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Assessment of Quality management practices in construction projects: the case of AACRA

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Approved by Board of Examiners

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Internal Examiner	Signature	Date
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External Examiner	Signature	Date

Declaration

I hereby declare that the study which is being presented in this thesis entitled "**Assessment of Quality management practices in construction projects: the case of AACRA**" is original work of my own. It had not been presented for a partial fulfillment for any educational qualification at this university or any other and in any projects by any means, and all the resources materials used for this thesis had been accordingly acknowledged.

_____ _____

Dereje Bitew Date

Declaration

I hereby declare that the study which is being presented in this thesis entitled "**Assessment of Quality management practices in construction projects: the case of AACRA**". It is conducted by Dereje Bitew for the partial fulfillment of the requirements for the award of master's degree in Project Management. To the best of my knowledge it is original work carried by her, it had not been presented for a partial fulfillment for any educational qualification at this university or any other and in any projects by any means.

_____ _____

Dr. Konjit H. Date

Advisor

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Abbreviation and Acronyms

AACRA Addis Ababa City Roads Authority

AAWSA Addis Ababa Water & Sanitation Authority

ELPA Ethiopia Electric Power & Light Authority

ETC Ethiopian Telecommunication Agency

FDRE Federal Democratic Republic of Ethiopia

ISO International Organization for Standardization

PDEM Postgraduate Diploma in Enterprise Management

PMBOK Project Management Body of Knowledge

PMC Project Management Consultancy

PMI Project Management Institute

QA Quality Assurance

QM Quality Management

QMP Quality Management Process

QMS Quality Management System

QP Quality Policy

SPSS Statistical Package for Social Science

TQM Total Quality Management

UK United Kingdom

UNCRD United Nations Center for Regional Development

UNIDO United Nations Industrial Development Organization

Abstract

This study was mainly set out with a general purpose to assess the quality management practices and major quality management challenges in road construction projects at AACRA. To achieve its objective, the study employed both descriptive and explanatory research and both primary and secondary data were used. Questionnaires, interview, and document review were, therefore, used as data collection tools. Furthermore, it employed purposive sampling techniques to draw its samples. The survey questionnaire was designed based on the literature and on the information collected through the document review of the project. The survey questionnaire was distributed to 60 project implementation team members who were selected purposively among them 55 respondents were responded, which represented a response rate of 91.67%. The data gathered through the questionnaire was analyzed by Statistical Package for Social Science (SPSS). The generated data was analyzed using tables, frequency, percentage, and multiple regression approaches. The result of the study indicated that AACRA does not employ all stages of quality management process, tools and techniques. Since they use only Inspection are found to be the major quality management tools and techniques used to control quality of project. Qualified and experiences personnel, top management support, communication with stakeholders, quality of materials and equipments used in the project construction and conformance to specification are identified as the top factors in the determinant of the quality of road construction projects. In the study it is examined that various quality assurance measures were taken starting from defining project objectives and to monitoring and the tasks that were carried out mostly in monthly, quarterly monitoring at specified level with management members involvement. It was also identified that some barriers of quality management; inadequate management support, problems with contractors performance, unrealistic deadline, lack of quality management policy, and right of way were the major once. The study also recommended that AACRA 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.

Key words: Quality, Quality management, Quality management process, top management commitment.

CHAPTER ONE

1. 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 (Abdul Razzak 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. These participants are both influenced by and depend on each other in addition to "other players" involved in the construction process. 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 Rumane, 2011). In order to meet customer requirements, and do so on time and within budget, the project manager must incorporate sound quality management practices. He or she will be concerned with the quality of the following: The product/service/process that is the deliverable from the project, and the project management process itself (Robert K. 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 (Tan & Abdul-Rahman, 2005). Quality management is critically required for a construction company to sustain in current construction market which is highly challenging and competitive. Harris and Mc-Caffer (2001) 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 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 Institute (2000). Therefore, this paper tries to assess quality management practices in construction projects: the case of Addis Ababa City Road Authority.

1.2. **Background of the organization**

Addis Ababa city was founded by Minilik II and Empress Tayitu in 1887. The history of the city's road development also begins from the inception of the city. Minilik II constructed the first ever two roads in the city as well as in the country that stretch from Addis Ababa to Addis Alem and from his place to England Embassy in 1902. In 1904 the first roller was imported by the emperor and was being pulled by many people for its operation. Emperor Minilik was also believed to be the first in importing two cars in Addis Ababa and introduced the car technology in the city for the first time in 1907. The country's modern road construction is highly interlinked with Emperor Haile Sellase's ruling period. During the regime of Haile Sellase I a number of contractors were organized to carry out road construction.

The first one to be established by the Government to construct roads was Public Works Department. It was established to construct roads in Addis Ababa and in its surrounding. After a few years this department was raised to a minister level and Addis Ababa also got the chance to establish its road development organizational structure. When it was decided for Addis Ababa to have a mayor and a council in 1942, the city roads construction and maintenance was organized under the municipality. To fulfill the road construction activities together with building works the "Road and Building works" department was established. This department stayed until the replacement of the Haile Sellase regime by the Derge regime performing its duties. But no fundamental organizational change of the department was observed in the Derg regime.

In 1993 the existing Government (FDRE) has established regional governments and gave them power to administer their regions with autonomy. During this time Addis Ababa was also established as one of the regions. The Addis Ababa administration during this period established

the “bureau of works and urban development” and the bureau organized a department under it to carry out the road construction and maintenance works. The newly established road department constructed and maintained the city roads till the establishment of the Addis Ababa City Roads Authority in March 15, 1998 by regulation No. 7/1998 to be administrated by board of directors to construct maintain and administer the road works in Addis Ababa by the city Administration. Since the organization still does not focus on quality management (report from AACRA).

1.3. **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 (PMI, 2008).

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 (Tan & Abdul-Rahman, 2005). Quality management is critically required for a construction company to sustain in current construction market which is highly challenging and competitive. Harris and Mc-Caffer, 2001) 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 (Biggar, 1990). 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, flow-charting and trend analysis (Abdul-Rahman, 2011).

Jha and Jha (2006) 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. Turner (2000) on his 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. Moatazed-Keivani et al. (1999) 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. Kumaraswamy and Dissanayaka (2000) 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. Abdul-Rahman (1996) 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. (2003) concluded that senior managers' involvement, understanding and customer focus are essential antecedents of TQM success. Chin et al. (2003) found that top management commitment is the most critical factor for the successful implementation of ISO 9000.

Birhanu in his study identified that lack of effective supervision, communication, management of commitment, proper equipments 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 he identified to the attainment of project quality (Birhanu, 2014). Furthermore, Temesgen on his 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 sectoral policy and strategy, weak technical skill and poor project design are some of the identified problems (Temesgen, 2007).

According to the researcher assessment and findings from different organizational project documents the main problems of project quality management practice in Addis Ababa city Road construction are: there is no quality management guidelines, policy's, processes, tools and techniques and standards, there is a problem of experts about quality, lack of top management commitment, employee turnover, lack of expert consultant and contractor, communication gap between top management and their subordinates', no one takes accountability and responsibility about individual duties, communication gap between consultant and Addis Ababa sub-city that facilitates infrastructure (ETC, ELPA, AWSA, and others) during a design stage, no detailed design before construction starts, bureaucracy, material shortage due to inflation, and right of way etc. Therefore, based on what has been done in different contexts, Ethiopia and practical problems observed in the construction projects in AACRA that indicated above, this study aims to assess project quality management practices, top management commitment, and quality management implementation problems with special focus on construction of Road projects in Addis Ababa.

1.4. **Research Questions**

The study tried to answer the following specific research questions:

- What is the quality management processes, tools and techniques commonly applied?
- To what extent the management of construction companies is perceived as committed towards quality management implementation?
- What problems are encountered if any, in relation to the implementation of quality management?

1.5. **Objectives of the research**

This study sets the following general and specific objectives

1.5.1 General objective

The general objective of this research is to explore the quality management practice in construction projects at Addis Ababa City Road Authority.

1.5.2 **Specific objectives**

The specific objectives of the research are:

- ❖ To assess the quality management practices in AACRA from the perspective of processes, tools and techniques applied;

- To assess the level of commitment of top management towards the implementation of quality management in AACRA;
- To assess the challenges faced in relation to the implementation of quality management in AACRA.

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, is at its infant stage of development as a profession especially in Ethiopia. This research also aims to add to the existing literature and findings for other similar related projects to improve quality problems through successful implementation and management of projects.

Therefore, this research work will contribute to the development of the disciple and adds to the project management body of knowledge by providing additional experiences of the organization. The study findings also are relevant input to the management of the case company-Addis Ababa City Road Authority in identifying the existing strength and weakness of quality management 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, it may serve as a starting point towards further studies in the area at regional and national levels.

1.7. **Scope of the study**

This study is limited to quality management practices and problems of construction projects limited to Addis Ababa City 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, and challenges to implement Quality management in Addis Ababa City Road Authority. This study is also limited to project owners/clients and consultant while actors in project implementation and management are also contractors, and project team workers, only assessed due to limited personal and financial capacity, and shortage of time.

1.8. **Conceptual Definition of Terms**

Project: is a unique set of co-ordinated activities, with definite starting and finishing points, undertaken by an individual or organization to meet specific objectives within defined schedule, cost and performance parameters.

Management: is the art of getting things done through people (Mary Parker follet).

Project management: is the art and science of converting vision into reality (Turner).

Quality: is a situation when a set of inherent characteristics consistently fulfill the continuously changing requirements of the organization's customers and other stakeholders. Quality management: is to ensure efforts to achieve the required level of quality for the product/services which are well planned and organized.

Road: is Any area the public have access, including streets, highways, riverbeds, beaches, wharves and car parks. Construction: is the process of constructing a building or infrastructure.

1.9. Organization of the Study

The study is organized into five chapters. The first chapter presents introduction of the study. It includes background of the study, background of the organization, and statement of the problem, objectives, significance of the study, scope and limitation of the study, and terms of definitions. Chapter two covers the review of related literature. Research design and methodology is given in chapter three. Chapter four is about Data presentation, analysis and discussions. The last chapter deals with conclusion and recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2. Introduction

This section covers review of literature 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 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.

2.1. Theoretical Literature Review

2.1.1. Project and Project Management

2.1.1.1 Project

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

Likewise, the organization of Governance Commerce defines a project as “a unique set of coordinated activities with definite starting and finishing points undertaken by an individual or team to meet specific objectives within defined time, cost and performance parameters as specified in the business case”. Also a project is “a unique endeavor to produce a set of deliverables within a clearly specified time, cost, and quality constraints”(UNCRD,2000).

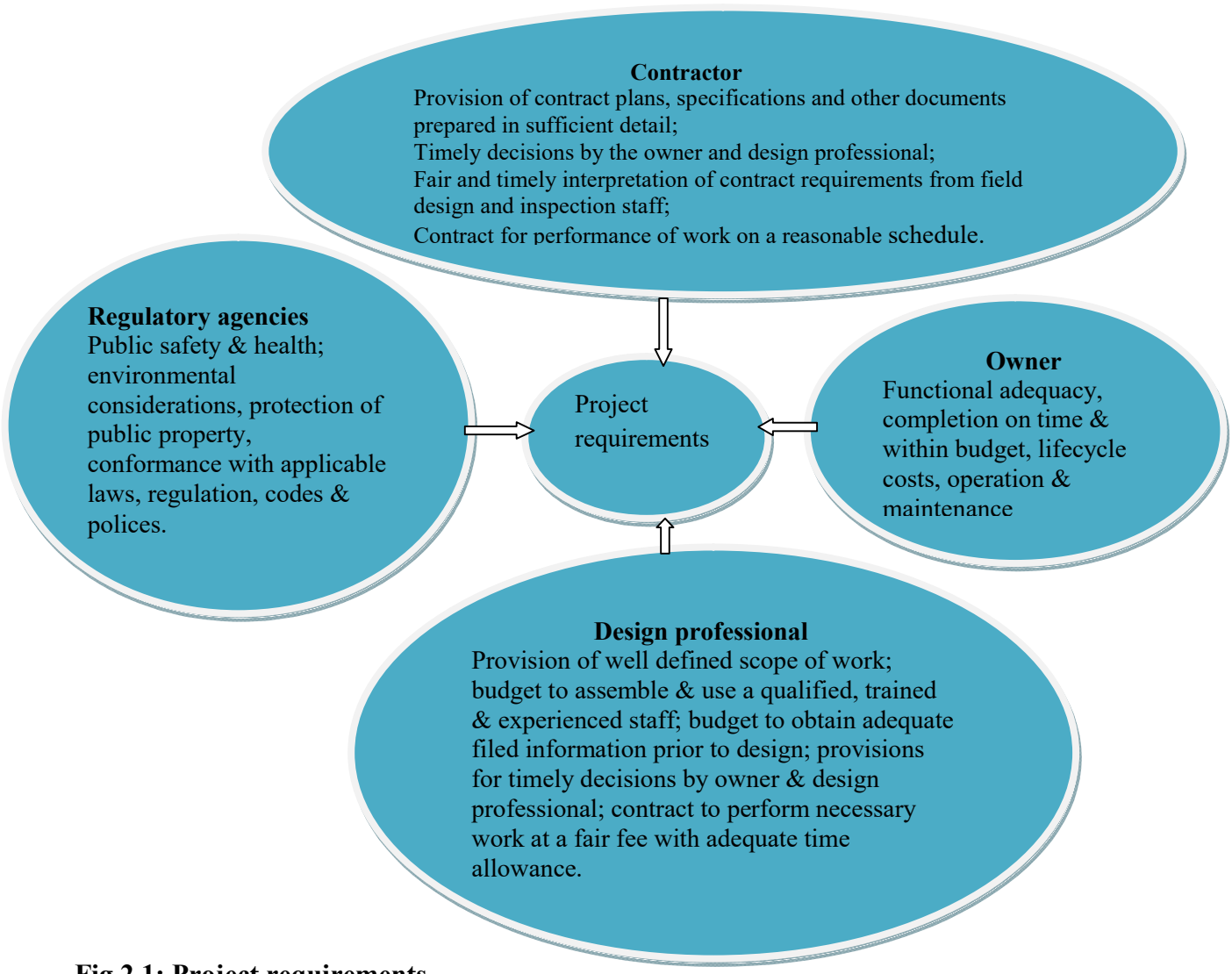

Fig 2.1: Project requirements

Source: Ferguson, H. and Clayton, L. (Eds) (1988). Quality in the Constructed Project:

2.1.1.2. Project Management

Project management refers to the application of knowledge, skills, tools and techniques to project activities to meet a relatively short-term objective that has been established to complete specific goals and objectives (PMI, 2008). It is accomplished through the planning, organizing, directing, and controlling of company resources (Kerzner, 2009). Today, the concept of project management has been increasingly applied in diverse industries and organizations (Kerzner, 2009; Packendorff, 1995).

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 (Soderlund, 2004). A Guide to the Project Management Body of Knowledge (PMBOK Guide), published by PMI, presents a set of standard terminology and guidelines for project management. The PMBOK Guide is process-based, 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.

2.1.2. Overview of Quality

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 (1986), Crosby (1979), Feigernbaum (1991) and Ishikawa (1985). 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.

2.1.2.1 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 (Shen, 2000). Moreover, Crosy who is one of 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 nonconformance (Kerzner, 2003).

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" (Abdulaziz, 1999).

Additionally Wysocki 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 (R. K.Wysocki, 2003). Moreover, he described 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, 2000). The following scope triangle clearly illustrate variables of the project and there interdependence.

Fig 2.2: Triple triangle or Iron triangle

Source: (Robert K.Wysocki, 2014)

According to Dale Bester field (Quality Control, A Practical Approach, 7th edition, 2004), 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.

2.1.2.2. Project Quality Management

according to Crawford 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 (Crawford, 2002). Moreover, Wysocki in his 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. He further 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" (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, 2000).

Furthermore, the PMI's PMBOK 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 cited in Sabah 2011). Similarly Harold Kerzner (2003) descried the changing view of quality in the past and present as follows.

Table 2.1: changing views of quality

Past	Present
Quality is the responsibility of blue-collar workers and direct labor employees working on the floor	Quality is everyone's responsibility, including white-collar workers, the indirect labor force, and the overhead staff
Quality defects should be hidden from the customers (and possibly management)	Defects should be high-lighted and brought to the surface for corrective action
Quality problems lead to blame, fault justification, and excuses	Quality problems lead to cooperative solutions
Corrections-to-quality problems should be accomplished with minimum documentation	Documentation is essential for "lessons learned" so that mistakes are not repeated
Increased quality will increase project costs	Improved quality saves money and increases business

Quality is internally focused	Quality is customer focused
Quality will not occur without close supervision of people	People want to produce quality products
Quality occurs during project execution	Quality occurs at project initiation and must be planned for within the project

Source: Harold Kerzner

From the Harold Kerzner changing view of comparing the past and present 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 goal.

2.1.2.3. Quality Policy

As different scholars state quality policy is considered as a guide for improving quality of products and services. As Dale (2003) 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 (Dale, 2003).The Japanese approach known as 'Hoshin Kanri', or policy deployment, can be adopted when defining a company's quality policy (Tennant & Roberts, 2000, 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, Kerzner (2003) 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" (Kerzner, 2003). He also described good quality policy as: Statement of principles stating what, not how, Promote consistency throughout the organization and across 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 QP 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, non-discrimination, 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)

2.1.2.4. Principles of Quality and Quality Management

Kodak identified five principles of quality these are leadership, customer focus, analytical approach, teamwork and continuous improvement which is the center of his principle (Harold K, 2003). In addition according to Evans and Lindsay Quality Management is based on three fundamental principles (Evans and Lindsay, 2008) cited in 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. Farther more, 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. Eight principles were shown in table 2.6.

2.1.3. Project Quality Management Process Flow

From the PMBOK, Project quality management processes flow provides an overview of the processes which include: Plan Quality Management, Perform Quality Assurance, and Control Quality.

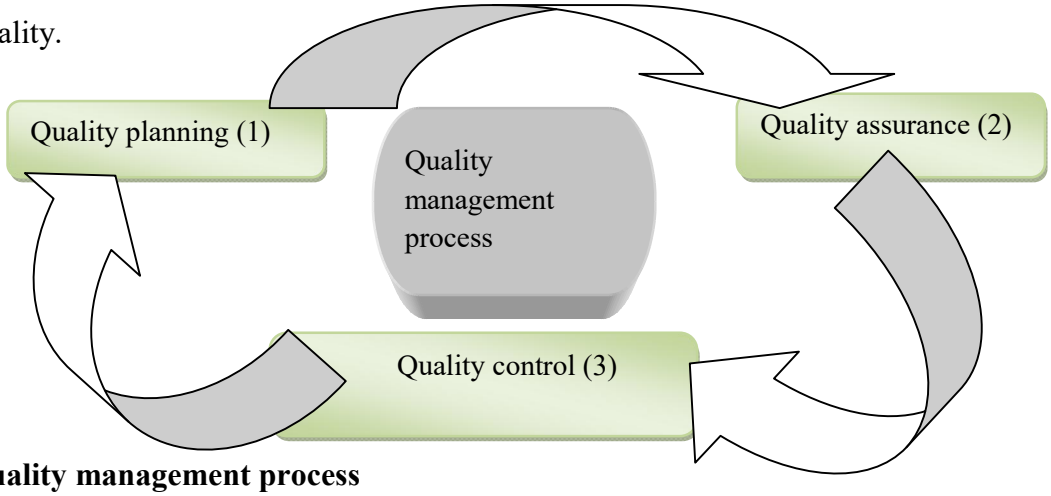

Fig 2.3: Quality management process

Source: quality management for delivering sustainable construction projects in South African rural areas: the construction project manager's perspective.

2.1.3.1. Step 1: Quality Planning

The first step in quality management is to define quality which is under taken by the project manger 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. 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), 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.(Liydia, 2010). Harris and McCaffer, (2001) 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, Construx, (2003) 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

Step	Description
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,

2.1.3.2. Step 2: Quality Assurance

Harris and McCaffer, (2001) 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 (Harris and McCaffer, 2001). 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.

2.1.3.3. Step 3: Quality Control

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 Harold (2003) 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" (Harold, 2003). Similarly Juran 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 (Juran, 1999). 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).

Table 2.4: Quality control steps

Step	Description
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: Juran, 1999

2.1.3.4. Others: Quality Improvements

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.

According to Walter A. Shewhart who was the developer of control charts and the continuous cycle of process improvement which was popularized by Deming who was a disciple of Shewhart, popularized the Shewhart Cycle as the Plan-Do-Check-Act (PDCA) cycle.

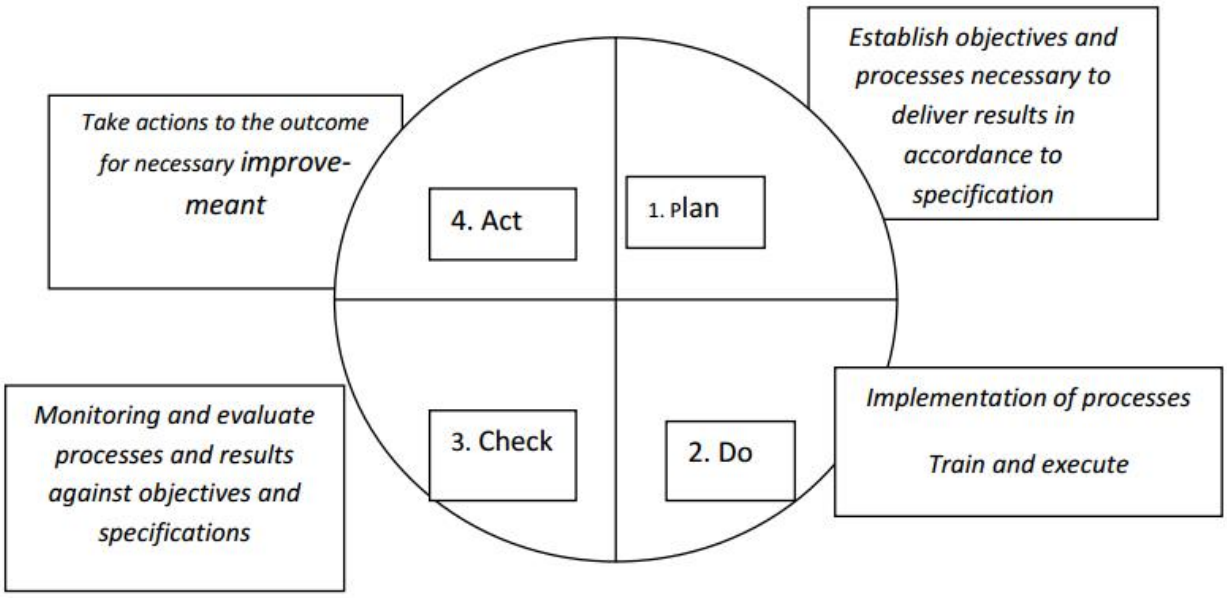

Fig 2.4: The Deming cycle for improvement

Source: *Huemann, M, Improving Quality in Projects and Programs, Chapter 37 in Morris P.W. and Pinto. J.K. (eds), The Wiley Guide to Managing Projects, Wiley & Sons, 2004.*

In general different scholars put various approaches to Quality improvement. The most popular philosophers in quality management put different approach on quality improvements, among these the following are the steps by the famous quality scholars.

Table 2.5: Quality Management Pioneers View on Quality Improvement

Deming's 14 Points to Quality Management	**Juran's 10 Steps Quality Improvement**	**Crosby's 14 Steps Quality Improvement**
1. Create constancy of purpose for improvement of product and service. 2. Adopt the new philosophy. 3. Cease dependence on inspection to achieve quality. 4. End the practice of awarding business on the basis of price tag alone. Instead, minimize total cost by working with a single supplier. 5. Improve constantly and forever every process for planning, production, and service. 6. Institute training on the job. 7. Adopt and institute leadership. 8. Drive out fear. 9. Break down barriers between staff areas. 10. Eliminate slogans,	1. Build awareness of the need and opportunity for improvement. 2. Set goals for improvement. 3. Organize to reach the goals (establish a quality council, identify problems, select projects, appoint teams, and designate facilitators). 4. Provide training. 5. Carry out projects to solve problems. 6. Report progress. 7. Give recognition. 8. Communicate results. 9. Keep score	1. Make it clear that management is committed to quality. 2. Form quality improvement teams with representatives from each department. 3. Determine where current and potential quality problems lie. 4. Evaluate the cost of quality and explain its use as a management tool. 5. Raise the quality awareness and personal concern of all employees. 6. Take actions to correct problems identified through previous steps. 7. Establish a committee for the zero-defects program. 8. Train supervisors to actively carry out their part of the quality improvement program. 9. Hold a "zero-defects day" to let all

exhortations, and targets for the work force. 11. Eliminate numerical quotas for the workforce and numerical goals for management. 12. Remove barriers that rob people of workmanship. Eliminate the annual rating or merit system. 13. Institute a vigorous program of education and self-improvement for everyone. 14. Put everybody in the company to work to accomplish the transformation.	10. Maintain momentum by making annual improvement Part of the regular systems and Processes of the company.	employees realize that there has been a change. 10. Encourage individuals to establish improvement goals for themselves and their groups. 11. Encourage employees to communicate to management the obstacles they face in attaining their improvement goals. 12. Recognize and appreciate those who participate. 13. Establish quality councils to communicate on a regular basis. 14. Do it all over again to emphasize that the quality improvement program never ends.

Source: Harold Kerzner.

2.1.4. Total Quality management in construction project

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 (Biggar, 1990). The adoption of TQM in construction industry has been promoted in some literatures (Low & Teo, 2004;Biggar, 1990; Haupt &Whiteman, 2004). ISO certification is nowadays a trend in most industries including construction industry. The ISO 9001 standard is now on its year 2006 revision. 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. Moatazed-Keivani, Ghanbari-Parsa and Kagaya (1999) 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. Dissanayaka, Kumaraswamy, Karim and Marosszeky (2001) 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. Love, Li, Irani and Faniran (2000) 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 (2003) 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 below. 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).

Table 2.6: Matrix of the Five Clauses and Eight Management Principles of ISO 9001 Standard.

ISO 9001 principles / ISO 9001clauses	Customer focus	Leadership	People involvement	Process approach	System approach	Continual improvement	Factual approach to decision making	Mutually 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				■	■		■	
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: (Luke, 2006).

2.1.5. Quality Management in Construction project

Defining quality of construction is more difficult due to the uniqueness of the project. Chang 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." (Chang, 1999). For Rumane, 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 (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 his 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 (Rumane, 2011).

2.1.5.1. Quality Plan in Construction Project

According to Chung typical quality plan contains most, if not all, of the following: (Chung, 1999).

- ✓ 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 programme and sub-programmes;
- ✓ 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;
- ✓ 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.

2.1.5.2. Quality Assurance in Construction Project

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" (Chang, 1999). He 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(Chang, 1999).

2.1.5.3. Quality Control in Construction Project

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. 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 (Chang, 1999).

2.1.6. Factors Affecting Quality

Lepartobiko (2012) stated that quality can be assured by identifying and eliminating the factors that cause poor project performance. Jha&Jha (2006) 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. Turner (2000) on his 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.

2.1.7. 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 Project Management Institute (2000). Mathews, Ueno, Kekale, Repka, Pereira and Silva (2001) 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. Let me define each individuals based on PMBOK.

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

2.1.8. 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. (2004) 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. Tang and Kam (1999) 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, Landin (2000) argued that in construction process, many of the concepts in ISO 9001 are experienced as being too abstract and too difficult to comprehend. He 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. Moatazed-Keivani et al. (1999) 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. Kumaraswamy and Dissanayaka (2000) 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. Abdul-Rahman (1996) 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. Low (1994) found that most contractors in Singapore consider human-related problems are most critical in implementing quality assurance (QA). Serpell (1999) 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. Lai, Weerakoon and Cheng (2002) 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. Kubal (1996) 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 2.7: Factors affecting on quality of construction projects

Factors	Description
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 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 material use in construction related	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 Fraudulent activities of subcontractors
For labor and equipment related factors	Obsolete or unsuitable construction equipment Improper handling of materials at site 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

2.1.9. Management Commitment in Quality Management Implementation

From the literature of Abdul-Rahman, Hamzah; Taylor et al. (2003) concluded that senior managers' involvement, understanding and customer focus are essential antecedents of TQM success. Samson et al. (1999) described that leadership and human resources management are among strong predictors of performance TQM practices. On construction related research, Low et al. (2004) commented that top management commitment as one of the elements that would reflect TQM performance measures in construction firms. Chin et al. (2003) found that top management commitment is the most critical factor for the successful implementation of ISO 9000. Haupt et al. (2004) argued that high levels of management actions would lead to reduced prevalence of the problems as TQM is deployed on construction sites. Arditi et al. (1997) emphasized that management commitment to quality and to continuous quality improvement is very important in each phase of the building process. Biggar (1990) 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. Different authors have defined it in their own ways although some similarities are observed, and the details are shown below.

Table 2.8: Conceptual Definition for Management Commitment

Author (Year)	Element(s) in conceptual definition for management commitment.
Rodgers et al. (1993)	Goal setting, feedback, participation.
Arditi et al. (1997)	Top priority.
Samson et al. (1999)	Leadership.

Chin et al. (2003)	Common goal setting, management review and continuous improvement, management involvement & leadership, management attitude to change.
Low et al. (2004)	Allocation of budget, planning for change, providing methods for monitoring progress of construction works.
Haupt et al. (2004)	Initiative for successful implementation, support.

In addition to the above, ISO 9001:2000 requires the following in relation to management commitment: Communicating about the importance of meeting customer as well as statutory and regulatory requirements; Establishing the quality policy; Ensuring that quality objectives are established; Conducting management reviews; Ensuring the availability of resources.

2.2. Empirical Review of Literature

The empirical literature provides empirical evidences of quality management practices in construction projects. Additionally, at the end of this section the conceptual framework of this study is presented.

Quality Management has increasingly been adopted by construction companies as an initiative to solve quality problems and to meet the needs of the final customer. Accordingly, this section is concerned with other studies conducted on other area in similar discipline. The first study selected for the empirical review is "Study of Quality Management in Construction Projects" in Malaysia. This research explores preliminarily the practices of quality management, management commitment in quality management, and quality management implementation problems in construction projects in the context of Malaysian construction industry. The other study conducted by Ever line in his study on factors affecting the performance of Construction projects in Kenya, identified four major factors that most important determinants in general construction projects; Experience and qualification of personnel, quality of materials and equipments, conformance to specification and quality assurance training and meetings (Everline, 2014). In addition as Joy stated in his study on factors influencing quality of construction projects, the major factors that affect quality; material, labor, financial issues, conformance to codes and standards, top management support, management factors, selection of contractor, selection of designer design, co - operation of parties, contract documents and lack of communication (Joy, 2014).

Further as stated by Agbenyega(2014) in his study in quality management practices of construction firms in Ghana, in solving the potential barriers are the main measures to be taken, namely: management commitment, communication between managers and employees,

employee involvement, detailed and logical work program, regular inspection, quality audit report, lack of training and education of team members and review and analysis(Agbenyega,2014). Birhanu in his study identified that lack of effective supervision, communication, management of commitment, proper equipments 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 he identified to the attainment of project quality (Birhanu, 2014). Furthermore, Temesgen on his 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 sectoral policy and strategy, weak technical skill and poor project design are some of the identified problems (Temesgen, 2007).The problems identified by different researchers are almost similar even though there is variation due to their practical context of the projects. Accordingly, these variables are also considered in the researcher study to consider in the context of the construction projects.

2.3. Conceptual Framework of the study

The conceptual framework of the study is first assessing the Parameters of Project quality management process tools and techniques, top management commitment from the perspective of Leadership and participation, Allocation of resources, and then followed by examination of major areas of project quality management problems. The following figure shows the details of the conceptual framework:

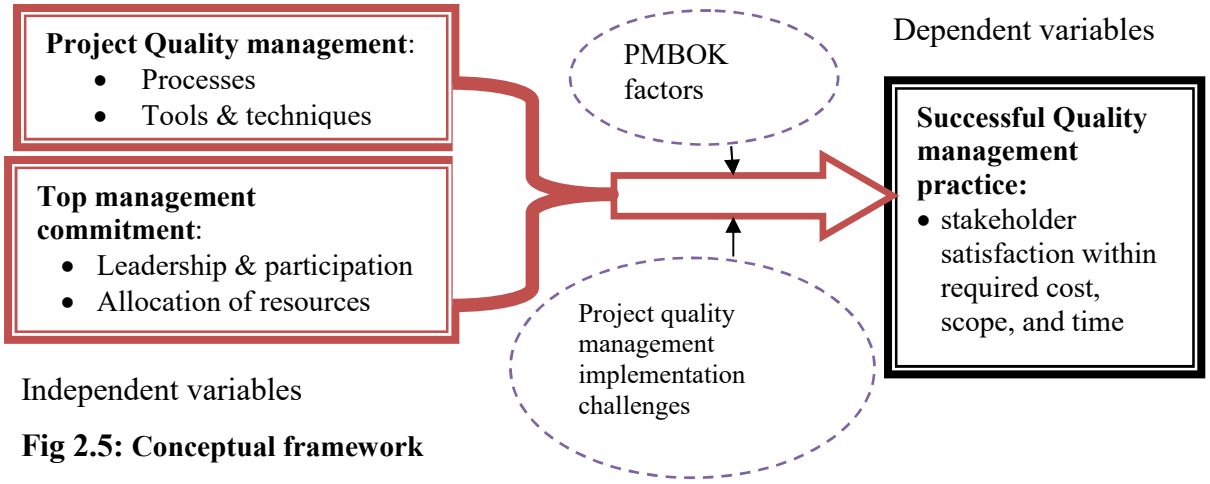

Fig 2.5: Conceptual framework

Source: own developed

CHAPTER THREE

Research Design and Methodology

3. Introduction

This part aims at elaborating the methodological process that is used, it outlines how the research was conducted based on the objective of the study. It explains the research design, sampling techniques and sample size determination, data sources, data collection tools used, validity and reliability test; describe how data collected from the research were analyzed and ethical considerations.

3.1. Research Design

In this study both descriptive and explanatory research method be used that makes use of quantitative data since the method enables to easily be an instrument to analyze, tabulate the frequency and percentage, correlation, and use multiple regressions. The study adopts mixed research approach both qualitative and quantitative. According to Mark (2009), as cited in Aida (2015) mixing qualitative and quantitative approaches gives the potential to cover each method's weaknesses with strengthens from the other method. While explaining the collected data use the visual aids such as tables are used so as to make the reader understand the data.

3.2. Sampling Techniques

To select the respondents for the questionnaire, and interview a purposive sampling technique was employed. This sampling method is chosen for it allowed the researcher to focus on a limited number of informants that were selected from different project experts to get the required information to carry out the study in order to get optimal insight. In this study projects are taken as unit of analysis. The respondents were selected based on their experience, information and area of work they have about project quality management implementation and management challenges in their respective organization at Addis Ababa City Road Authority.

3.3. Target Population and Sample Size

For the successful project quality management almost all member of the organization are responsible since they are involved directly or indirectly in the process. But due to limited time the sample is limited to three ongoing Road construction projects in Addis Ababa (CMC Overpass Bridge construction, Lideta Tsebel Mazoria road construction, and Keranio medhanialem Ambo road construction). Cost and time of the project was mentioned in appendix

II. Thus, due to the above mentioned the optimum size of 60 samples of respondents was taken from large population in the organization inorder to managing the study. Therefore, the focus of the primary data for sampling focus on the ongoing projects since the project management team is still on assignment to provide information.

The target populations from various participants of the Road construction projects were mainly from the client or owner side of the project; such as owner project manager, project management consultancy (PMC), project contractors, and various project teams of the construction project from AACRA. The questioners were distributed, and interview was conducted with concerned participants of project which was started from general director up to four deputy directors from the client side, and contractors and consultants.

3.4. Sources of Data

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 AACRA selected for the study.

Apart from primary data, secondary data were also exploited to conduct the study. Documents review and analysis of secondary data from various sources were used as useful source of information for the study. Relevant books, text books, journals, organization's past and current written documents on the relevant issues were used. Moreover, available organizational documents such as structure, accessible project documents including agreement project profile, plans and reports were also reviewed.

3.5. 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 (Sunders, 2009). Therefore, semi-structured interview and questionnaires were administrated as survey instruments to the project manger 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-structure questionnaire composed of close-ended and open-ended questions.

3.6. Procedures of Data Collection

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 process, tools and techniques, management commitment, and challenges to implement project quality management. Questionnaires have been prepared considering quality aspects and problems of Road construction projects in Addis Ababa 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 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 steps that respondents want to fill 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 project.

3.7. Methods of Data Analysis

After collecting all required data using the above mentioned 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 SPSS (Version 20). 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 tables and figures.

3.8. Validity and Reliability of Instruments

3.8.1. Validity

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

3.8.2. Reliability

Reliability analysis was carried out three 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. So cronbach's alpha for quality planning was 0.874, for quality assurance was 0.757, for quality control was 0.762, for top management commitment was 0.763, for quality management tools and techniques was 0.794, and for quality management implementation challenges was 0.781 by using SPSS.

3.9. Ethical Issues

Interaction with participants would be done after prior appointment and written letter from the University to AACRA. Questions 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 voluntary participate 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

DATA PRESENTATION, ANALYSIS AND DISCUSION

4.1. Introduction

This chapter presents the result of the analysis and discusses that the data collected to answer the research questions and the derived objectives that the study was set to achieve. The result of the survey was discussed by triangulating the different source results: questionnaire results, interview and document review results.

For the purpose of clarifying the methods that the researcher analysis and discussions: Quantitative data was analyzed by employing descriptive and explanatory statistics using statistical package for social science (SPSS) version 20. 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 study further adopted correlation, and multiple regression models were fitted to establish the strength and direction of the relationship between the independent variables (Project quality management processes, tools and techniques, top management commitment along with leadership and participation , and allocation of resources, and other factors) and the dependent variable (successful project quality management practices). The dependent variable was regressed against three independent variables. A multiple regression model that was then fitted to determine the combined effect that the independent variables had on the dependent variable when acting jointly was expressed as follows: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$, Where;

Y= successful project quality management practices; β_0= constant (coefficient of intercept), X_1= Project quality planning; X_2=Quality assurance; X_3= Quality control; X_4= Quality management tools and techniques; X_5= top management commitment; ε = error term; $\beta 1 \ldots \beta 5$= Regression coefficient of five independent variables.

A total of 60 questionnaires were distributed to various respondents of interest for the study. Out of the covered population, 55 were responsive representing a response rate of 91.67%. This was in line with Orodho (2009) 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**.**

4.2. ANALYSIS OF RESULTS AND DISCUSSION

The study explored project quality management practices and the factors that influence it at AACRA. The factors influencing project quality management were studied in three aspects; Project quality management processes, tools and techniques; top management commitment along with leadership and participation, and allocation of resources; and other factors.

4.2.1. General Information of Respondents

4.2.1.1. Gender composition

The demographic statistics shown in the figure below show the distribution of respondents by gender. Participants were asked to indicate their gender by selecting the appropriate option provided (male or female). Accordingly only 19 (34.5%) of the respondents were female while the remaining 65.5% were male. This clearly indicates that the sample population was dominated by male respondents.

Table 4.1. Sex of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	36	65.5	65.5	65.5
	Female	19	34.5	34.5	100.0
	Total	55	100.0	100.0	

Source: own survey, 2019

4.2.1.2. Educational Background

From the analysis on educational background of the respondents, it was found that only 49 respondents (89.1%) have Bacheler Degree, 6 respondents (10.9%) have master's degree and above. This profile shows that majority of the respondents have Bachelor degree or first degree level.

Table 4.2: Educational Background of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bacheler Degree	49	89.1	89.1	89.1
	Masters Degree and above	6	10.9	10.9	100.0
	Total	55	100.0	100.0	

Source: own survey, 2019

4.2.1.3. Work Division

From table 4.3, the work division of respondents has only Engineers. Most of the employees are Engineers. This indicates that other professions like project management have no included.

Table 4.3: work division respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Engineer	55	100.0	100.0	100.0

Source: own survey, 2019

4.2.1.4. Work Experience

The study chose to consider respondent's level of experience in the project area, which is vital towards knowledge of project management. 47.3% of the respondents have less than 5 years work experiences, 30.9% have between 6-10 years, and only 21.8% of them have 11years and above of experiences. This profile shows that more experienced employee does not have in the organization.

Table 4.4: Work Experience of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 5 years	26	47.3	47.3	47.3
	(6-10) years	17	30.9	30.9	78.2
	11 years and above	12	21.8	21.8	100.0
	Total	55	100.0	100.0	

Source: own survey, 2019

4.2.2. Quality planning processes

The result shows that, 5.5% and 32.7% of the respondents strongly disagreed and disagreed respectively, 25.5% of the respondents were neutral, and 29.1% and 3.6% of the respondents responded as agree and strongly agree respectively on brief description of the project. 1.8% and 40% of the respondents strongly disagreed and disagreed respectively, 32.7% of the respondents were neutral, and 20% and 5.5% of the respondents responded as agree and strongly agree respectively on list of contract documents and drawings. 3.6% and 38.2% of the respondents strongly disagreed and disagreed respectively, 29.1% of the respondents were neutral, and 25.5% and 3.6% of the respondents responded as agree and strongly agree respectively on project

quality objectives. 5.5% and 34.5% of the respondents strongly disagreed and disagreed respectively, 34.5% of the respondents were neutral, and 23.6% and 1.8% of the respondents responded as agree and strongly agree respectively on Site organization chart, with named personnel if known. 7.3% and 38.2% of the respondents strongly disagreed and disagreed respectively, 34.5% of the respondents were neutral, and 18.2% and 1.8% of the respondents responded as agree and strongly agree respectively on Responsibilities and authorities of project staff. 0% and 32.7% of the respondents strongly disagreed and disagreed respectively, 36.4% of the respondents were neutral, and 30.9% and 0% of the respondents responded as agree and strongly agree respectively on site layout plan. 7.3% and 41.8% of the respondents strongly disagreed and disagreed respectively, 30.9% of the respondents were neutral, and 16.4% and 3.6% of the respondents responded as agree and strongly agree respectively on construction programme and sub-programmes. 3.6% and 38.2% of the respondents strongly disagreed and disagreed respectively, 41.8% of the respondents were neutral, and 14.5% and 1.8% of the respondents responded as agree and strongly agree respectively on schedules of subcontractor nomination, material and equipment.

1.8% and 38.2% of the respondents strongly disagreed and disagreed respectively, 32.7% of the respondents were neutral, and 27.3 and 0% of the respondents responded as agree and strongly agree respectively on procurement, based on the construction programme. 3.6% and 27.3% of the respondents strongly disagreed and disagreed respectively, 34.5% of the respondents were neutral, and 29.1% and 5.5% of the respondents responded as agree and strongly agree respectively on list(s) of materials and appliances used for the project, showing the verification requirement of each. 3.6% and 38.2% of the respondents strongly disagreed and disagreed respectively, 36.4% of the respondents were neutral, and 20% and 1.8% of the respondents responded as agree and strongly agree respectively on Inspection and test plans, or list thereof. 5.5% and 36.4% of the respondents strongly disagreed and disagreed respectively, 29.1% of the respondents were neutral, and 25.5% and 3.6% of the respondents responded as agree and strongly agree respectively on list of quality procedures and work instructions applicable to project by making reference to the company's Quality Manual and Procedures. 5.5% and 40% of the respondents strongly disagreed and disagreed respectively, 30.9% of the respondents were neutral, and 23.6% and 0% of the respondents responded as agree and strongly agree respectively on list of project-specific procedures, work instructions and inspection. 5.5% and 34.5% of the

respondents strongly disagreed and disagreed respectively, 34.5% of the respondents were neutral, and 23.6% and 1.8% of the respondents responded as agree and strongly agree respectively on checklists, or target dates for their provision. 7.3% and 41.8% of the respondents strongly disagreed and disagreed respectively, 29.1% of the respondents were neutral, and 20% and 1.8% of the respondents responded as agree and strongly agree respectively on list of quality records to be kept, including appropriate quality records from subcontractors. 3.6% and 41.8% of the respondents strongly disagreed and disagreed respectively, 34.5% of the respondents were neutral, and 20% and 0% of the respondents responded as agree and strongly agree respectively on frequency (or provisional dates if possible) of internal quality audits.

1.8% and 40% of the respondents strongly disagreed and disagreed respectively, 32.7% of the respondents were neutral, and 23.6% and 1.8% of the respondents responded as agree and strongly agree respectively on Frequency of updating the quality plan. Most of the result shows that the respondents had disagree with project quality planning processes. According to Harris and McCaffer, (2001) 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. And also from project management body of knowledge quality planning means how to fulfill process and product (deliverable) quality requirements. Quality planning contains the standard variables for construction project as recommended by Chung, (1999). So the result does not contain all planning process. Since, the importance of quality management planning process was indicated that 43.6% of respondents had high that followed moderate.

Table 4.5: Frequencies and percentages of the ratings of Quality planning contains

	Strongly dis-agree	Dis-agree	Neutral	Agree	Strongly agree
Brief description of the project	3(5.5%)	18(32.7%)	14(25.5%)	16(29.1%)	2 (3.6%)
List of contract documents and drawings	1(1.8%)	22(40%)	18(32.7%)	11(20%)	3(5.5%)
Project quality objectives	2(3.6%)	21(38.2%)	16(29.1%)	14(25.5%)	2(3.6%)
Site organization chart, with named personnel if known	3(5.5%)	19(34.5%)	19(34.5%)	13(23.6%)	1(1.8%)
Responsibilities and authorities of project staff	4(7.3%)	21(38.2%)	19(34.5%)	10(18.2%)	1(1.8%)
Site layout plan	0(0%)	18(32.7%)	20(36.4%)	17(30.9%)	0(0%)
construction programme and sub-programmes	4(7.3%)	23(41.8%)	17(30.9%)	9(16.4%)	2(3.6%)
schedules of subcontractor nomination, material and equipment	2(3.6%)	21(38.2%)	23(41.8%)	8(14.5%)	1(1.8%)
procurement, based on the construction programme	1(1.8%)	21(38.2%)	18(32.7%)	15(27.3%)	0(0%)
list(s) of materials and appliances used for the project, showing the verification requirement of each	2(3.6%)	15(27.3%)	19(34.5%)	16(29.1%)	3(5.5%)
Inspection and test plans, or list thereof	2(3.6%)	21(38.2%)	20(36.4%)	11(20%)	1(1.8%)
list of quality procedures and work instructions applicable to project by making reference to the company's Quality Manual and Procedures	3(5.5%)	20(36.4%)	16(29.1%)	14(25.5%)	2(3.6%)
list of project-specific procedures, work instructions and inspection	3(5.5%)	22(40%)	17(30.9%)	13(23.6%)	0(0%)
checklists, or target dates for their provision	3(5.5%)	19(34.5%)	19(34.5%)	13(23.6%)	1(1.8%)
list of quality records to be kept, including appropriate quality records from subcontractors	4(7.3%)	23(41.8%)	16(29.1%)	11(20%)	1(1.8%)
frequency (or provisional dates if possible) of internal quality audits	2(3.6%)	23(41.8%)	19(34.5%)	11(20%)	0(0%)
Frequency of updating the quality plan	1(1.8%)	22(40%)	18(32.7%)	13(23.6%)	1(1.8%)

Source: own survey, 2019

4.2.3. Quality Assurance

From table 4.6, 5.5% and 45.5% of the respondents strongly disagreed and disagreed respectively, 30.9% of the respondents were neutral, and 14.5% and 3.6% of the respondents responded as agree and strongly agree respectively on Selects the appropriate quality management system requirements for each contract. 3.6% and 38.2% of the respondents strongly disagreed and disagreed respectively, 36.4% of the respondents were neutral, and 16.4% and 5.5% of the respondents responded as agree and strongly agree respectively on Clearly specifies the quality management system requirements in tender and contract documents. 3.6% and 43.6% of the respondents strongly disagreed and disagreed respectively, 32.7% of the respondents were neutral, and 20% and 0% of the respondents responded as agree and strongly agree respectively on Evaluates and selects subcontractors on their ability to satisfy specified requirements. 3.6% and 40% of the respondents strongly disagreed and disagreed respectively, 41.8% of the respondents were neutral, and 12.7% and 1.8% of the respondents responded as agree and strongly agree respectively on appropriate checking, measurement or testing of products and keeping proper records. This result shows most of the respondents had disagree on quality assurance. According to Harris and McCaffer, (2001) defined 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.

Table 4.6: Frequencies and percentages of the ratings of Quality Assurance processes

	Strongly dis-agree	**Dis-agree**	**Neutral**	**Agree**	**Strongly agree**
Selects the appropriate quality management system requirements for each contract.	3(5.5%)	25(45.5%)	17(30.9%)	8(14.5%)	2(3.6)
Clearly specifies the quality management system requirements in tender and contract documents.	2(3.6%)	21(38.2%)	20(36.4%)	9(16.4%)	3(5.5%)
Evaluates and selects subcontractors on their ability to satisfy specified requirements.	2(3.6%)	24(43.6%)	18(32.7%)	11(20%)	0(0%)
Appropriate checking, measurement or testing of products and keeping proper records.	2(3.6%)	23(41.8%)	22(40%)	7(12.7%)	1(1.8%)

Source: own survey, 2019

4.2.4. Quality control

From table 4.7, 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. According to Chang, 1999 defined, a good quality control system should have to consider Quality control processes. Since, the organization does not consider project quality control processes.

Table 4.7: Frequencies and percentages of the ratings of Quality control

	Strongly dis-agree	**Dis-agree**	**Neutral**	**Agree**	**Strongly agree**
Select what to control and set standards that provide the basis for decisions regarding possible corrective action.	3(5.5%)	24(43.6%)	18(32.7%)	10(18.2%)	0(0%)
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%)
Act to bring nonconforming processes and material back to the standard based on the information collected.	3(5.5%)	21(38.2%)	18(32.7%)	11(20%)	2(3.6%)
Monitor and standardize measuring devices, include detailed documentation for all processes.	1(1.8%)	24(43.6%)	22(40%)	5(9.1%)	3(5.5%)

Source: own survey, 2019

4.2.5. Top management commitment

From table 4.8, 9.1% and 36.4% of the respondents strongly disagreed and disagreed respectively, 32.7% of the respondents were neutral, and 20% and 1.8% of the respondents responded as agree and strongly agree respectively on Communicate the importance of meeting customer requirements. 10.9% and 45.5% of the respondents strongly disagreed and disagreed respectively, 27.3% of the respondents were neutral, and 16.4% and 0% of the respondents responded as agree and strongly agree respectively on setting quality policies. 7.3% and 45.5% of the respondents strongly disagreed and disagreed respectively, 40% of the respondents were neutral, and 7.3% and 0% of the respondents responded as agree and strongly agree respectively on Conduct management reviews on project quality. 3.6% and 45.5% of the respondents strongly disagreed and disagreed respectively, 40% of the respondents were neutral, and 9.1% and 1.8% of the respondents responded as agree and strongly agree respectively on Seek to have more financial resources. 7.3% and 43.6% of the respondents strongly disagreed and disagreed respectively, 38.2% of the respondents were neutral, and 10.9% and 0% of the respondents responded as agree and strongly agree respectively on Seek to have more human resources. This result shows most of the respondents had disagree on top management commitment. From the result of interview questions the top management had not regularly communicate with project concerned stakeholders and also top management had not conduct quality management reviews. According to Samson et al. (1999) described that leadership and human resources management are among strong predictors of performance TQM practices. This indicated that top management does not as much work on leadership as well as allocation of resources.

Table 4.8: Frequencies and percentages of the ratings of Top management commitment

	Strongly dis-agree	**Dis-agree**	**Neutral**	**Agree**	**Strongly agree**
Communicate the importance of meeting customer requirements	5(9.1%)	20(36.4%)	18(32.7%)	11(20%)	1(1.8%)
Setting quality policies.	6(10.9%)	25(45.5%)	15(27.3%)	9(16.4%)	0(0%)
Conduct management reviews on project quality.	4(7.3%)	25(45.5%)	22(40%)	4(7.3%)	0(0%)
Seek to have more financial resources.	2(3.6%)	25(45.5%)	22(40%)	5(9.1%)	1(1.8%)
Seek to have more human resources.	4(7.3%)	24(43.6%)	21(38.2%)	6(10.9%)	0(0%)

Source: own survey, 2019

4.2.6. Quality management tools and techniques

From table 4.9, 5.5% and 38.2% of the respondents strongly disagreed and disagreed respectively, 38.2% of the respondents were neutral, and 18.2% and 0% of the respondents responded as agree and strongly agree respectively on Benefit/ cost analysis. 3.6%and 38.2% of the respondents strongly disagreed and disagreed respectively, 36.4% of the respondents were neutral, and 20% and 1.8% of the respondents responded as agree and strongly agree respectively on Benchmarking. 1.8% and 43.6% of the respondents strongly disagreed and disagreed respectively, 30.9% of the respondents were neutral, and 21.8% and 1.8% of the respondents responded as agree and strongly agree respectively on Flowcharting. 3.6% and 45.5% of the respondents strongly disagreed and disagreed respectively, 41.8% of the respondents were neutral, and 9.1% and 0% of the respondents responded as agree and strongly agree respectively Design of experiments. 12.7% and 36.4% of the respondents strongly disagreed and disagreed respectively, 34.5% of the respondents were neutral, and 16.4% and 0% of the respondents responded as agree and strongly agree respectively on cost of quality. 3.6% and 40% of the respondents strongly disagreed and disagreed respectively, 38.2% of the respondents were neutral, and 18.2% and 0% of the respondents responded as agree and strongly agree respectively on quality audits.

5.5% and 41.8% of the respondents strongly disagreed and disagreed respectively, 30.9% of the respondents were neutral, and 20% and 1.8% of the respondents responded as agree and strongly agree respectively on inspection. 3.6% and 41.8% of the respondents strongly disagreed and disagreed respectively, 47.3% of the respondents were neutral, and 7.3% and 0% of the respondents responded as agree and strongly agree respectively on control charts. 5.5% and 47.3% of the respondents strongly disagreed and disagreed respectively, 41.8% of the respondents were neutral, and 5.5% and 0% of the respondents responded as agree and strongly agree respectively on Pareto diagrams. 3.6% and 49.1% of the respondents strongly disagreed and disagreed respectively, 34.5% of the respondents were neutral, and 10.9% and 1.8% of the respondents responded as agree and strongly agree respectively on statistical sampling. 5.5% and 34.5% of the respondents strongly disagreed and disagreed respectively, 32.7% of the respondents were neutral, and 10.9% and 16.4% of the respondents responded as agree and strongly agree respectively on trend analysis. This result shows most of the respondents had disagree on quality management tools and techniques. From the result of interview questions

respondents had the tools and techniques used monthly reporting system by project contractors as well as consultants, and sometimes the organization had used inspection by the response of quality assurance department. According to PMBOK defined, project quality management tools and techniques was the very critical one for successful project implementation. Since, AACRA does not used proper tools and techniques.

Table 4.9: Frequencies and percentages of the ratings of Quality management tools & techniques

	Strongly dis-agree	Dis-agree	Neutral	Agree	Strongly agree
Benefit/ cost analysis	3(5.5%)	21(38.2%)	21(38.2%)	10(18.2%)	0(0%)
Benchmarking	2(3.6%)	21(38.2%)	20(36.4%)	11(20%)	1(1.8%)
Flowcharting	1(1.8%)	24(43.6%)	17(30.9%)	12(21.8%)	1(1.8%)
Design of experiments	2(3.6%)	25(45.5%)	23(41.8%)	5(9.1%)	0(0%)
cost of quality	7(12.7%)	20(36.4%)	19(34.5%)	9(16.4%)	0(0%)
quality audits	2(3.6%)	22(40%)	21(38.2%)	10(18.2%)	0(0%)
Inspection	3(5.5%)	23(41.8%)	17(30.9%)	11(20%)	1(1.8%)
control charts	2(3.6%)	23(41.8%)	26(47.3%)	4(7.3%)	0(0%)
Pareto diagrams	3(5.5%)	26(47.3%)	23(41.8%)	3(5.5%)	0(0%)
statistical sampling	2(3.6%)	27(49.1%)	19(34.5%)	6(10.9%)	1(1.8%)
trend analysis	3(5.5%)	19(34.5%)	18(32.7%)	6(10.9%)	9(16.4%)

Source: own survey, 2019

4.2.7. Quality management implementation challenges

From table 4.10, 3.6% and 7.3% of the respondents strongly disagreed and disagreed respectively, 29.1% of the respondents were neutral, and 36.4% and 23.6% of the respondents responded as agree and strongly agree respectively on inadequate management support. 1.8% and 14.5% of the respondents strongly disagreed and disagreed respectively, 21.8% of the respondents were neutral, and 49.1% and 12.7% of the respondents responded as agree and strongly agree respectively on unwillingness of project staff to accept the quality system. 9.1% and 7.3% of the respondents strongly disagreed and disagreed respectively, 16.4% of the respondents were neutral, and 47.3% and 20% of the respondents responded as agree and strongly agree respectively on difficulties in understanding the quality system. 1.8% and 9.1% of

the respondents strongly disagreed and disagreed respectively, 21.8% of the respondents were neutral, and 43.6% and 23.6% of the respondents responded as agree and strongly agree respectively on problem with more paper works. 5.5% and 9.1% of the respondents strongly disagreed and disagreed respectively, 16.4% of the respondents were neutral, and 47.3% and 21.8% of the respondents responded as agree and strongly agree respectively on problem with documentation. 3.6% and 12.7% of the respondents strongly disagreed and disagreed respectively, 25.5% of the respondents were neutral, and 38.2% and 20% of the respondents responded as agree and strongly agree respectively on difficulties in measuring results. 10.9% and 12.7% of the respondents strongly disagreed and disagreed respectively, 20% of the respondents were neutral, and 34.5% and 21.8% of the respondents responded as agree and strongly agree respectively on problems with contractor's performance. 5.5% and 7.3% of the respondents strongly disagreed and disagreed respectively, 12.7% of the respondents were neutral, and 45.5% and 29.1% of the respondents responded as agree and strongly agree respectively on problems with consultant's performance.

1.8% and 5.5% of the respondents strongly disagreed and disagreed respectively, 21.8% of the respondents were neutral, and 50.9% and 20% of the respondents responded as agree and strongly agree respectively on ineffective communication. 0% and 3.6% of the respondents strongly disagreed and disagreed respectively, 23.6% of the respondents were neutral, and 49.1% and 23.6% of the respondents responded as agree and strongly agree respectively on increase of cost. 3.6% and 7.3% of the respondents strongly disagreed and disagreed respectively, 21.8% of the respondents were neutral, and 49.1% and 18.2% of the respondents responded as agree and strongly agree respectively on increase of time. 0% and 5.5% of the respondents strongly disagreed and disagreed respectively, 25.5% of the respondents were neutral, and 49.1% and 20% of the respondents responded as agree and strongly agree respectively on inadequate information. 0% and 5.5% of the respondents strongly disagreed and disagreed respectively, 34.5% of the respondents were neutral, and 49.1% and 10.9% of the respondents responded as agree and strongly agree respectively on inadequate technical expertise/skills. 3.6% and 9.1% of the respondents strongly disagreed and disagreed respectively, 34.5% of the respondents were neutral, and 40% and 12.7% of the respondents responded as agree and strongly agree respectively on problem with government bureaucracy. 1.8% and 3.6% of the respondents strongly disagreed and disagreed respectively, 29.1% of the respondents were neutral, and 43.6%

and 21.8% of the respondents responded as agree and strongly agree respectively on problem with raw materials shortage due to inflation. 0% and 1.8% of the respondents strongly disagreed and disagreed respectively, 18.2% of the respondents were neutral, and 43.6% and 36.4% of the respondents responded as agree and strongly agree respectively on problem with right of way. 1.8% and 7.3% of the respondents strongly disagreed and disagreed respectively, 25.5% of the respondents were neutral, and 38.2% and 27.3% of the respondents responded as agree and strongly agree respectively on problem with scope change. 0% and 10.9% of the respondents strongly disagreed and disagreed respectively, 23.6% of the respondents were neutral, and 40% and 25.5% of the respondents responded as agree and strongly agree respectively on lack of standardized quality management guidelines. 0% and 16.4% of the respondents strongly disagreed and disagreed respectively, 29.1% of the respondents were neutral, and 41.8% and 12.7% of the respondents responded as agree and strongly agree respectively on employee turnover. This result shows most of the respondents had agree on quality management implementation challenges. From the result of interview questions some of the respondent's responded as the main problem in the organization was a right of way. For this problem the main solution was integrated work with Addis Ababa City Administration (like ELPA.TELE, water and sanitation…) and integrated with master plan. Most of the Authors from the literature were similar with those implementation challenges. According to Turner (2000) on his 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. For successful project quality implementation and management institutional as well as national quality management system guidelines should be needed, and accountability and responsibility of each individual for project and other related works should also be developed.

Table 4.10: Frequencies and percentages of the ratings of quality management implementation challenges

	Strongly dis-agree	Dis-agree	Neutral	Agree	Strongly agree
Inadequate management support	2(3.6%)	4(7.3%)	16(29.1%)	20(36.4%)	13(23.6%)
Unwillingness of project staff to accept the quality system	1(1.8%)	8(14.5%)	12(21.8%)	27(49.1%)	7(12.7%)

Difficulties in understanding the quality system	5(9.1%)	4(7.3%)	9(16.4%)	26(47.3%)	11(20%)
Problem with more paper works	1(1.8%)	5(9.1%)	12(21.8%)	24(43.6%)	13(23.6%)
Problem with documentation	3(5.5%)	5(9.1%)	9(16.4%)	26(47.3%)	12(21.8%)
Difficulties in measuring results	2(3.6%)	7(12.7%)	14(25.5%)	21(38.2%)	11(20%)
Problems with contractors' performance	6(10.9%)	7(12.7%)	11(20%)	19(34.5%)	12(21.8%)
Problems with consultants performance	3(5.5%)	4(7.3%)	7(12.7%)	25(45.5%)	16(29.1%)
Ineffective communication	1(1.8%)	3(5.5%)	12(21.8%)	28(50.9%)	11(20%)
Increase of cost	0(0%)	2(3.6%)	13(23.6%)	27(49.1%)	13(23.6%)
Increase of time	2(3.6%)	4(7.3%)	12(21.8%)	27(49.1%)	10(18.2%)
Inadequate information	0(0%)	3(5.5%)	14(25.5%)	27(49.1%)	11(20%)
Inadequate technical expertise/skills	0(0%)	3(5.5%)	19(34.5%)	27(49.1%)	6(10.9%)
Problem with Government bureaucracy	2(3.6%)	5(9.1%)	19(34.5%)	22(40%)	7(12.7%)
Problem with raw materials shortage due to inflation	1(1.8%)	2(3.6%)	16(29.1%)	24(43.6%)	12(21.8%)
Problem with Right of way	0(0%)	1(1.8%)	10(18.2%)	24(43.6%)	20(36.4%)
Problem with scope change	1(1.8%)	4(7.3%)	14(25.5%)	21(38.2%)	15(27.3%)
Lack of standardized quality management guidelines	0(0%)	6(10.9%)	13(23.6%)	22(40%)	14(25.5%)
Employee turnover	0(0%)	9(16.4%)	16(29.1%)	23(41.8%)	7(12.7%)

Source: own survey, 2019

4.2.8. Pearson correlation

Table 11 below presents the Pearson correlations for the relationships between the various drivers and successful quality management in road construction industry. The analysis of correlation results in Table 11 illustrates that between project quality planning and successful quality management in road construction industry there is a positive correlation coefficient which was 0.604, with p-value of 0.000. It indicates that the result is significant at 5% and that if the project quality planning increases it will have a positive impact on successful project quality management in road construction industry. The correlation results between Quality Assurance and successful project quality management in road construction industry also indicates the same type of result where the correlation coefficient is 0.521 and a p-value of 0.000 which significant at 5%. The results also show that there is a positive association between

Quality control and successful project quality management in road construction industry where the correlation coefficient is 0.46, with a p-value of 0.000. Further, the result shows that there is a positive association between top management commitment and successful project quality management in road construction industry where the correlation coefficient is 0.631, with a p-value of 0.000. Furthermore, the result shows that there is a positive association between quality management tools and techniques and successful project quality management in road construction industry where the correlation coefficient is 0.660, with a p-value of 0.000. This therefore infers that project quality management tools and techniques can contribute most to successful project quality management in road construction industry following by top management commitment, then quality planning, and then quality assurance, while quality control had the least influence on performance in roads in the study area.

Table 4.11: Pearson Correlation Matrix

		Successful Quality management	quality planning	quality assurance	quality control	top management commitment	quality management tools and tech
Successful Quality management	Pearson Correlation	1	.604**	.521**	.460**	.631**	.660**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	55	55	55	55	55	55
quality planning	Pearson Correlation	.604**	1	.363**	.084	.521**	.320*
	Sig. (2-tailed)	.000		.007	.543	.000	.017
	N	55	55	55	55	55	55
quality assurance	Pearson Correlation	.521**	.363**	1	.197	.302*	.374**
	Sig. (2-tailed)	.000	.007		.149	.025	.005
	N	55	55	55	55	55	55
quality control	Pearson Correlation	.460**	.084	.197	1	.179	.411**
	Sig. (2-tailed)	.000	.543	.149		.191	.002
	N	55	55	55	55	55	55
top management commitment	Pearson Correlation	.631**	.521**	.302*	.179	1	.445**
	Sig. (2-tailed)	.000	.000	.025	.191		.001
	N	55	55	55	55	55	55
quality management tools and tech	Pearson Correlation	.660**	.320*	.374**	.411**	.445**	1
	Sig. (2-tailed)	.000	.017	.005	.002	.001	
	N	55	55	55	55	55	55

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4.2.9. Multiple Regression Analysis

The assumption was to establish the strength and direction of the relationship between the independent variables and the dependent variable. A multiple regression model that was then fitted to determine the combined effect that the independent variables had on the dependent variable when acting jointly was expressed as follows: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$, Where;

Y= successful project quality management practices; β_0= constant (coefficient of intercept), X_1= Project quality planning; X_2=Quality assurance; X_3= Quality control; X_4= Quality management tools and techniques; X_5= top management commitment; ε = error term; $\beta 1 \ldots \beta 5$=Regression coefficient of five independent variables.

As can be observed in Table 4.12, the regression model of successful project quality management in road construction industry coefficient of determination R Square was 0.732 and R was 0.855. The coefficient of determination R Square indicated that 73.2% of the variation on successful project quality management in road construction industry can be explained by the set of independent variables, namely X_1= Project quality planning; X_2=Quality assurance; X_3= Quality control; X_4= Quality management tools and techniques; X_5= top management commitment. The remaining 26.8% of variation in successful project quality management in road construction industry can be explained by other variables not included in this model. This shows that the model has a good fit since the value is above 60%. This concurs with Graham (2012) that R-squared is always between 0 and 100%: 0% indicates that the model explains none of the variability of the response data around its mean and 100% indicates that the model explains the variability of the response data around its mean. In general, the higher the R-squared, the better the model fits the data.

The study further used Analysis of Variance (ANOVA) in order to test the significance of the overall regression model. Green and Salkind (2013) posit that Analysis of Variance helps in determining the significance of relationship between the research variables. The result of Analysis of Variance (ANOVA) for regression coefficients in table below reveals that the significance of the F statistics is 0.000 which is less than 0.05. The F-table value (26.726) being significant at 95% confidence level. The value of F is large enough to conclude that the set coefficients of the independent variables are not jointly equal to zero. This implies that at least

one of the independent variables has an effect on the dependent variable (successful project quality management in road construction industry).

Table 4.12 presents the beta coefficients of all independent variables versus successful project quality management in road construction industry. As can be observed from Table below, Project Quality Planning (X_1) had a coefficient of 0.309 which is greater than zero. The t statics is 3.276 which has a p-value of 0.002 which is less than 0.05 implies that the coefficient of X_1 is significant at 0.05 level of significance. This shows that project quality planning has a significant positive influence on versus successful project quality management in construction industry. The coefficient of quality assurance (X_2) was 0.226 which was greater than zero. with a p value of 0.032 which is less than 0.05. This implies that the coefficient 0.032 is significant. Since the coefficient of X_2 is significant, it shows that quality assurance have a significant effect on versus successful project quality management in road construction industry. Table 4.12, also shows that quality control (X_3) had a coefficient of 0.228 which is greater than zero. which has a p-value of 0.006 which is less than 0.05 implies that the coefficient of X_3 is significant at 0.05 level of significance. This shows that quality control has a significant positive influence on versus successful project quality management in road construction industry. Further, shows that Quality management tools and techniques (X_4) had a coefficient of 0.394 which has a p-value of 0.003 which is less than 0.05. This shows that a Quality management tools and techniques have a significant positive influence on versus successful project quality management in road construction industry. Furthermore, shows that top management commitment (X_5) had a coefficient of 0.266 which has a p-value of 0.009 which is less than 0.05. This implies that the coefficient of X_5 is significant at0.05 level of significance. This shows that a top management commitment has a significant positive influence on versus successful project quality management in road construction industry. Finally, the constant term is -1.025. The constant term is the value of the dependent variable when all the independent variables are equal to zero. The constant term has a p value of 0.004 which is less than 0.05. This implies that the constant term is significant. The multiple regressions versus successful project quality management in road construction industry are thus an equation through the -1.025. If all the independent variables take on the values of zero, there would be a negative value of successful project quality management in road construction industry. Therefore the most significant factor was Quality management tools and techniques that followed project quality planning.

Finally, the finding revealed that holding independent variables, a unit increase in project quality planning would lead to increase in successful project quality management in road construction industry by a factor of 0.309, a unit increase in quality assurance would lead to increase successful project quality management in road construction industry by factor of 0.226, a unit increase in quality control would lead to increase in successful project quality management in road construction industry by a factor of 0.228, a unit increase in top management commitment would lead to increase in successful project quality management in road construction industry by a factor of 0.266, and a unit increase in quality management tools and techniques would lead to increase in successful project quality management in road construction industry by a factor of 0.394.

Table 4.12: multiple Regression model summary

Model	R	R square	Adjusted R square	Std. Error of the Estimate
1	0.855[a]	0.732	0.704	0.356

a. Predictors: (Constant), quality management tools and techniques, quality planning, quality control, quality assurance, top management commitment

ANOVA[a]

Model		Sum of squares	df	Mean Square	F	Sig.
1	Regression	16.977	5	3.395	26.726	0.000[b]
	Residual	6.225	49	0.127		
	Total	23.202	54			

a. Dependent Variable: Successful Quality management

b. Predictors: (Constant), quality management tools and techniques, quality planning , quality control , quality assurance , top management commitment

Regression Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	P-value
		B	Std. Error	Beta		
1	(Constant)	-1.025	0.343		-2.985	0.004
	Quality planning	0.309	0.094	0.295	3.276	0.002
	Quality assurance	0.226	0.102	0.184	2.211	0.032
	Quality control	0.228	0.079	0.236	2.896	0.006
	Top management commitment	0.266	0.098	0.252	2.722	0.009
	Quality management tools and techniques	0.394	0.126	0.288	3.126	0.003

As per the SPSS generated table above, the model equation would be ($Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \varepsilon$) becomes: $Y = -1.025 + 0.309X_1 + 0.226X_2 + 0.228X_3 + 0.394X_4 + 0.266X_5$. This indicates that successful Project quality management in road Construction Industry = -1.025+ 0.309(project quality planning) + 0.226(project quality assurance) + 0.228(project quality control) + 0.394(project quality management tools and techniques) + 0.266(Top management commitment).

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. CONCLUSION

The study assessed project quality management practices in road construction projects at AACRA a general objective of assessing the quality management practices and identifying the major quality management challenges in road construction projects at AACRA. On the basis of the major findings of the study and as discussed in detail in the literature review part of this study, successful project management enhances the chance of successfully completing projects within time, cost, scope, and quality constraints. Project quality management also helps to achieve project constraints such as within customer satisfaction, and meeting the organizational goal of the project.

Project quality management is one of the ten core knowledge areas that project managers should be familiar with and for the successful management of projects; the organization should undergo the quality management process. This is estimating the planning process, quality assurance process, quality controlling process based on the organizational quality policy and procedure. Since, the organization depending on project contract agreement as reference document. The project quality management practice at the organization is challenged by various factors mainly; insufficient management support, problems with contractors, unrealistic deadline and lack of quality management policy and strategy for successful quality management in road construction projects.

Additionally regular and periodic construction site supervision and inspection were the most important measure to improve quality of road construction projects. The next important measure is implementing a comprehensive quality control mechanism starting from the planning phase and continuing into the end of the project implementation phases.

Therefore, it may be concluded that, undertaking complete quality management process by developing quality management policy at organizational level helps to improve the quality management related problems listed and working on the factors that affect the quality of projects.

5.2. RECOMMENDATIONS

Based on the findings of study it is recommended that AACRA considers the following areas of improvement in management of its projects in general and quality management in particular.

- ✓ Most of the employees at AACRA are first level degree. So the organization should update their skills, and most of the employees also Engineers; this indicates that the management system does not as much concerned with project quality management. Therefore, AACRA should also employ other professionals such as project managers for a successful project quality management.
- ✓ The AACRA 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.
- ✓ According to different scholars, planning is the first stage of any activity. Since, as observed in the result most of the planning process does not apply in the organization. This indicated that the system does not organize with project quality management. So, the organization should follow quality planning process inorder to prevent project defect.
- ✓ 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 AACRA.
- ✓ 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 organization 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 scope change. Therefore, due to scope change

the project incurred additional cost, time, as well as the project will phase-out. So AACRA 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 main challenge at AACRA is right of way that both the client, contractor, and consultants side tell me. So, the organization integrated work with Addis Ababa City Administration, fit Cities master plan with the organization plan, take experience and trainings from other stakeholders as well as from foreign countries, and communicate with cities master plan in order to update it.
- ✓ Additionally, the existing government contract administration and procurement policies, procedures and requirements need revision. Especially the least price should not be the only criteria to select winners. The revision is expected to include past performance contractors, work experience, current capacity of contractors and any other relevant criteria.

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

5.3. FUTURE STUDIES

The practice of quality project management based on the project management skills and knowledge is in its early stages in Ethiopia and only few researches were conducted that are relevant to project management in general specially to quality management. Thus, future researches can be conducted in detail and incorporating various project based organizations to compare their project quality management practice and contribute to growth of the disciple.

Moreover, this study focused on the organizational level at AACRA road construction projects to assess the quality management practices and related challenges. Future studies can be done incorporating quality management practice in the national level for a better performance of road construction projects.

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APPENDICES

Appendix I: Questionnaire, and Interview Questions

Addis Ababa University

College of Business and Economics

School of Commerce

M.A Research on Project Management

Dear respondent,

The purpose of this questionnaire is to collect data for the study on **Assessment of Quality management practices in construction projects: the case of AACRA** for partial fulfillment of a degree Masters of Art in project Management. Believing that your frank and genuine responses will contribute vastly to the quality of the findings of this study, I would like to request you kindly to complete this questionnaire which will be kept confidentially for the study purpose. I would like to express my heartfelt thanks in advance for taking part in this endeavor.

Dereje Bitew //0922601080//derebitew@gmail.com

Part I. General information

Please put a "√" mark to all your responses in the circle provided beside each statement.

Sex:	☐ Male	☐ Female		
Educational Background:	☐ Blow Diploma	☐ Diploma		
	☐ Bacheler Degree	☐ Masters Degree & above		
Work Division:	☐ Project manager	☐ Enginner	Other:_____	
Work Experience:	☐ less than 5 years	☐ (6-10)years	☐ 11years & above	

Part II. **This sub-section covers questions related to quality management process, tools and techniques, top management commitment, and problems encountered in AACRA**.

The scale rating description: 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree

<u>Quality planning</u>:

Does your quality plan contain the following?

Project quality planning contains:-	1	2	3	4	5
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 programme and sub-programmes					
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					
list of quality records to be kept, including appropriate quality records from subcontractors					
frequency (or provisional dates if possible) of internal quality audits					
Frequency of updating the quality plan					

How important do you think the quality management plan is to your construction projects?

☐ Very low ☐ Low ☐ moderate ☐ high ☐ very high

Quality Assurance

Do you consider the following factors in your quality assurance mechanism?

Descriptions	1	2	3	4	5
Selects the appropriate quality management system requirements for each contract.					
Clearly specifies the quality management system requirements in tender and contract documents.					

Evaluates and selects subcontractors on their ability to satisfy specified requirements.					
Appropriate checking, measurement or testing of products and keeping proper records.					

Quality control

Do you consider the following factors in your quality control mechanism?

Descriptions	1	2	3	4	5
Select what to control and 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.					

Top Management Commitment to Quality Management

Description	1	2	3	4	5
Communicate the importance of meeting customer requirements					
Setting quality policies.					
Conduct management reviews on project quality.					
Seek to have more financial resources.					
Seek to have more human resources.					

Quality Management Implementation Problems /challenges

List of Quality Management Implementation Problems:-	1	2	3	4	5
Inadequate management support					
Unwillingness of project staff to accept the quality system					
Difficulties in understanding the quality system					
Problem with more paper works					
Problem with documentation					
Difficulties in measuring results					

Problems with contractors' performance					
Problems with consultants performance					
Ineffective communication					
Increase of cost					
Increase of time					
Inadequate information					
Inadequate technical expertise/skills					
Problem with Government bureaucracy					
Problem with raw materials shortage due to inflation					
Problem with Right of way					
Problem with scope change					
Lack of standardized quality management guidelines					
Employee turnover					

Quality Management Tools and Techniques Applied

The organization applied:-	1	2	3	4	5
Benefit/ cost analysis					
Benchmarking					
Flowcharting					
Design of experiments					
cost of quality					
quality audits					
Inspection					
control charts					
Pareto diagrams					
statistical sampling					
trend analysis					
Any other Quality tools and techniques? Please mention					

Part III. **Interview Questions**

1. How project quality management is been practiced? Based on:
a. Has formal quality management system (e.g., ISO 9000) been widely practiced?
b. Is the philosophy of TQM adopted?
c. What are the quality management tools and techniques commonly applied?
2. Does the top management ever communicate to the subordinate of the importance of meeting customer requirements?
3. Is there quality management standardized guidelines?
4. Does the top management lead in setting quality policies? If yes, please mention the policy principles.
5. Does the top management conduct management reviews on project quality?
6. Have you participated during project designing process? If yes, please mention which quality management processes that you involved.
7. What are the problems to implement project quality management in your organization?
8. As for quality management in your project is concerned, do you recommend the allocation for financial resources to be increased?
9. As for quality management in your project is concerned, do you recommend the allocation for human resources to be increased?
10. What do you think must be fulfilled for successful project quality implementation and management in general?

Appendix II. **List of three selected ongoing construction project at AACRA**

Projects name	Planned cost (Birr)	Actual cost (Birr)	Planned time	Actual time	Performance
Lideta-Tsebel	338,193,589.86	550,042,177.90	2year	8year	90%
Keranio- medhanialem	115,215,708.55	135,109,062.32	8month	3year	93%
CMC overpass bridge	134,342,619.41	181,566,636.50	8month	5year	60.62%