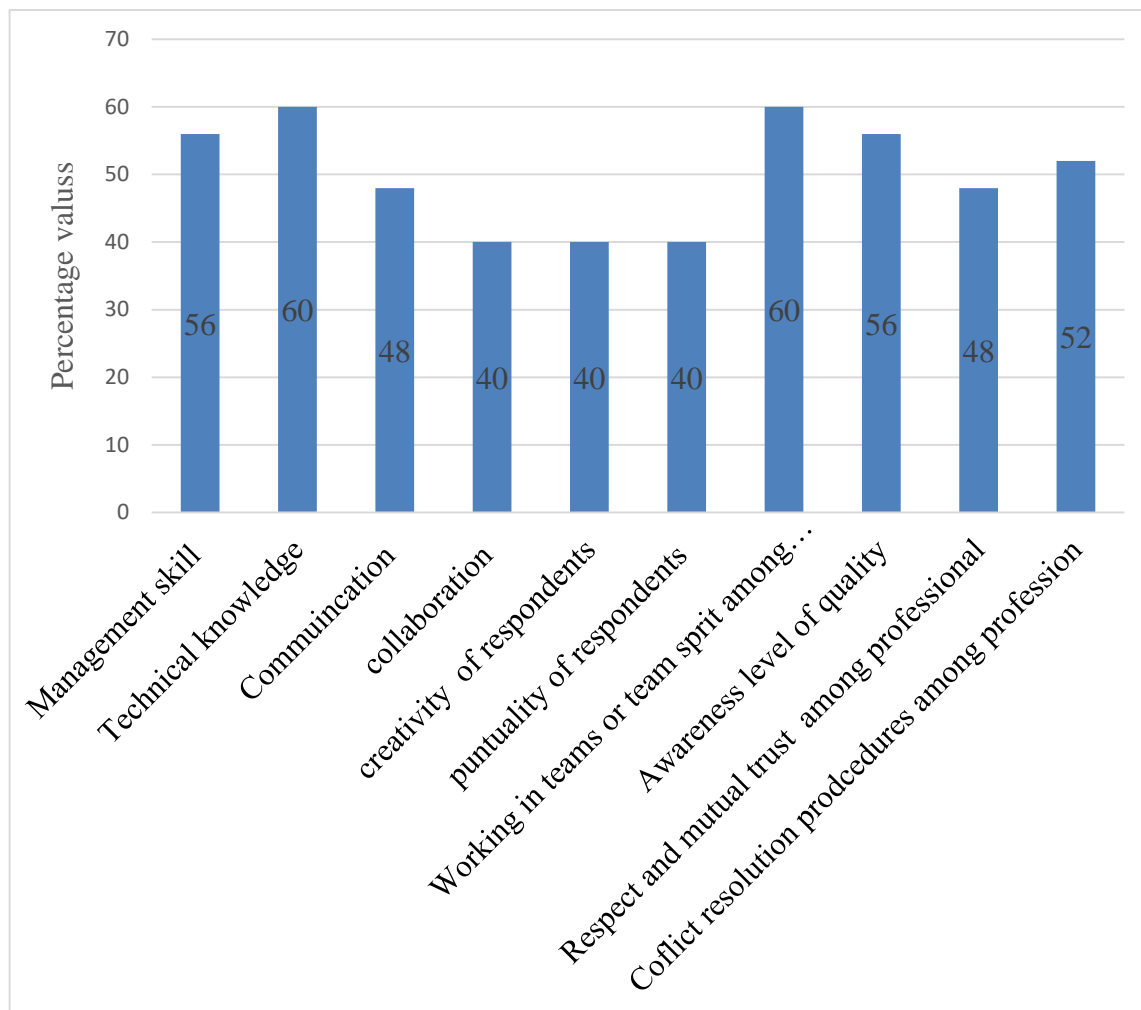
Figure: 4.4 Professional skills in unpaved roads

1. **Management skill**- Construction is a broad and wide-ranging industry, there are an enormous variety of different skills, both physical and mental, required of those who work within it. Specific unpaved roads construction skills can include; scope of work of selected materials such as sub-grade materials, sub-base materials and base materials ,concreting of mixing materials, soil laboratory test such as CBR value, trial axial test, compression test and so on. Having management skills helps to be employable readily in any field. But, in the construction industry such as unpaved road projects, the employee must have excellent management skills to succeed in the project goal and output. From the result shows 56% of the respondent said their management skill is good, 28% of them said very well and 16% of them also said adequately. In general, their management skill is very good.

2.**Technical knowledge**- Technical knowledge on unpaved road construction are qualities acquired by using and gaining expertise in performing physical or design tasks. Technical knowledge or skill is one of management skill and it is the duty and obligation of each of the

Construction professionals to exercise all reasonable skills, care and diligence and display their skills according to the professional standards that generally govern the disciple that they practice. The result tells 60% of respondents said very good, 32% of them said well and 8% said adequate and the general overview of the technical knowledge or skill of professionals is very good.

3**. Communication**– Communication skills are important for any professional. It includes written, verbal, and non-verbal communication. It is an essential skill in every construction industry. In construction, it is especially important since the stakes on a worksite can be higher than they are in a meeting room or behind a desk. So, 48 % of the respondent agrees that the professionals have very good communication skill, 44% of them said good and 8% said adequate and this indicates they have good communication skill.

4. **Collaboration**– Collaboration skills help to work toward a common goal with others. Most work environments require collaboration and so these skills are essential. Collaboration skills include communication, emotional intelligence, and respect for the diversity of co-workers. The result also shows they have good collaboration skills.

5. **Creativity** –creativity skill is the ability to solve an expected challenge in a systematic way and good in risk management during construction. Creativity is behind every breakthrough material that changes the way structures are considered and every process that helps restructure project schedules. The result of respondents said 40% good, 28% of them said adequate, 24% said very good, and 8% of them said poor. So, the professionals have modern creativity, but it be should improve.

6. **Punctuality** –Punctuality skill means doing or happening at the correct time, that is the possible time lag existing between the actual delivery date of data and the target date of the project. The result from respondents shows, somewhat good punctuality but needs a huge change to finish and submit the project on time and within allocated budgets.

7**. Work in a team or team sprit**–Teamwork creates human interaction, which can help and achieve much bigger objectives that seem impossible to be possible, if the same individuals working on their own skill as a teams. When it comes to construction projects, good collaboration among people working together in a team is a must. Therefore, the team work or team spirit is very good from respondent's response.

8.**Awareness level skill**–the result shows 56% of the respondents said very good, 20% of them said good, 16% of them said adequate and 8% of them said very poor. As discussed and explained by participants ,awareness level skill is described as a cause of poor coordination

in in construction projects, if it's not well aware to professionals, but here 56% said very good in this case, the respondent tries to describe the awareness level of coordination as good for construction , but they did not implement it or considered it .

9. **Respect and mutual trust among Professionals** –the respondents were oriented and said that 48% have very good respect and mutual trust among professionals, 28% of them said good, and 24% of them said adequate. Generally, they have got a very good respect among each other.

10.**Conflict resolution procedures among professionals**-Conflict seems to be very synonym with construction projects and giving the impressions of problems which includes increasing project cost, project delays, reduce productivity, loss of profit, or damage in a business relationship. According to this, the respondents or participants suggested 52%, they were good in conflict resolution procedures among professionals, 28% said very well, 12% said adequate, and 8% of respondents said poor.

4.3 Asssessment of Quality control system, tools and techniques

In this part of question, respondents` view towards quality management system and quality control were identified. Respondents were asked whether there was a quality management system within their organization or not.

As discussed in figure 4.5: that, 50% of respondents said `yes answer` to quality system, 20% of respondents said `No answer`, and 30 % of respondents said , ` I don`t know answer ` by stated that , whether quality management system was being applied or not applied in their company. The other questions presented to the participants were a quality type or quality management system in their institution. Most of the respondents who were at management level, knew what type of quality management system should be in place in their organization, but there was some confusion among contractors, engineering firm (consultants) and clients/employers.

The contractors stated that, they had a quality system within the organization, but 30% of the respondents responded that the quality management system is following some international standard system(ISO). Two thirds of large engineering(consultants) firm, knew rightfully that the organization has to follow some standard rather than certified ISO 9000 quality system, but one third of respondents, thought they were follows a quality management system within the organization.
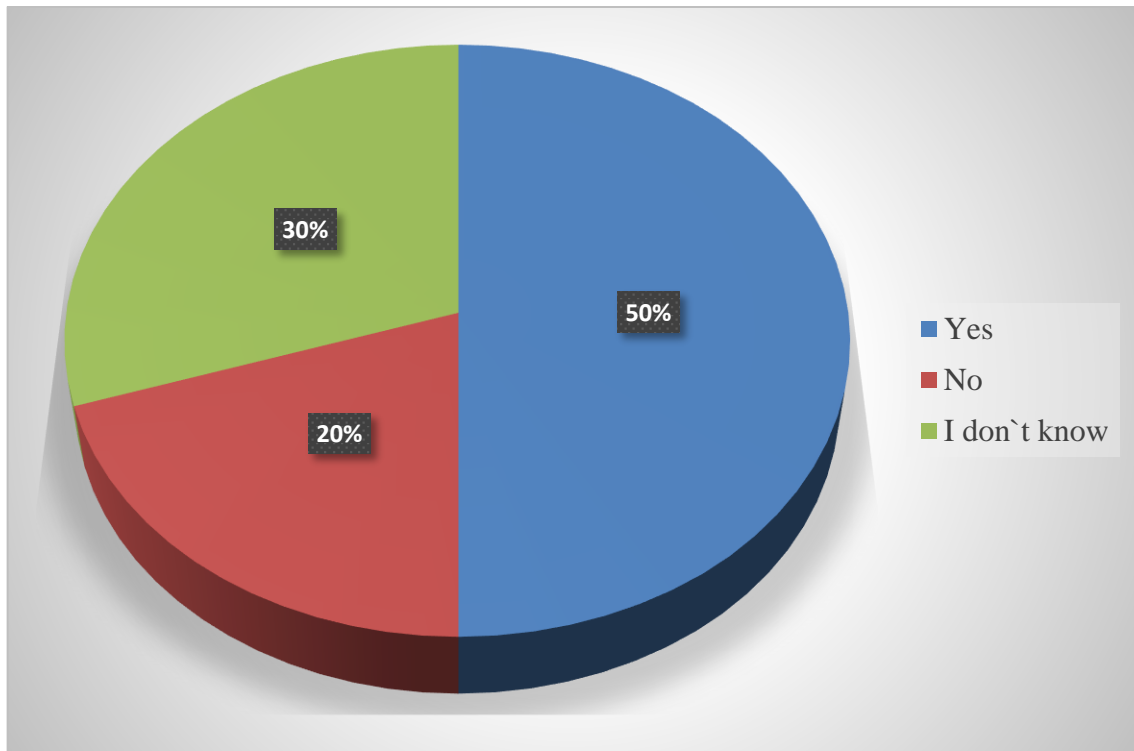
Figure: 4.5 Quality system in the organization

4.3.1 Frequency of Training within construction Firms of unpaved roads

Participants were asked, how much training they had received from their employer to learnt about awareness level in order to implement the quality system in their work place. They were asked to answer on a scale from 1 (No training) to 5 (Comprehensive Training).

4.3.2 Frequency of Training with Contractor firms

Professionals on the side of contractors were asked whether they received training from their employer to have awareness level to implement the quality system on their work place or not with the scale 1 (no training) to 5(comprehensive training). 16% of respondents have not taken training, 20% of them have taken insufficient training, 18 % of them have satisfactory awareness level, 25% have taken good training and 21% have taken comprehensive training. This result is shown in figure 4.6. From this, we can learn that more than half of the participants answered this question, were either on a negative or a neutral scale of their response were (16+20+18=54%) of respondents. This could indicate that, the organizations that were part of this research are not putting enough emphasis on teaching their staff on how to use the quality management system with in their workplace.
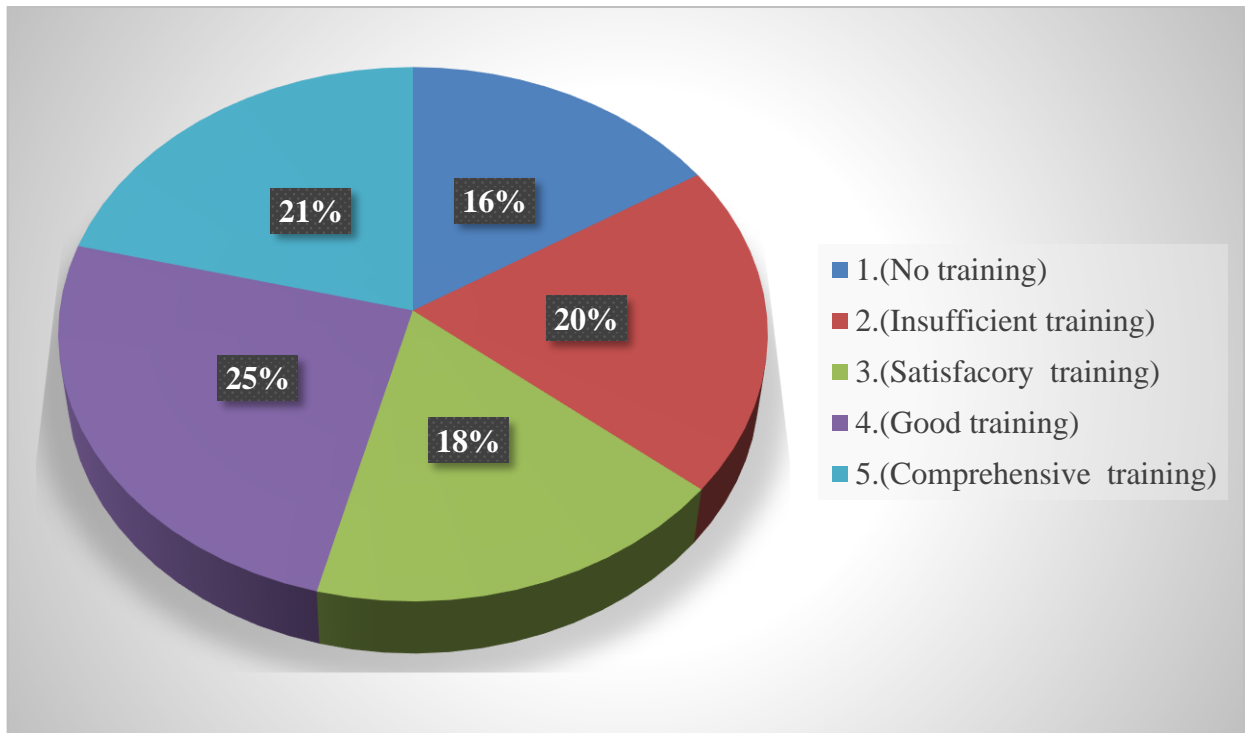
Figure: 4.6 Amount of training in contractor firm

4.3.3 Frequency of training in Consulting or engineering firms

Professionals on the side of consultant were also asked whether they received training from their employer to have awareness level to implement the quality system on their work or not with the scale 1 (no training) to 5(comprehensive training). 10% have not taken training (no training), 14% have taken insufficient training, 17% have taken satisfactory awareness level, 29% have taken good training and 30% have taken comprehensive training. Awareness level in their work place. This result is shown in figure 4.7. From this, we can learn that considerable amount of the participants answered this question either on a negative or a neutral scale were (10+14+17=41%). Even though, this result is better than that of contracting firm, still works of awareness level of quality system in training have to be done in the future.
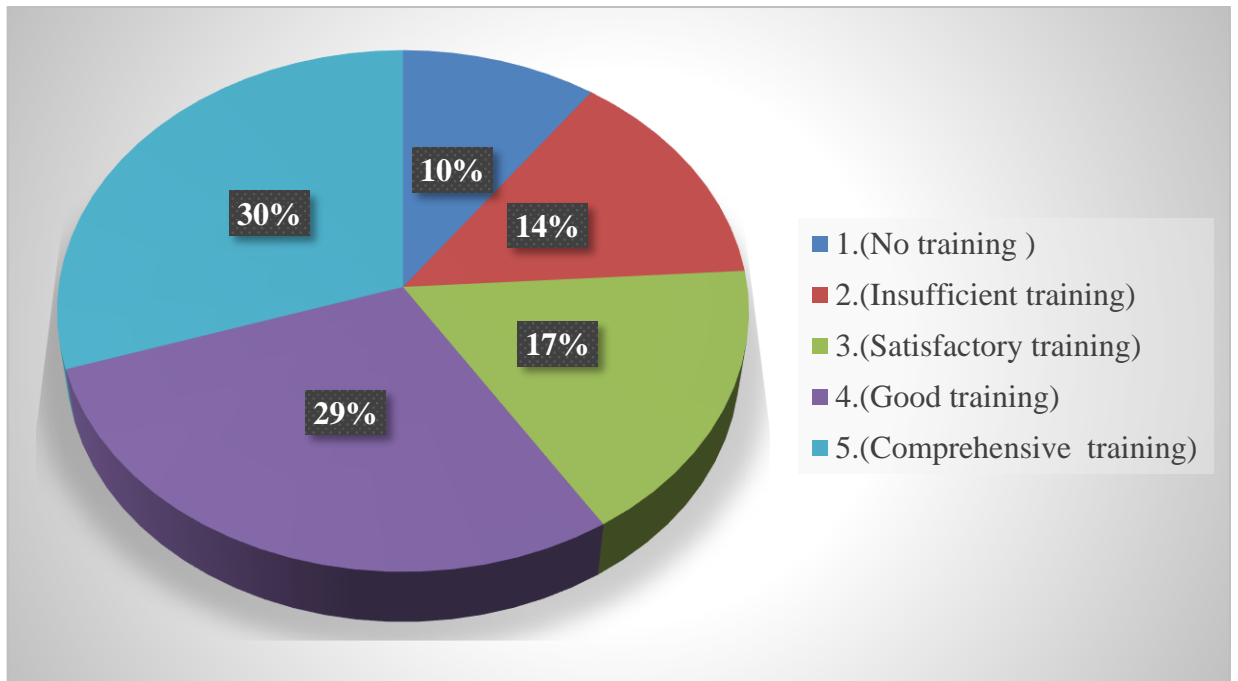
Figure: 4.7 Amount of training in engineering firms

4.3.4 Quality control system standards in work place

Respondents were responded questionnaires based on activities or processes used in quality control system in work place or in construction projects which related to unpaved road construction.

From table 4.2, 5.5% and 43.6% of the respondents strongly disagreed and disagreed respectively, 32.7% of the respondents were neutral, and 18.2% and 0% of the respondents responded as agree and strongly agree respectively on Select what to control and set standards that provide the basis for decisions regarding possible corrective action. 1.8% and 41.8% of the respondents strongly disagreed and disagreed respectively, 40% of the respondents were neutral, and 14.5% and 1.8% of the respondents responded as agree and strongly agree respectively on Establish the measurement methods used, compare the actual results to the quality standards. 5.5% and 38.2% of the respondents strongly disagreed and disagreed respectively, 32.7% of the respondents were neutral, and 20% and 3.6% of the respondents responded as agree and strongly agree respectively on Act to bring nonconforming processes and material back to the standard based on the information collected.

1.8% and 43.6% of the respondents strongly disagreed and disagreed respectively, 40% of the respondents were neutral, and 9.1% and 5.5% of the respondents responded as agree and strongly agree respectively on Monitor and standardize measuring devices, include detailed

documentation for all processes. This result shows most of the respondents had disagree on quality control processes in their work place. According to (Dereje Bitew, 2019) of Ethiopia, defined a good quality control system should have to consider Quality control processes. Since, the organization does not consider project quality control processes.

Table: 4.2 Frequency and percentages of the rating of quality control system in work place

S/No	Processes	Strongly disagree	Disagree	Neutral	Agree	strongly Agree
1	Select what to control and set standards that provide the basis for decision regarding possible corrective action	3(5.5%)	18(43.6%)	4(32.7%)	10(18.2%)	0(0%)
2	Establish the measurement methods used, compare the actual results to the quality standards.	1(1.8%)	23(41.8%)	22((40%)	8(14.5%)	1(1.8%)
3	Act to bring non-conforming processes and materials back to the standard based on the information collected.	3(5.5%)	21(38.2%)	18(32.7%)	11(20%)	2(3.6%)
4	Monitor and standardize measuring devices, which include detailed documentation for all processes.	1(1.8%)	24(43.6%)	22(40%)	5(9.1%)	3(5.5%)

4.3.5 Top management commitment for quality system in work place

The other issue that participants were asked, was the extent of their agreement towards commitment of top management in quality management system or toward one of quality indicators and the average rating of agreement was 70% . Therefore, a total of 70% of respondents or participants were positive (agree) towards the statement, 27% of respondents

were neutral towards the statement and 3% of respondents were disagreed with the statement for both stakeholder such as contractor and consultants firms. This result shows that, most of the respondents had agreed on top management commitment for quality system. From the result of interview questions, the top management had regularly communicate with project concerned stakeholders and also top management commitment had conducted project quality management reviews in their work place.

According to (Dereje Bitew,2019) of Ethiopia,described that leadership and human resources management are among strong predictors of performance of TQM practices. This indicated that top management does more work on leadership as well as allocation of resources, on communicating the importance of meeting customer requirements and setting quality policies the results has shown in figure 4.8:
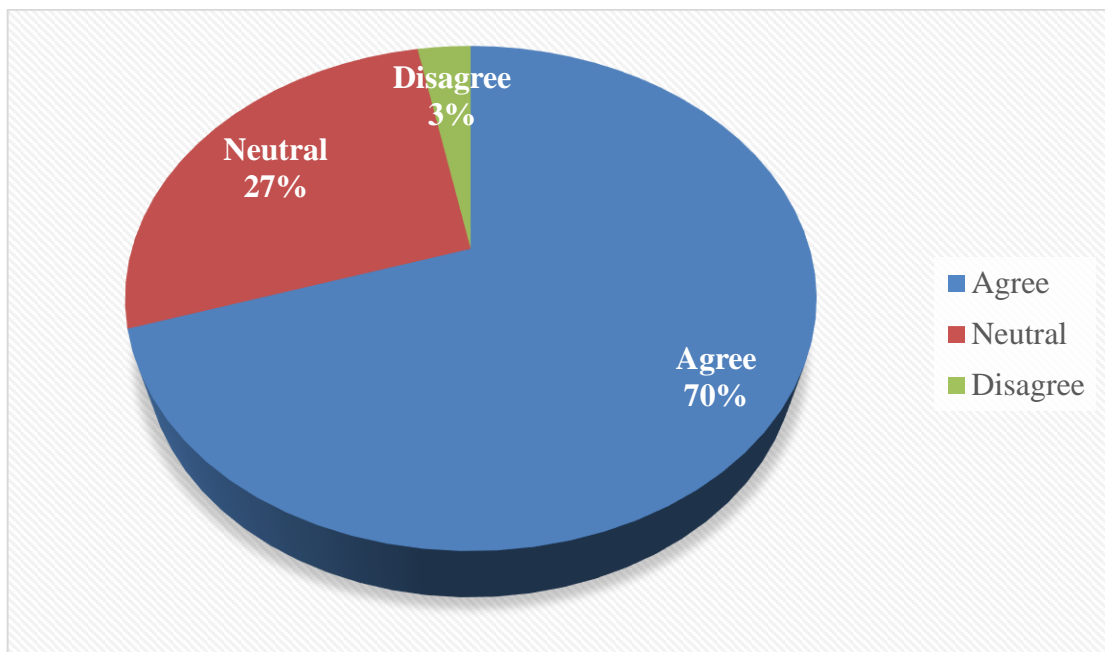
Figure: 4.8 Top management commitment to quality

4.3.6 Quality in general on unpaved road construction projects

This section aims to identify aspect, status and safety of quality, rating quality of work, quality indicators factor, cost of quality and quality in general. Different questionnaires related with quality aspects were presented to respondents or participants and also questionnaire was presented to correspondents to define quality from lists. 19 of correspondents (54.3%) said that quality is to meet end users' demand and satisfaction. 12 respondents (34.3%) stated that quality is to guarantee that the product has no problem or will

not fail, 4 respondents (11.4%) selected quality is looking good, work good or making their company's name on finished product or end products.

4.3.7 Quality indicators performance on unpaved road construction

Different indicators that affect unpaved road construction quality were listed with scale one to five, meanwhile 1 represents very poor and 5 represents very good. Respondents or participants were asked to rate and rank from list of eleven indicators on how they would indicate good quality performance on unpaved road projects. The Weighted RII values and ranking can be seen in Table 4.3. From these results, it can be interpreted that participants have a positive (very good) view towards almost all of the quality indicators, except for quality award/recognition in their company.

Table: 4.3 Quality indicator performance on unpaved road

Quality indicators performance	Weighted RII values	Ranking
Client satisfaction	0.99	1
Management commitment to quality system	0.97	2
End user/society/public/customer satisfaction	0.97	3
Skill work force involvement	0.95	4
Training and education	0.94	5
The amount of rework due to error/defects	0.93	6
Regular inspections(supervision)	0.91	7
The length of warranty the company can give on their work	0.89	8
General construction standards	0.87	9
Project manager cooperation with site engineer/office engineer	0.83	10
Quality awards/recognition in their company	0.72	11

Figure 4.9 shows how the quality indicators performance in the company has been determined or evaluated according to their RII values and ranking orders,based on the quality indicators of them. Most of the cases there were similarities/coherence in their RII values, but their ranking order is not the same, that means client satisfaction ranks ist, since it give a good satisfy to the customer or end users/society .
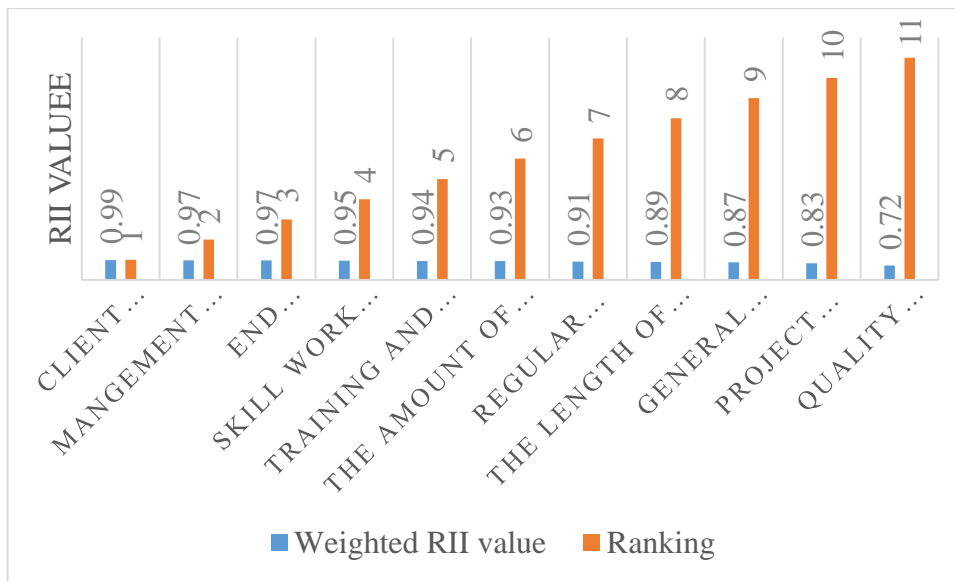
Figure: 4.9 Quality indicators performance with rate

4.3.8 Rating the Quality of work

Quality is defined as the total conventionality of a product to standard and specification that mean, the product must be able to meet the client's requirements and specification and must be fit for its purpose. So, the result 41% of respondents shows that, most of unpaved road construction projects in Gambella town were handled in high quality. In this case, this quality is coming from the threat of project failure at the first processes, so to avoid that failure they used over quality and to cover the target quality they faced in project work, were related to cost overrun and time overrun as the result shown in Figure 4.10, and 37% of respondents justified the work quality is good, 18% of respondent said it's excellent quality work and 4% of them said, quality of work, its low.
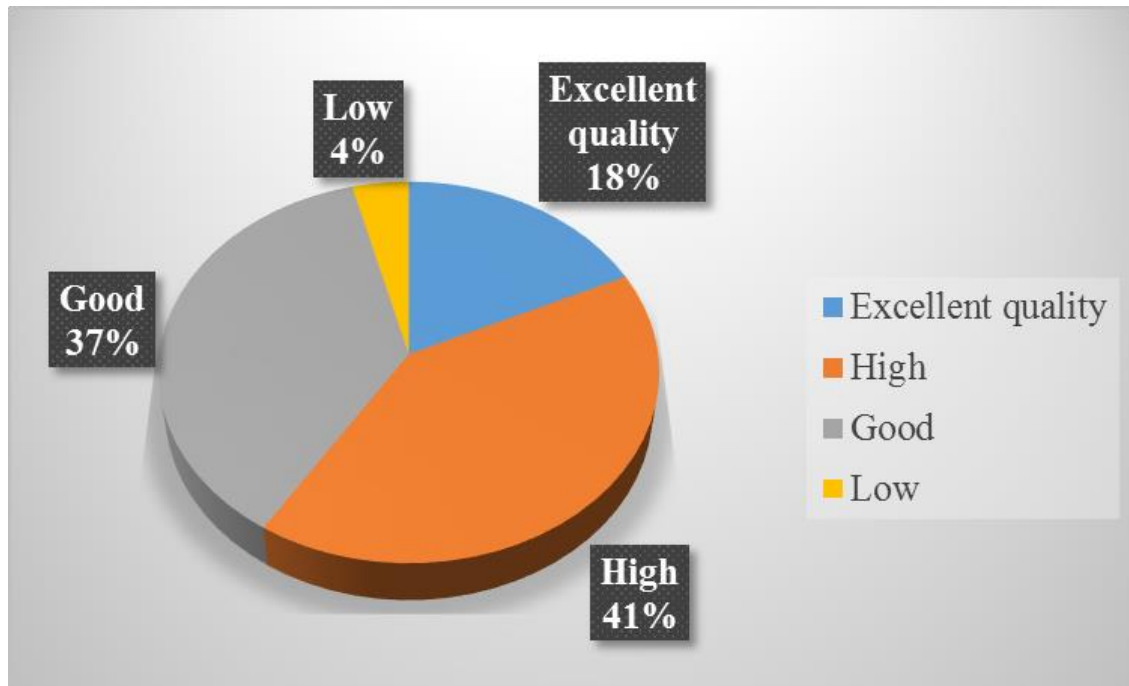
Figure: 4.10 Rating quality of work

4.3.9 Control of quality cost from projects to projects

In this part of questionnaire, participants were asked to response and define cost of quality, which is one of quality management tools and techniques on unpaved road construction, especially for roads crossing structures such as culverts like single box culverts, double slab box culverts, inverted fords structures, stone gabion, and road check dam, etc. Then, 25% of respondents said that, `yes answer` for cost of quality control. Others 15% of respondents said that, `No answer` for quality cost control and 60% of the respodents, said `I don`t know answer` for cost of quality control
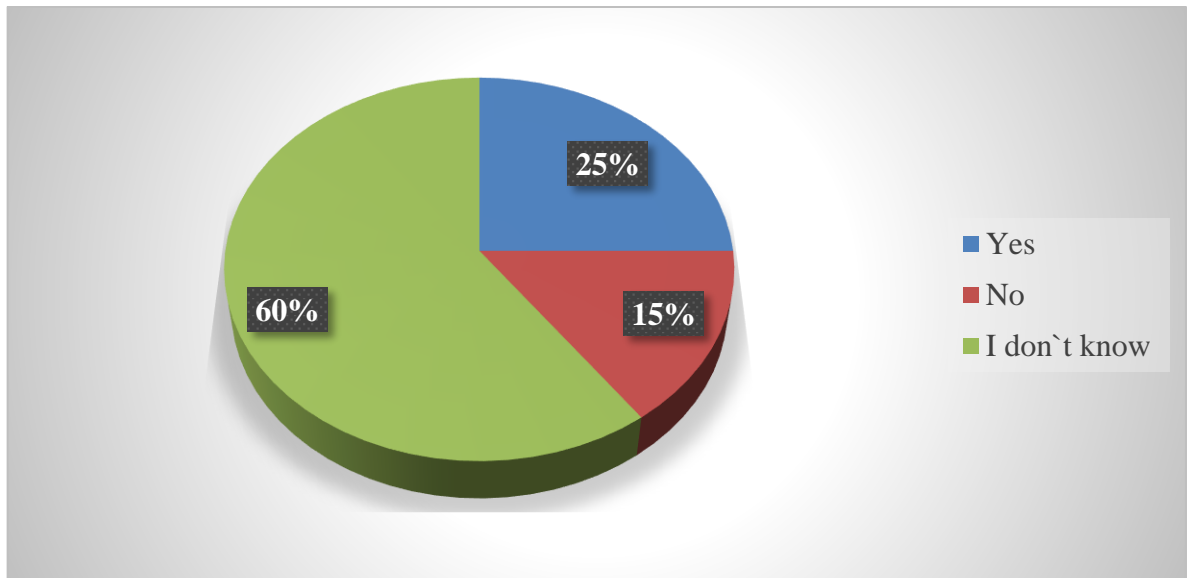
Figure : 4.11 Quality cost control

4.3.10 Status of Quality and Safety in Unpaved Roads Construction (gravel road)

Participants were asked to rate the status of quality and safety in unpaved roads construction for both contractors and consultant`s employees. The scale was rate from 1(Very bad – Serious Problems) to 5 (Very good – No problems). As shown in Table 4.4, the contractors' employees rated the safety status at 2.71 on average and the quality status a little lower at 2.6. Even though, both the ratings of contractor`s employees can be interpreted as positive outcomes, nearly half of the employees are under unsafe condition and believe that quality status needs improvement. The engineering (consultants) firm's employees rated the safety status at 2.51 and the quality status at 2.5. This result again shows that works have to be done for safe work and quality status need to be improved. The results also show that the consultants' employees rated on both quality and safety status was slightly lower than those working in the contractor firms. Generally, all participants, for both contractors and consultant`s employees have rated safety and quality status at average of 2.61 for safety and 2.55 for quality status respectively. This result again shown that, safety status was very good (no problem) and quality status need improvements, during unpaved road construction project in Gambella town or in project area of study.

Table: 4.4 Status of quality and safety in unpaved road projects

Participants(Groups of respondents)	No of respondents in each employees	Safety status on unpaved roads construction		Quality status on unpaved roads construction	
		Means	Std.Deviation	Means	Std.Deviation
Contractor`s employees	17	2.71	0.7	2.6	0.6
Consultant`s employees	18	2.51	0.75	2.5	0.9
All participants(respondents) on average of status	35	2.61	0.74	2.55	0.75

4.3.11 Quality control improvement in general

This part of questionnaires was intended to point out the effect of company characteristic to improve road construction quality. Participants or respondents were asked to rate the status of quality and safety in unpaved roads construction based on the quality improving factors on unpaved roads. Moreover; the scale was from 1 (very weak) to 5 (very strong).

The improving characteristics from the sample data were ranked in table form, based on results from correspondents or respondents, who responded the questionnaires and their rating was taken as mean of correspondents response by using ranking order, and RII values, according to quality control implementation processes.

Table: 4.5 Quality improving on unpaved road construction

Quality improving characteristics	RII values	Ranks
Employees involvement in quality of the organization	0.94	1
Management commitment involvement	0.90	2
Skilled work force	0.80	3
Communication between managers and employees	0.77	4
Training and education in the organization	0.75	5
Sub-contractors involvement	0.73	6

Organizational work habits	0.70	7
Well defined roles and responsibilities	0.67	8
Clearly defined quality goals and objectives	0.66	9
Quality review/analysis used to improve performance of work	0.66	10
Regular inspection and audits of work	0.65	11
Incentives for good quality performance of work	0.64	12
Regular discussion on the worksite(jobsite)	0.62	13
Criteria used for pre-qualification in bidding process	0.59	14
Written program or quality policy in work	0.58	15
Certified program such as ISO-9000	0.55	16
Increased use of special soft wares in work	0.45	17
Increased use of strategic methods/planning in work	0.39	18

4.3.12 Quality Planning Processes in construction projects

According to the interview with head of Engineering and Maintenance department in GRRA, quality planning starts when specification of material is prepared based on ERA manual, 2013 by Ethiopia Road Authority. The document which aims to ensure compliance of constructions with the minimum requirements for design, procurement procedures, construction and quality of materials set down by the road Authority. Based on the standard set and the actual requirement and nature of specific unpaved road construction projects, the office starts preparing the contract document or bid specification document and announce the bid of the unpaved road construction projects to invite the competent contractors guided by the country procurement policy and procedures. On the other hand, the importance of quality plan was also part of the research questionnaires. Most of the respondents were agreed to the importance of the quality management system in unpaved road construction projects. In the same manner, they were requested to rate the level of importance as very low, low, moderate, high and very high levels. As a result 13(53.4%) as very high, 10(29.3%) as high, 5(5.2%) as moderate, 4(6.9%) rate as low, only 3 respondents (5.2%) rate as very low. This might indicate that majority of the staff consider quality management system is important in unpaved road construction projects. Consequently, majority of the respondents responded `yes` on almost on all variables, but below 50% for two variables. Table 4.6 describes the result of the findings on quality planning processes and its content.

Table: 4.6 Frequencies and percentages of quality planning contents

Variables	Responses	Count	Percentage values(%)
Brief description of project	Yes	32	94.8
	No	3	5.2
List of contract documents and drawings	Yes	35	100
	No	0	0
Project quality objectives	Yes	23	74.1
	No	12	25.9
Site organization chart, with named personnel if known	Yes	20	51.7
	No	15	48.3
Responsibilities and authorities of project staff	Yes	19	62.1
	No	16	37.9
Schedules of sub-contractor nomination ,materials and equipment procurement based on the construction program	Yes	21	60.3
	No	14	39.7
List(s) of materials and appliances used for the project, showing verification requirement for each	Yes	23	79.3
	No	12	20.7
Inspection and test plans as well as site lay out plan for the project, list thereof	Yes	24	75.9
	No	11	24.1
List of quality procedures and work instructions applicable to project by making references to the company`s quality manual and procedures	Yes	28	74.1
	No	7	25.9
List of project-specific procedures, work instruction and inspection	Yes	25	67.2
	No	10	32.8
Checklists, or target dates for their provision	Yes	19	58.6
	No	16	41.4
It's of quality records to be kept ,including appropriate quality records from sub-contractor	Yes	21	53.4
	No	14	46.6
Frequency (or provisional dates if possible) of internal quality audits	Yes	22	37.9
	No	13	62.1
Frequency of updating the quality plan for the project	Yes	26	44.8
	No	9	55.2

Accordingly, the variable included in the quality plan of the organization are raked the top five variables as follows; list of contract documents and drawings has 100% agreed by all respondents, this might be because of contract document is consider as quality policy manual as implementation guideline for the construction projects, followed by brief description of project(94.8%), list of materials and appliances used for the project(79.3%) ranked as third, inspection and test plans (75.9%) ranked fourth and both project quality objectives and list of quality procedures and work instructions applicable to project by making reference to the company's quality manual and procedures count for (74.1%) are ranked fifth.

On other hand, frequency of internal quality audits and frequency of updating the quality plan which counts 38 below 50% that is 37.9% and 44.8% respectively disagreed by majority of the respondents which gets less emphasis as the content of the quality planning. Unlike, the literature which recommend the content of the quality plan as listed in the above table, it may be indicate partially inclusion of the content and there is no separate document for quality plan for project, but the respondents that the contract document as agreement includes of the contents of the quality plan for each project.

4.3.13 Quality Management tools and techniques Practices

As described in the literature review part in the project quality control managements, there are different quality management tools and techniques to control quality of the projects. Here, the primary question is whether there is actual performance measurement of unpaved road construction projects in Gambella region.

Accordingly, 87.9% of respondents confirmed that there is performance measurement to control quality of the projects using different parameters and the rest 12.1% responds as no performance measurements for the project. The next question deals with types of quality measurement tools and techniques they used. Most of the respondents agreed with the use of quality measurement tools and techniques, about 23(79.3%) response were responded as `yes answer` and the remaining 12 (20.7%) rejected the use of quality measurement tools. In the table below, a list of quality management tools and techniques were prepared based on the review of literatures. It is one of the objectives of the study to verify to what extent the tools and techniques stated are relevant in the local context of unpaved construction project quality management.

As can observe from the table below, most of the quality management tools and techniques might not be applicable since most of the findings of the respondents are below response required. Accordingly, inspection/supervision seem as the common practices tools and techniques to most of the projects in GRRA which count for 79.3% followed by statistical sampling method(75.9%) and as responses from the interview,design of experiment/laboratory test is used for conducting various types of test, e.g. Concrete test, industrial materials, etc. to verify whether the materials met the quality standard requirement of the construction project meet.

Meanwhile, site engineers and regional level supervisor team were engaged in every project to supervise and inspect the construction works. In addition to selecting from the lists provided some of the respondents added on other. Few quality management tools and techniques were revealed from the interview which were not highlighted in the literatures review are project weekly site reports, monthly project status reports, weekly site reports and monthly project progress reports are used as the monitoring tools of site activities, whereas regular quarterly report including field monitoring are considered as the major monitoring tool. Quality management tool and techniques are best described in table 4.7 as:

Table: 4.7 Quality management tools and techniques

S/No	Tools and techniques	Responses	Count	Percentage values(%)	Ranking order
1	Benefit/cost analysis	Yes	2	3.4%	7
		No	33	96.6%	
2	Bench marking	Yes	1	1.7%	8
		No	34	98.3%	
3	Flow -charting	Yes	1	1.7%	9
		No	34	98.3%	
4	Design of experiments(DOE)	Yes	16	27.6%	4
		No	19	72.4%	
5	Quality audits	Yes	15	34.5%	3
		No	20	65.5%	
6	Control charts	Yes	12	20.7%	5

			No	23	79.3%	
7	Inspection /Supervision		Yes	23	79.3%	1
			No	12	20.7%	
8	Pareto diagrams		Yes	1	1.7%	10
			No	34	98.3%	
9	Statistical sampling method		Yes	21	75.9%	2
			No	14	24.1%	
10	Trend analysis		Yes	6	10.3%	6
			No	29	89.7%	

4.4 Major factors Affecting Quality control of Construction Projects in general

This section of the study assesses the factors that influence the quality of project of unpaved road construction project surveyed based on the literature review and list of factors. From Table 4.8, the respondents were presented with variables to rank from 'great influence or strongly agree' (5) to 'very less influence' (1) on the bases of their influence on the quality of projects in unpaved construction surveyed data and the result of the respondents are presented in the table 4.8:

Table: 4.8 Factors affecting quality of projects in general

Quality factors	No of responses	Strongly agree	Agree	Moderately agree	Less agree	Very less
Qualified and experienced personnel	35	21(75%)	10(17.2%)	3(5.2%)	1(1.7%)	0
Quality of materials and equipment used in the construction projects	35	20(72.4%)	11(19%)	2(5.2%)	1(1.7%)	1(1.7%)
Conformance to specification	35	19(62.1%)	10(27.6%)	6(10.3%)	0	0
Quality assurance training and follow-up	35	13(44.8%)	10(34.5%)	10(17.2%)	2(3.4%)	0
Top management support	35	14(43.1%)	10(34.5%)	10(17.2%)	1(1.7%)	0
Contract documents	35	18(67.2%)	11(22.4%)	5(8.6%0	1(1.7%)	0
Selection of contractors	35	18(67.2%)	11(22.4%)	4(6.9%)	2(3.4%)	0

Co-operation of stakeholders	35	17(46.6%)	10(39.7%)	3(5.2%)	3(5.2%)	2(3.4%)

From above table, qualified and experiences personnel(92.2%), quality of materials and equipment used in the project construction(91.4%) and conformance to specification(89.7%) were ranked as 1st, 2nd, and 3rd respectively are estimated as the three most important factors in the determinant of the quality of unpaved road construction projects undertaken by the Gambella rural road authority on surveyed data. Existing literature review indicates that a quality system is designed to provide an assurance to clients, which can be supported through documented records, that all contracts will be completed in accordance with the agreed time, cost and specification. However, the least influential factor in terms of the quality of projects undertaken by the survey data were cooperation of stakeholders, top management support and quality assurance training and follow-up.

4.4.1 Problems in Project Quality Management implementation

The respondents were asked if they encounter problems as highlighted in the literatures for the implementation of quality management system is concerned. List of problems was as shown in Table 4.9. As for the problem which was not discussed in the literature review also identified by respondents and details for the feedbacks from the respondents are illustrated below:

Table: 4.9 Problems to project quality management implementation

Problems	Very strongly agree	Strongly agree	Moderately agree	Less agree	Very less	Ranks
Inadequate management support	39.7%	37.9%	6.9%	10.3%	5.2%	1
Lack of quality management policy and strategy	32.8%	36.2%	17.2%	6.9%	6.9%	3
Inefficient resources management	32.8%	31%	24.1%	5.2%	6.9%	5
Lack of regular supervision	20.7%	20.7%	24.1%	13.8%	20.7%	8
Unwillingness of project staff to accept the quality management system	15.5%	25.9%	24.1%	17.2%	17.2%	8
Lack of quality assurance team leading the process	31%	24.1%	20.7%	15.5%	8.6%	7
Problems with contractors and consultants	48.3%	29.3%	15.5%	3.4%	3.4%	1

Lack of effective communication	22.4%	37.9%	20.7%	12.1%	6.9%	6
Increase of cost	25.9%	39.7%	12.1%	12.1%	10.3%	4
Unrealistic dead line	39.7%	34.5%	13.8%	8.6%	3.4%	1
Inadequate technical expertise/skills	29.3%	25.9%	19%	12.1%	13.8%	7
Problem with documentation	24.8%	47.3%	16.4%	9.1%	5.5%	4
Difficulties in measuring results	20%	38.3%	25.5%	12.7%	3.6%	5

From the above table, the first three major problems in the order of their rank were inadequate management support (78%) and problems with contractors (78%), unrealistic deadline (74%), lack of quality management policy and strategy (69%) ranked 1st, 2nd and 3rd respectively. However, the least ranked three challenges to project quality in the construction project surveyed were lack of regular supervision, unwillingness of project staff to accept the quality management system and lack of quality assurance team leading ranked 6th, 7th, and 8th respectively. However, the remaining considered factors were found to be affect even if the degree varies since all the listed problems affect quality of the construction.

4.4.2 Identification of Challenge factors faced by professionals particularly with Contractors, consultants and clients

This section of questionnaires, investigates the challenges faced by quality control implementer professionals, in order to implement quality management system in unpaved road construction projects of Gambella rural road authority. As shown in table 4.10, by showing the RII (Relative Importance Index) method was deployed here, to find RII values of a client (owner), Consultants and Contractors independently with weighted RII values as well as their ranks. And this show that, the challenges faced by professionals are ranked by the values of weighted RII. That means, the ranked value given by respodents,show that Technology adoption challenges is the first, with highest values of RII valued 0.652, delay of cash flow is the second challenges with RII value of 0.622 and poor communication is the third challenges with RII value of 0.597.

Table: 4.10 Weighted RII values of challenges of quality control implementation

Challenge factors affecting quality	Client RII	Rank	Consultant RII	Rank	Contractor RII	Rank	Weighted RII	Weighted ranks
Lack of technology adoption	0.580	2	0.673	1	0.656	1	0.652	1
Delay of cash flow	0.460	6	0.660	2	0.640	2	0.622	2
Poor communication	0.620	1	0.607	3	0.576	3	0.597	3
Inadequate safety	0.520	3	0.580	5	0.528	6	0.551	4
Lack of collaboration and professionalism	0.440	7	0.580	5	0.512	7	0.532	5
Limited skill of man power	0.480	4	0.507	7	0.544	4	0.517	6
Construction policy	0.440	7	0.587	4	0.456	9	0.514	7
Lack of good organizational structure	0.400	10	0.473	11	0.536	5	0.486	8
Inadequate risk management	0.480	4	0.500	8	0.472	8	0.486	9
Bad forecasting (pessimistic estimation)	0.440	7	0.500	8	0.416	10	0.458	10
Weak capacity of contractors and consultants	0.380	11	0.493	10	0.384	12	0.434	11
Labor shortage	0.380	11	0.413	12	0.400	11	0.403	12
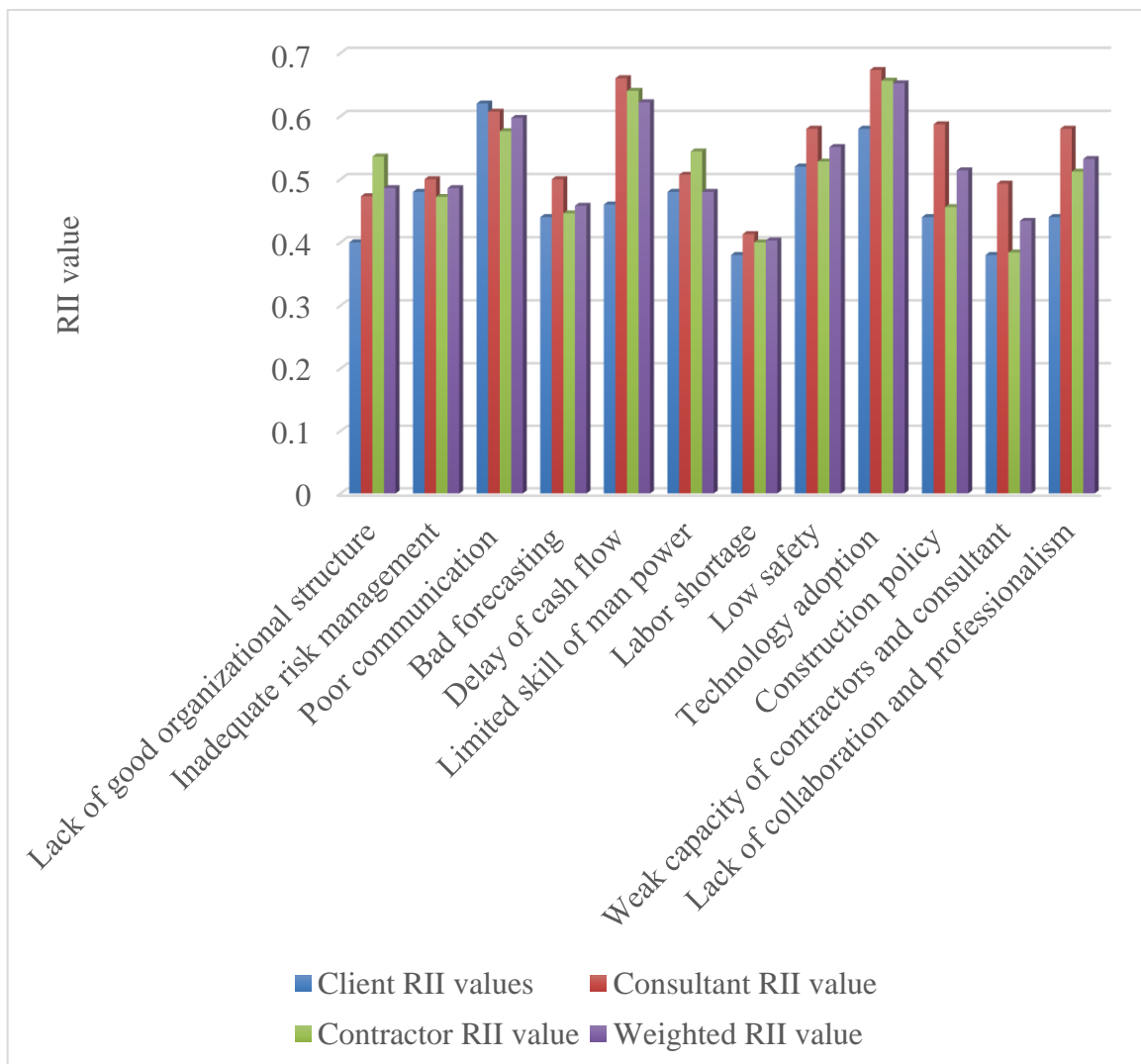
Figure: 4.12 Challenges faced by professional of quality control

Technology adoption is the first challenges and first factors faced by professional of quality control implementation on unpaved road, with a weighted RII value of 0.652. This indicates that, modern technology machines are very useful in different aspects of unpaved road construction project in the region. For example, the unpaved road construction projects use advanced technology machines, but the professionals are not compatible with the advanced technology available at the worksite and this leads to delay poor quality control, cost overrun, overtime schedules and others. Lack of good organizational structure and inadequate risk management have the same weighted RII value of 0.486 and rank 8, but according to the observation and interviews of respondents, inadequate safety is more challenged than organizational structure, because the weighted RII value of it is 0.551 and is higher than 0.486 RII value of both.

Table: 4.11 Cronbach value of challenges (factors)

k	12
	18.947
Var 2	78.255
Cronbach alpha(α)	0.827

The reliability of Cronbach α value is 0.827, it's near to 1 or between 0.7 and 0.9 and this value indicates that it is high reliability. Alpha values above 0.7 are generally considered as acceptable and satisfactory. Reliability is the most important and fundamental feature in the evaluation of any measurement instrument or tool for good research (Mohajan, 2017).

 At the same time, the correlation and significant value were also checked. Correlation is a statistical tool that helps to measure and analyze the degree of relationship between two variables and it is calculated by spearman's correlation method and excel correlation formula. Meaning, the value of the correlation coefficient varies between +1 and -1(Ellis and Victoria, 2011). The rating values of correlation are written as shown below;

- ❖ 0.0-0.19 "Very Weak "
- ❖ 0.20-0.39 "Weak"
- ❖ 0.40-0.59 "Moderate"
- ❖ 0.6-0.79 "Strong"
- ❖ 0.8-1.0 "very strong "

    The correlation values of the three stakeholders such as client, consultants and contractors are and checking reliability of data.

Table: 4.12 Correlation values of challenges faced by professional of unpaved roads

Correlation between Client vs Consultants	Correlation between Client vs Contractors	Correlation between Consultants vs Contractors
Value=0.753	Value= 0.753	Value= 0.705
Very strong correlation	Very strong correlation	Strong correlation

Then, refer to the table (appendixes) of Spearman`s correlation method, to get the critical R-value (rcrit or rs), if the critical value from the table is less than the calculated correlation coefficient, in other words if the calculated value is greater than the rcrit, it is save and not got by chance. The value of rcrit or rs is also calculated by N= 12 and p= 0.05, rs value is 0.587.Therefore, the rs is less than the correlation coefficient and it is significant. The

correlation value indicates both the client vs consultant and client vs contractor have a similar result, this shows both have agree on the similar attitude of the questionnaires.

Finally, the challenges raised are all existed on the unpaved road (gravel) construction and maintenance projects of Gambella rural road authority and all the respondents agree with those existed challenges faced by professional of unpaved road construction projects because of the lack of coordination, collaboration and communication of professionals.

4.5 Impact of factors affecting quality control on unpaved road construction

According to the collected data from the company's employees using questionnaire and interview, most of the respondents were justified that, contractors give more influence on quality. There were many unpaved roads construction started and not yet finish on time still in progress or no progress at all. From figure 4.10 of quality rate of work indicates that, the rating of work has high quality, but work were not completed on time and budget, this indicates that they fear quality and they focus on that. The effect of poor coordination among professionals as well as lack of good quality management system were those one impacts of showing poor quality control implementation (which is decreasing or loss of some construction constraints. Figure 4.13 shows a list of the impact of poor quality control .According to the participants` results, the impacts of factors affecting quality control implementation are ranked in figure 4.13 with relationship between client, consultants, and contractors.

Table: 4.13 Weighted RII value and ranking of Impact factors affecting Quality

Impact of factors	Client		Consultants		Contractors		Weighted RII values	Weighted ranks
	RII	Ranks	RII	Ranks	RII	Ranks		
Decrease of productivity	0.760	1	0.740	1	0.752	2	0.748	1
Delay the completion of tasks	0.740	3	0.733	2	0.720	3	0.729	2
Redesign	0.720	5	0.667	5	0.760	1	0.711	3
Complicate process of work	0.760	1	0.673	4	0.696	4	0.695	4

Materials wastage	0.720	5	0.700	3	0.648	6	0.683	5
Low profit	0.660	8	0.667	5	0.680	5	0.671	6
Rework	0.640	10	0.620	9	0.648	6	0.634	7
Weak accountability	0.640	10	0.627	8	0.608	8	0.622	8
Misunderstanding or conflict of opinion	0.740	3	0.613	10	0.584	9	0.622	9
Ineffective communication	0.680	7	0.640	7	0.576	10	0.622	10
Lack of acquisition and distribution of information	0.640	10	0.613	10	0.520	14	0.582	11
Claim and disputes	0.660	8	0.567	12	0.560	12	0.578	12
Unclear departmental priorities in the office	0.600	13	0.567	12	0.560	12	0.569	13
Duplication and unclear departmental on worksite	0.560	15	0.560	14	0.568	11	0.563	14
Loss of data	0.580	14	0.553	15	0.464	15	0.523	15

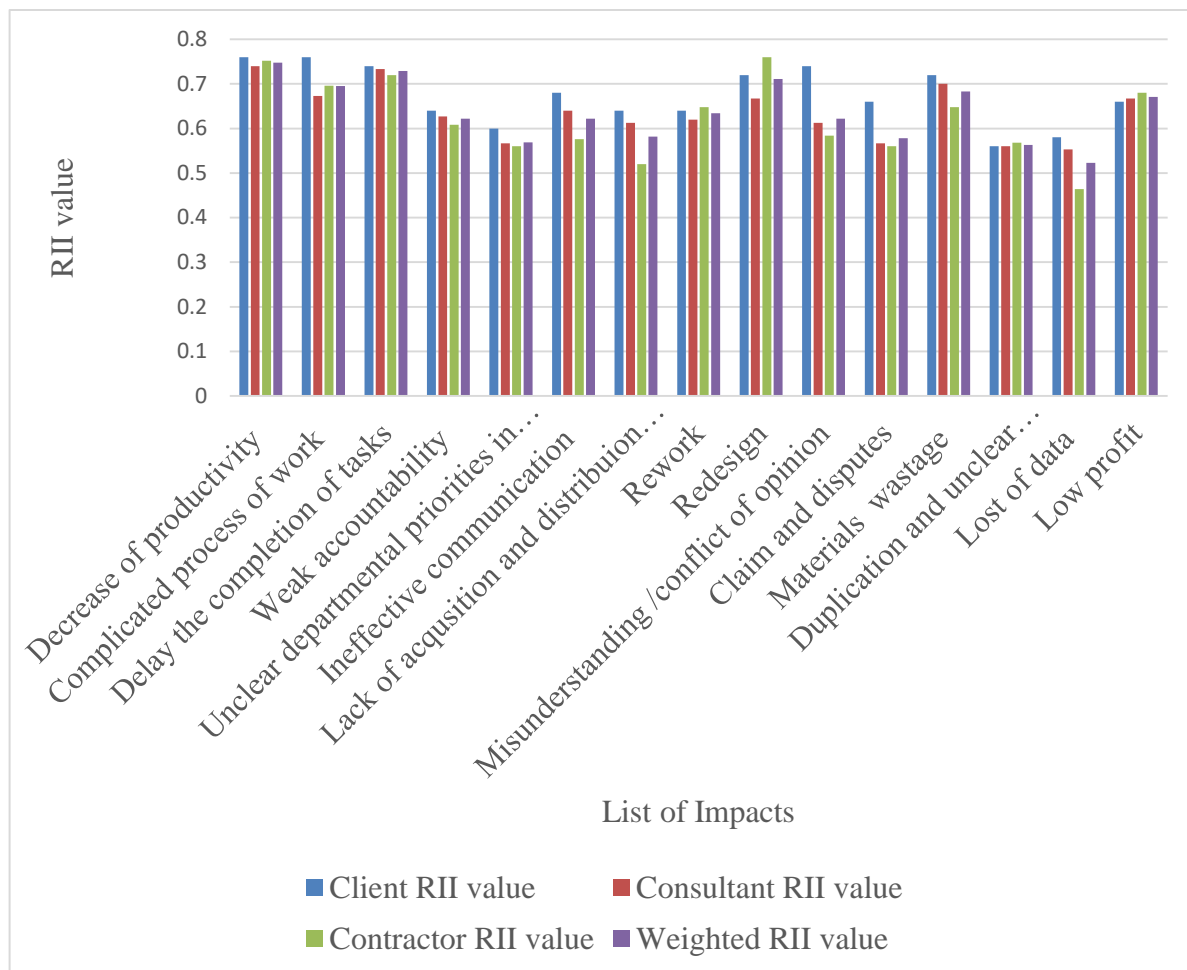Figure: 4.13 Impact factors of poor quality control

Checking for reliability of data, if they are reliable or not.

Table: 4.14 Cronbach value of Impact factors

k	15
	21.193
Varp	238.134
Cronbach alpha(α)	0.976

The cronbach value found is 0.976, which is approaching to 1 or greater than 0.9 and this
value indicate that the result is excellent reliability of data.

Correlation between	Correlation between	Correlation between
Client vs Consultants	Client vs Contractors	Consultants vs Contractors
Value=0.830	Value= 0.733	Value= 0.670
Very strong correlation	strong correlation	Very Strong correlation

Generally, the value of rcrit or rs(Spearman`s rank correlation coefficient) is also calculated as: N=15 and P=0.05, hence rs value is = 0.521, which is equal to k of cronbach =15.

4.5.1 Impacts of factors of overall observation of worksite

This type of research questionnaires required the participants or respondents on how they observed, assess their work habit and knowledge conducted on-site work and review the progress of the work and the workers. Perform monitoring and evaluation, checking and testing of materials as necessary/required to confirm that work is in conformance with plans, quality, and determinations and record the outcomes about work within the daily construction report and construction drawings. Perform tests as required by plans and details or asked by the project manager and get ready reports of the test outcomes of work. The overall observation of the work from the client/owner and consultant perspective were tried to generalize as follows and the respondent gives feedback about some common site-work they observe.

1. Safe work site: 36.36% of the respondent said well, 22.73% of the respondent also said the overall work is excellent and 20.45% of the respondent said adequate and same result 20.45% said poor safety worksite. Therefore, the safety of the worksite is good in general.

2. Quality workmanship: 43.18% of the respondent said good, 20.45% said excellent and

Same result 18.18% said adequate and poor. In general, it indicates good quality of

Workmanship, but should be more improved.

3. Met project specification and quality design: 38.64% of respondent said good, 29.55% said adequate, 22.73% said excellent and 9.09% said poor. The work is done by the specification listed. Hence, it mean that project met specification and quality design in good condition.

4. Met project schedule: 29.55% said adequate, 27.27% said poor, 22.73% said good and 20.45% said excellent. This indicates that, the project schedule was not done like planned, so it faced time ,cost overrun and dissatisfaction, all those came from poor quality control , poor communication and coordination of professionals.

5. Kept you informed about the situation of quality:-36.36% said good, 29.55% said excellent, 27.27% said adequate, and 6.82% said poor. This shows that, the communication between professionals in case of some corrected works or errors was good and shared appreciated information process about quality of their work.

6. Responded timely and effectively: - 50% of respondents said Good, 29.55% said adequate, 15.91% said excellent, and 4.55% said poor. This shows that, they were solving problems quickly and well informed about the situation of quality in good process.

7. Team player / team sprit: - 43.18% of respondents said good, 27.27% said adequate, 25% said excellent and 4.55% said poor. They have a good team sprit themselves.

8. Overall impression of work: – 61.36% of respondents said good, 29.55% said adequate, 9.09% said excellent and 0% said poor. This implies that, the general status of worksite look goods.
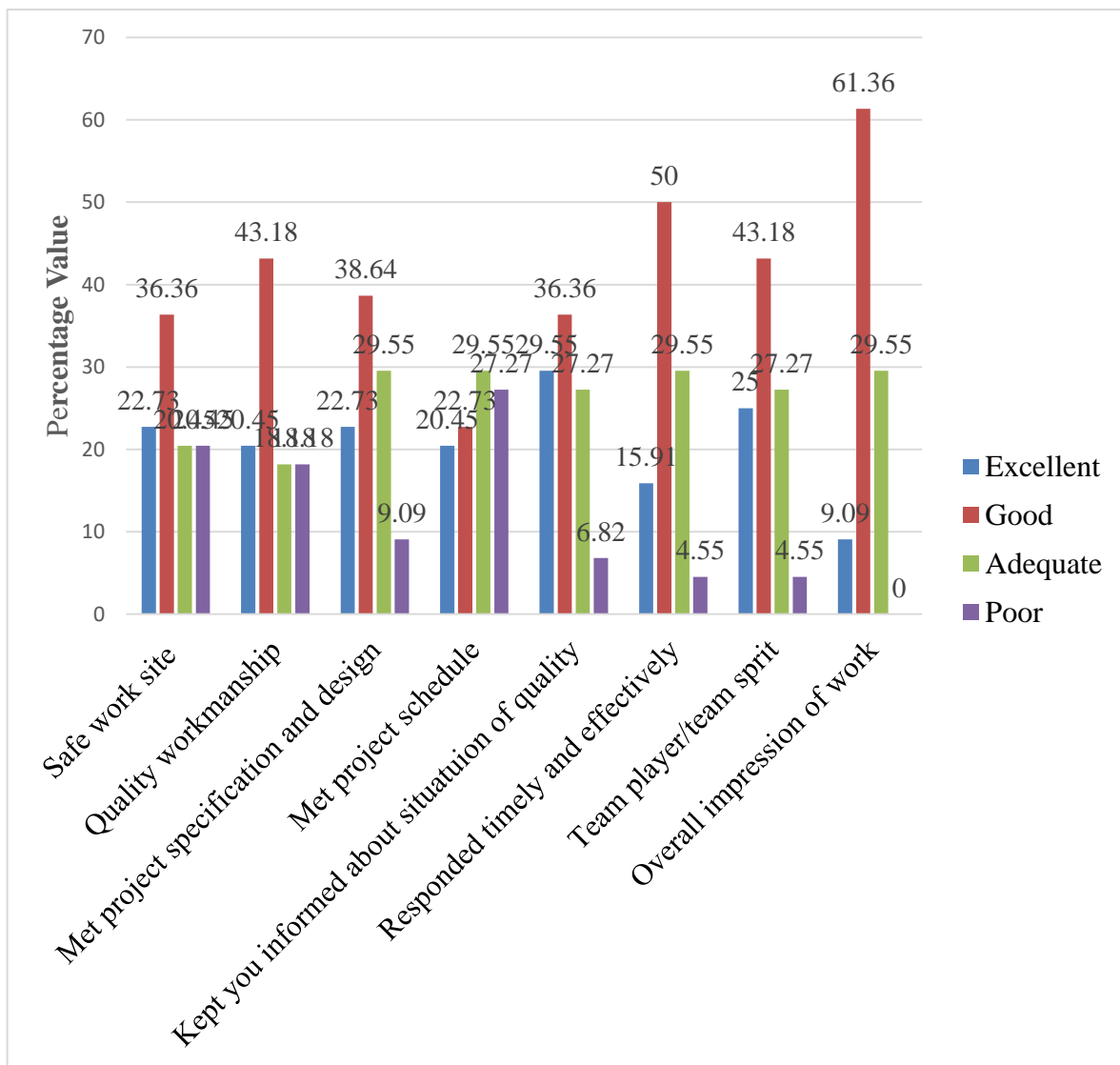
Figure: 4.14 Factors of overall observation of worksite

4.6 Discussion of the research results

This finding partially seems consistent with some of the literature and various among variables and there is no separate Quality management policy separately in the Organization.

This study, described quality policy is instrumental in creating the organization's standing and quality image since it is statement of principles stating what throughout the organization and across the projects. Description of quality planning ensure that all relevant parties involved including consultants, Contractors, subcontractors and suppliers were included in the task of quality planning for the project. Quality management tools are important factors for the implementation of quality management system in construction projects, where identification of quality standards, evaluation of overall project performance and quality control monitoring of specific project results in the quality management processes were

defined. In the study majority of the respondents agrees that there is performance measurement to control quality (87.9%) on unpaved road construction project in GRRA

A good quality control system should have to establish the measurement methods used, compare the actual results to the quality standard to monitor and standardize measuring devices accordingly to 10 major factors, inspection and design of experiment/laboratory test were considered as the major tools to control quality. Regarding to quality management factors, the major factors that affect quality were ;materials, labor, financial issues, conformance to codes and standards, top management support, management factors, selection of contractor, selection of designer to design, co-operation of parties, contract documents and lack of communication were identified also. Likewise, majority of the respondents identified qualified and experiences personnel, quality of materials and equipment used in the project construction, conformance to specification and quality assurance training and meetings.

Generally,the researcher found out that there was gaps observed to be use and implement the knowledge and best practices to achieve good quality for end product and follow best quality management systems. It has also pointed out that quality status in general needs to be improved for future.

4.7 Research findings

In order to give answers to questions raised in chapter one under research questions, answers can be formulated and further discussions can also be presented according to the data gathered and analyzed in relation to the earlier researches. This can be done using the research questions as follows.

4.7.1 To assess quality control system,tools and techniques on unpaved road

This research showed that those problems related to quality are not given proper attention because quality status need to be improved, a given general rule (such as quality standard) should be fulfilled. Other issues such as safety and quality status is poor, top managements' commitment to quality is poor, awareness level of creation or training status is low and other constraints such as budget shortage are hindered it.

The data and information that gathered from research correspondents found quality to needed be improved. The research also revealed that there is no quality assurance department within Gambella rural roads authority, itself in order to control either contractors or consulting firms. The research also indicated that all construction professionals interviewed for this research

had pointed out that quality was lagging behind and need to be improved. They also suggested that the quality concerns have to be increased because the projects are getting bigger and more complex.

4.7.2 To identify the factors affecting quality control on unpaved roads

Majority of the respondents identified major quality management factors that affects road quality were ; qualified and experiences personnel, quality of materials and equipment used in the project construction, conformance to specification and quality assurance training and meetings, top management support, selection of contractors, co-operation of parties contract document problems and lack of communication.

According to this research questions, the five top challenges faced by quality control implementation faced by project professional team implementer involved on unpaved road construction were found as technology adoption with RII value of (0.652); delay of cash flow (0.622); poor communication (0.597); inadequate safety (0.551) and lack of collaboration and professionalism (0.532) from the first to fifth. Those and other challenges are faced in the project and this leads to project failure.

4.7.3 To identify the impact of factors affecting quality control on unpaved roads

From the investigation made on the impact factors affecting quality, major impacts were identified as, decrease of productivity (0.748); delay of the completion of the task (0.729); redesign (0.711); complication of the work processes (0.695); materials wastage (0.683) and low profit (0.671) were ranked from high to low, those and other impact factors were developed and lead to dissatisfaction, claim and disputes, over cost, delay, etc.

In general, poor coordination,poor quality and management were common phenomenon that happens and affects the construction industry as a base challenges. Technology adaption, lack of awareness, delay of budget and material, limited communication and skill, and lack of safety and collaboration were assessed as main challenges and Decrease of productivity, time and cost overrun, redesign and rework, material waste, and claim & dispute were the main impacts assessed.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

From the anaylsis results,the following conclusions can be drawn based on the specific objectives of the research and finding of the study:

❖ To improve quality system and to asses construction quality,one must identify and recognize the influence of the primary factors affecting quality control implementation and a general objective of assessing the quality management practices and identifying the major quality management challenges on unpaved road construction projects as well as tools and techniques reviewed from literature such as benefit/cost analysis, bench marking, flow charting, design of experiment, quality audits,control charts, inspection/supervision, pareto diagrams, statistical smapling and trend analysis teeechniques at GRRA.

❖ The most important factors affecting unpaved road construction quality from literature review has been identified as follows; Qualified and experienced personnel, Quality of mateials and equipments used, poor specification and design, Quality assurance training and follow-up,poor site management and supervision, problem of contract document, selection of contractors and lack of experience ,poor communication/incomplete instruction,and co-operation of stakeholders. By Combining most important factors agreed by the owner,consultants and contractors as the main factors affecting the road construction quality projects, it showed that lack of experience and selection of contractors, quality workmanship on sitework were the major effects in contract implementation referring to detected major factors.

❖ From the investigation made,and on the finding,impact factors affecting quality control implementation were found as decrease of productivity, delay of completion of tasks, redesign, complication of work processes, materials wastage and low profit were ranked from high to low, those and other impact factors were identified and lead projects to dissatisfaction, claim and disputes, over cost and delayment of project completion time.

Generally, it can be concluded that, undertaking complete quality management process by developing quality management policy at organizational level,construction site supervision

and inspection helps to improve the quality management related problems listed and assessing all possible major factors that affect the quality of projects from planning phase to the end of the project implementation phases.

5.2 Recommendations

Based on the findings of study, it is recommended that GRRA should considers the following areas of improvement in quality management system of its projects in general and quality control implementation and management in particular.

- ✓ The GRRA should build capacity of project staff on project quality management to use qualified and experienced staffs to follow up the use of good quality of materials and equipment to ensure the project conformances to specification and standard requirements.

- ✓ The planning process needs improvements to make it participatory since the knowledge of the project team varies on the quality tools and techniques used in quality management to properly follow the projects they undertake in GRRA.so,the organization should follow quality planning process inorder to prevent project defects.

- ✓ In order to improve road construction quality, extensive training and education on quality control and management should be given to the professionals frequently. These training may focus on advanced unpaved road design, improved and locally available materials, improved road construction processes, repair and rehabilitation methods, workforce and enhanced user satisfaction.

- ✓ There should also be quality management department within GRRA, so that this department determines whether a quality process is being implemented as intended and is producing the desired result or not.

- ✓ Quality Assurance authority should give attention to appropriate quality management system requirements for each contractor, consultant, and tenders of imported construction materials, and the authority should appropriate checking, measurement or testing of products and keeping proper records.

- ✓ The GRRA should also focus on project management body of knowledge areas in order to minimize the road construction project challenges, and should assign at least one project manager professional at the organizational level.

- ✓ Top management should work on identifying the gaps which require their strong support and strengthen the quality focused activities, since their guidance is decisive for the success of the project.
- ✓ Quality management of construction projects require stakeholders collaboration from clients, contractors, consultant sides on the basis on their respective roles and responsibilities defined. Therefore, the organization should strongly work on to build partnership/collaboration with its stakeholders.
- ✓ As observed regarding consultants, there was a time gap between project design and project implementation; this may happen because of scope change. Therefore, due to scope change the project incurred additional cost, time, as well as the project will phase-out. So, GRRA should be minimizing the gap.
- ✓ Currently , there is no quality management policy document in the organization, the organization is considering project agreement document as reference/basis for quality management, but there should be defined quality policy since there are many projects undertaken by the sector to improve the customer satisfaction.
- ✓ The regional road authority should focus to work on the challenges identified such as lack of contractor experiences, right of way that both client, contractor and consultants needed to improve the quality of the construction project and application of the knowledge area of the project quality management.
- ✓ GRRA should assign project quality management focal person at least at regional level is important to control overall quality of the projects by application project quality management skills and knowledge.
- ✓ A gap was identified in terms of knowledge of quality management and the application of quality control implementation and management systems.

Generally, the organization and others stakeholders can make use of the results of this study to identify areas of improvements in order to manage its projects quality control as per the standards of other literature which helps to manage the project in a more effective and efficient manner.

Future studies should be conducted on the extent of quality failures, how to minimize it and reduce the gaps in relation to road construction projects, both during the design phase and during execution phases. And also,should be conducted in public building construction quality,railway construction quality, hydropower construction quality and others similar

projects to find factors differing with this study. This would help to understand quality control
of completed projects in order to reduce losses interm of cost by the government.

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APPENDIXES A

Questionnaire format

Questionnaire
Dear Respondents !

The purpose of this questionnaire and formats is to obtain information and data for the specified research conducted as partial fulfillment of the requirements for a master's degree of Science in civil engineering (Construction Engineering and Management stream) at Jimma University, Institute of Technology/JIT.

Research title:

Assessment of Quality control implementation on unpaved roads construction and Maintenance project of Gambella rural road authority.

Objective:

The purpose of this research is to assess the Quality control implementation on unpaved road construction and maintenance project of Gambella rural road authority.

Confidentiality

The data collected and the information to be answered in this questionnaire will be used for academic research purpose only. All specific company and interviewee information will be kept confidential at all times. Only generalized analysis of the information contained within this completed questionnaire will be utilized in the research process.

Instruction

Please answer, rate, and tick (✓) the questionnaire by choosing the appropriate choices. The questionnaire and data collection contain four parts. Part one contains Personal information and Professional skill, part two deals with quality management system with its quality control, part three challenges of quality control implementation, and part four impact of factors affecting quality control. I realize that there are numerous demands on your time. However, your involvement is a vital requisite for this study. I appreciate your anticipated cooperation in answering this questionnaire, which may take less than 30 minutes of your valuable time. Thank you for your earnest cooperation in advance.

Best Regards,
Sincerely yours
Koang Maluth Goach
Postgraduate student in Construction Engineering & Management Stream
Jimma University, JIT, Civil Engineering Department.
Tel: 09 24 55 32 74/09 65 75 63 71
E-mail: **akoangpeter@gmail.com**

Part one: General information

1**.** Name of your firm/Organization_____

2. Profession _____

3**.** Construction project Name (Optional) _____

4**.** Delivery Methods _____

5**.** Original Expected Completion Period _____

6. Your work experience related to unpaved road construction

☐ 1-2 years   ☐ 2-4years   ☐ 4-6 years   ☐ above 6 years

7. Please select your education level below or background (Profession) and choose your highest level:

☐MSc.in Engineering   ☐ MSc in Environmental Engineering   ☐ TVET College

☐Highway Engineering   ☐ MSc in Construction Engineering ☐ Secondary School graduate

☐Structural Engineering   ☐BSc   ☐PhD   ☐MSc in Geotechnical Engineering ☐ Others please, specify------------------

➢ Rate these activities to what extent were the following skills and trait exhibited by the professionals on unpaved road construction and maintenance projects.

	Very good	Good	Moderate	Poor	Very poor
Management skill					
Technical knowledge					
Communication and Collaboration					
Creativity					
Punctuality					
Working in team					
Awareness Level of quality					
Respect and mutual trust among Professionals					
Conflict resolution Procedure among profession					

8. What is your work title / position in the company?

☐Owner/CEO   ☐ Project manager/ Supervisor   ☐ Construction engineer

☐Site/Office engineer   ☐Material engineer   ☐Quality controller

☐Foreman   ☐Surveyor   ☐Technical person ☐Consultants/Engineering firm

☐Safety manager   ☐if others, please specify your comments-------------------------

Part two: Questions concerning quality management system or Quality control in your company/organization

❖ For each statement, please indicate by ticking the appropriate rating that describes your opinion from your experience of working in a team for unpaved road construction project in which fit the purpose of this questionnaire.

1. Is there quality management system in your company/organization?

☐ Yes   ☐ No   ☐ I don`t know

2. What is the system that your organization/company follows?

☐ Quality management system within the organization/company

☐ ISO (International standard Organization) Quality management system

☐ I don't know   ☐ if other please specify: Your comment --------------------------

3. Have you received training from your employer to have awareness level of implementing the quality system on your work? Please use the following scales and tick!

1(Very poor)	2(poor)	3(Moderate)	4(good)	5(very good)
No training			Comprehensive training	

4. How much would you agree that the quality system is useful to your work place?

☐Totally agree   ☐Totally disagree   ☐ Agree   ☐ Disagree   ☐ Neutral

5. How much would you agree that the quality system is **easy** to use in your work place?

☐Totally agree   ☐ Totally disagree   ☐ Agree   ☐ Disagree   ☐ Neutral

6. How much would you agree that the top management system is committed to follow the quality system in your company?

☐ Totally agree   ☐ Totally disagree   ☐Agree   ☐Disagree   ☐ Neutral

7. Quality system is not in place. Do you know why there isn't a system in place? Check as many choices as apply!

☐We don't see the benefits   ☐ we don't have time to implement it
☐We don't believe that the system is useful to us   ☐ I don't know

☐We are currently in the implementing process   ☐Too expensive

☐Others: Please specify your comments--------------------------
8. How would you rate the quality of work in your organization?

a) Excellent quality☐   b) High ☐   c) Good ☐   d) Low ☐

9. Questions about quality in general on unpaved roads construction and maintenance. Please rank the following items from 1-5 based on how well they indicate good quality performance in your organization/company!

	1(very weak)	2(Weak)	3(Moderate)	4(Strong)	5(Very strong)
End-user(society)/public/Customer satisfaction	☐	☐	☐	☐	☐
Management commitment to quality system	☐	☐	☐	☐	☐
Client satisfaction	☐	☐	☐	☐	☐
Skilled work force involvement	☐	☐	☐	☐	☐
Training and education	☐	☐	☐	☐	☐
The amount of rework due to errors/defects	☐	☐	☐	☐	☐
Regular inspections (supervision)	☐	☐	☐	☐	☐
The length of warranty the company can give on their work	☐	☐	☐	☐	☐
General construction standards	☐	☐	☐	☐	☐
Quality awards in your company	☐	☐	☐	☐	☐
Project Manager cooperation with site Engineer/office engineer	☐	☐	☐	☐	☐

10. What do you assume to be the most accurate definition of quality in construction?

☐ We don't use the definition of quality
☐ Non applicable to our work
☐ Looks good, works good or proud to put the company's name on the finished product
☐ Meets all end users/society) expectations or demands for the finished product
☐ Meets design or code requirements, minimal call-backs or rework
☐ Able to guarantee that the finished product will not fail or have
☐ Others: please specify your comments-----------------------

11. Does your organization or company collect quality cost from projects to projects?

☐ Yes   ☐ No   ☐ I don't know

12. What is your definition of quality cost? Please mark as many items as apply!

☐ Cost incurred due to material testing

☐ Prevention costs

☐ Appraisal costs

☐ Cost of repairing defects/error after hand over

☐ Cost of redesign/ construction defect(error)

☐ Cost of deviation

☐ Cost of quality assurance in the bidding or tender process

☐ I don't know

☐
Other: Please specify: your comment---

13. What do you consider to be the status of quality in unpaved roads construction
activities?

	1	2	3		4	5
Very bad-Serious problems					Verygood –No problem	
	☐	☐	☐	☐ ☐	☐	☐

14. Improving quality indicators in general and Please rank the importance of the following
aspects for improving quality on a scale from 1-5 taking 1 as very weak/less important and 5
as very strong/very important!

Improving Quality indicators	1 (very weak)	2 (weak)	3 (Moderate)	4 (strong)	5 (Very Strong)
Employee involvement					
Management commitment involvement					
Skilled work force					
Communication between managers and employees					
Training and education					
Sub-contractors involvement					
Organizational work habit					
Well defined roles and responsibilities					
Clearly defined quality goals and objectives					
Review/analysis used to improve performance					
Regular inspection and audits					
Incentives for good quality performances					
Regular discussion					
Criteria used in pre-Qualification on bidding process					
Written program or policy					

Certified program					
Increased use of special soft wares					
Increased use of strategic method/planning					

Part three: The challenges (Factors) in general of Quality control implementation of unpaved roads construction professionals. And what is the degree of Challenges faced by Quality control implementation professionals particularly with Consultants, Contractors, and Client?

Challenges factors affecting Quality	Extremely high	Very high	High	Moderate	low
a. Lack of good organizational structure					
b. Inadequate risk management					
c. Poor communication					
d. Bad forecasting					
e. Delay of cash flow					
f. Limited skill of man power					
g. Labor shortage					
h. Low safety					
f. Technology adoption					
j. Construction policy					
k. Weak capacity of contractors and consultants					
l. Lack of collaboration and professionalism					

Other challenges --

Part Four: Questions about Impact of poor Quality control implementation on unpaved road construction and maintenances.

A. What is the degree of impact of poor quality control implementation you observe on unpaved roads construction?

Impacts factors affecting Quality control	Very high	High	Moderate	Low	Very low
Decrease of productivity					
Complicate processes of work					
Delay the completion of tasks					
Weak accountability					
Unclear Departmental Priorities in the office					
Ineffective communication					
Lack of acquisition and distribution of information					
Rework					
Redesign					
Misunderstanding /conflict of opinion					
Claim and dispute					
Material wastage					
Duplication and unclear department on job site					
Loss of data					
Low profit					

B. Tick "√" on the degree of factors and describes your opinion that you observe on the worksite.

Factor affecting Quality on worksite	Excellent	Good	Adequate	Poor
Safe work site				
Quality workmanship				
Met project specifications				
Met project schedule				
Kept you informed about situations of quality				
Responded timely and effectively				
Team player /sprit				
Overall impression of work site				
Met project quality design				

APPENDIXES B

Interview Questions

1. What is your responsibility in the project?

2. Do you have the awareness level of quality control implementation on unpaved roads?

3. Do you think that lack of quality control implementation can affects the unpaved road construction work? If yes? How? And if no? Why?

4. How do you explain the quality control implementation in your organization?

5. Do you face problems by lack of quality control implementation in your organization?

6. Does Gambella rural road authority follow-up quality control implementation on your work place?

7. Do you think quality control implementation is so important for the success of unpaved roads construction? And How?

8. Do you have suggestions in minimizing material quality, over cost, quality workmanship; project periods and others related problems in unpaved road construction?

Note:

❖ Do you have anything else you would like to share regarding the quality control implementation on unpaved (gravel) roads construction and maintenance project?