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Quality Assurance Management Practices in Public Building Construction Projects (The Case of Bahir Dar City)

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FACULTY OF CIVIL AND WATER RESOURCE ENGINEERING
CONSTRUCTION TECHNOLOGY and MANAGEMENT

**MSc. Thesis on: Quality Assurance Management Practices in Public Building
Construction Projects (The Case of Bahir Dar City)**

By

Abrham Zegeye Getie

March 15, 2021

BAHIR DAR, ETHIOPIA



BAHIR DAR UNIVERSITY

BAHIR DAR INSTITUTE OF TECHNOLOGY

FACULTY OF CIVIL AND WATER RESOURCE ENGINEERING

**Quality Assurance Management Practices in Public Building Construction
Projects (The Case of Bahir Dar City)**

BY

ABRHAM ZEGEYE GETIE

A Thesis Submitted to Bahir Dar Institute of Technology in Partial Fulfillment of the
Requirements for the Degree of Masters of Science in Civil Engineering

(Construction Technology and Management Engineering)

Principal Advisor Name: Bahiru Bewket (Ph.D.)

Co- Advisor Solomon Melaku (ph.d cand.)

March 15, 2021

BAHIR DAR, ETHIOPIA

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DECLARATION

This is to certify that the thesis entitled "**Quality Assurance Management Practices in Public Building Construction Projects (The Case of Bahir Dar City)**", submitted in partial fulfillment of the requirements for the degree of Master of Science in Civil Engineering (**Construction Technology and Management**) under (**Faculty of Civil And Water Resources Engineering**), Bahir Dar Institute of Technology , is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during the course of this investigation have been duly acknowledged.

Abraham Zegeye

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Approval of Thesis for defense

I hereby certify that I have supervised, read, and evaluated this thesis titled “Quality Assurance Management Practices in Public Building Construction Projects (The Case of Bahir Dar City)” prepared By Abrham Zegeye under my guidance. I recommend the thesis to be submitted for oral defense

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Approval of Thesis for Defense Result

I hereby confirm that the changes required by the examiners have been carried out and incorporated in the final thesis.

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LIST OF ABBREVIATIONS

ANOVA	One-Way analysis of variance
ASQC	American society for Quality control
AWSCOD	Amhara water work construction and design office
CAPA	Corrective action and preventative action
DPC	damp proof course
FIDIC	International Federation of Consulting Engineers
GCC	General Condition of contract
IDEF	integrated definition
ISO	International standardization organization
PMI	Project Management Institute
PPA	Public procurement agency
QA	Quality Assurance
QM	Quality Management
QMS	Quality Management System
QC	Quality Control
RII	Relative importance index
SPSS	Statistical Package for the Social Sciences
TQM	Total Quality Management
UK	United Kingdom

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ABSTRACT

The term Quality Assurance is an important subject matter in the construction industry in Ethiopia. The industry has challenged with serious Quality Assurance issues. The stakeholders of the industry (that is clients, consultants, contractors, and Regulatory Body) collectively play a vital role in addressing the challenges of the quality assurance in the industry. In light of these, this study aimed at Quality Assurance Management Practices for public construction projects in the case of Bahir city. In the undertaking of this, the research investigates current and existing quality assurance methods, techniques, and practices, determine the Major factors that affect QA Management practices, to explore mechanisms to improve QA management practices in and prepare a conceptual framework for public construction projects in Bahir Dar City. Based on this, the researcher undertook a critical literature review of the subject of the study. The survey questionnaires developed based on the findings of the literature review and expert opinions on the topic, conduct interviews, and case study for three projects would undertake. The Questionnaires administered to the respondents (Client, Consultants, Contractors, and Regulatory Body in Bahir dar) which were directly involved for the 26 public construction projects. A descriptive analysis used involving the use of Relative Important Index (RII) of the various Major factors of QA, Techniques used for QA, and Improving Mechanisms identified from the literature. The findings of the study point out to the fact that, following instructions standards, and codes, direct supervision, laboratory experiment, and inspection were major techniques for QA management practices. Project type and complexity, design, contract, material, labor, and equipment were Major factors that affect QA management practices, and management commitment, reduce miscommunication, review/analysis, the satisfaction of contract specification and well-defined roles and responsibilities were improving mechanisms for QA management practices for public construction projects in Bahir Dar City.

Keywords; - Quality, Assurance, Management, Practices, Public Construction, Construction Project

CHAPTER ONE

1. INTRODUCTION

1.1. Background

The construction industry is vital for the development of any nation. It is a large, advanced industry and it has many important links to the rest of the economy. The importance of the construction industry to the economy can be measure by its contribution to the Gross Domestic Product (GDP); its contribution to investment and the amount of labor employed. (Hackman, et al., 2016).In other ways, the stages of the economic development of any nation can be measure by the development of physical infrastructures such as roads and bridges, buildings. construction project progress involves several parties, several methods, different sections or pieces and stages of work and, a great deal of input from both the public and private sectors, with the major goal being to successfully implement the project (Takim & Akintoye, 2002). The construction project is the foundation of economic development where it represents the index of a country's development. The degree of its quality relates to national image and is further closely related to public life, property, and living quality. (Chieh, Tsung, n.d.,2019)

The level of success in carrying out construction projects development activities depends heavily on the quality of managerial, financial, and technical. Besides, the organizational performance of the respective parties, although taking into consideration. The associated risk management, the business environment, and economic and political stability(Takim & Akintoye, 2002),

As construction is becoming more complex, a more refined approach is necessary to deal with initiating, planning, and financing, designing, approving, implementing, and, completing a project. The common assessment of the success of construction projects is that they have delivered on time, to budget, to technical specifications and to meet client satisfaction. (Mbugua et al.,1999)

The large numbers of participants, the complexity of the relationships and a large number of functions to been performed in the construction process do not always work efficiently. It is often massive and inefficient. Quality has become a very popular subject in recent years due to conceptual changes in the industry.

The definition of quality in the past as compliance to standards was now, found to be inadequate and replaced with the current definition as customer satisfaction. (M.Amer, 2002), meeting the requirements of the customer standing alongside the price.

Quality assurance is certain schemes that are implemented in construction in order to maintain the standard or the quality of the work in a consistent manner. Quality assurance forms the integral management system in a construction company. quality assurance (QA) is a set of activities whose purpose is to demonstrate that an individual meets all quality requirements (Samsudin, et al., 2012). QA activities carried out in construction projects to encourage the confidence of stakeholders in meeting the requirements; meanwhile, Quality control in construction typically involves insuring compliance with minimum standards of material and workmanship in order to insure the performance of the facility according to the design. Quality control (QC) is the set of activities or techniques whose quality purpose is to confirm that all quality requirements are being meet. To achieve QC, processes are monitor, and performance problems are resolved.

1.2. Problem Statement

Currently, the construction industry is widely complained about the low quality of delivery of construction projects both the finished product quality and the process used during the project design and construction stages (Kidanu T, 2014) quality-related problems during construction can be on the functioning lifecycle of the project. To a contractor, nonconformance can yield penalties as well as cost time burdens for re-work, which can convert into productivity loss (Agbenyega et al., 2014)

In general, when construction industry compared with other sectors of the economy within their own countries, as well as with their counterparts elsewhere concerning productivity, quality problem, safety and health, and environmental factors affect the performance of construction projects. (Yusof & Aspinwall, 1999)

According to Kidanu T(2014), Implementation of quality assurance in the construction industry has been mainly client-led. The basic reason is that understanding the execution of the contract in law after big nonconformance has already happened cannot reverse any damage already done. Again, if a project lacks quality assurance, the consequences of a time overrun are always serious and hard to resolve (Kidanu T,2014). It also distracts a project from meeting deadlines and this

brings financial losses to the users and, more often than not, it hurts the profitability of the project for the promoters.

Besides the above-mentioned problems, lack of quality assurance in construction is causing litigation among architects, engineers, subcontractors, and material suppliers since each party is blaming each other for the problems at the building site. In the circumstance, the positive feeling and understanding of enjoying the beauty of a house are to give full comfort and safety of the client but due to lack of quality assurance in construction, this comfort cannot be fulfilled. In addition to this, the researcher argument would have based on quality assurance in the design and construction project study(Takim & Akintoye, 2002).

1.3. Objectives of the Study

1.3.1. General Objective

The general objective of this study was to investigate quality assurance and management practices in Public Construction Projects in the case of Bahir Dar City.

1.3.2. Specific Objectives

The specific objectives are:

- ✓ To investigate current and existing quality assurance methods, techniques, and practices in the Bahir Dar construction projects;
- ✓ To identify major factors that affect quality assurance management practices in the public construction project in the case of Bahir Dar
- ✓ To explore mechanisms to improve QA management practices in public construction projects in Bahir Dar;
- ✓ To develop a quality assurance management framework for a public construction project.

1.4. Research Question

To understand the quality assurance management practices techniques, methods, concept, and the major factors, which affect its practices, and improving mechanisms for QA management practices in the construction industry, the following research questions must puzzle the minds of the public construction project in the case of Bahir Dar town.

- What seems like the current quality assurance and management practices and Techniques in public construction projects in the case of Bahir dar?

- What are the major factors that affect QA management practices in Bahir Dar public construction projects?
- Identify major improving mechanisms for quality assurance and management practices in a public construction project.

1.5. Scope and Study Area

The scope of this research was limited to building construction projects owned by a government authority or public projects, which was under construction. The research have been conducted in Bahir Dar city from a different category of (institutional building's, office accommodation, industrial buildings and other) public building construction projects. The study compromise for contractors, consultants, clients, and regulatory bodies involved in the construction of public building projects in Bahir Dar city due to the limitation of researcher time and financial resource.

1.6. Significance of the Study

The study has been contributions to the areas of improving quality assurance management practices. It has been noticed that several problems in the construction industry caused by poor quality assurance practices, and the situation seems to be compounding. Understanding the quality criteria for building construction projects and its impacting factors will make it possible to handle the quality problems much better. In addition, this research would be served as a resource material for use in the construction industry and as reference material for further research activity.

1.7. Organization of the Study

The study has been organized into five major chapters. The first chapter deals with the introduction section of the research. It includes the background of the study, statement of the problem, the significance of the study, limitations of the study. Chapter two deals with a review of related literature, which examines the theoretical and conceptual aspects of, quality assurance management practice in public construction projects in Bahir Dar. Chapter three deals with research design, and methodology. Chapter four of this study deals with data analysis and interpretation. The last chapter deals with the summary, conclusion, and recommendations of the study.

CHAPTER TWO

2. LITERATURE REVIEW

The literature review aims to study into detail and to gain awareness of the existing research work or writings on the subject of the proposed study.

Quality Assurance has become a very popular subject in recent years due to conceptual changes in the construction industry and many projects in Ethiopia suffer poor workmanship and in some cases failure of buildings.

2.1. Definition of Quality

The term quality means different things to different people. Some take it to be the characteristics of a product or service that stands on its ability to satisfy a need. Whereas others take it as the degree, to which a product exceeds a customer's requirements and expectations. On the other hand, others think it is the attainment of given standards. (Chiari ni, 2013)

Implementation of quality assurance in the construction industry has been mainly client-led; the basic reason is that realizing enforcement of the contract in law after big nonconformance already happens cannot reverse any damage already done. Thus, a client, when awarding a contract, takes into account the construction companies “capability to do it the right first time and every time”, which is the underlying philosophy of quality assurance. (Fikreab M. et al., 2018), Customers in both the private & public sectors are looking for confidence that could have provided by a business with effective (or even certified). QMS and begun to maintain an effective quality system as a prerequisite for tendering. The basis of completion for business is shifting from “price only” to a combination of price and quality (Marasini & Quinnell, 2010).

Quality control (QC) is concerned with actual measurement, testing, or supervision of manufacturers' own final product control, either by inspection of each unit or by sample testing. The main objective of construction QA/QC was have independently assured that the activities of a specific project are being performed by all contractual specifications, code, and standards, or government regulations.

The systematic measurement of comparison with a standard, monitoring of the process, and an associated feedback loop that confers error prevention. This can be contrasted with quality control, which is focused on process outputs (Felin & Foss, 2004). In the construction industry,

quality have generally considered very expensive, and QA/QC organizations have established only because of contractual requirements. However, in the construction industry, production (construction/installation) is different from factory or plant production, therefore quality consideration needs special care, because the cost of remedial works may go extremely high if attention is not paid to quality assurance (M.Amer, 2002). In the modern construction market, quality is a major function in construction organizations because the quality is rapidly becoming an important factor, as the price has been traditional. (Adamu Samaila, 2017).

According to Dinku, n.d.(2017), quality control and quality assurance have much in common. Each evaluates performance. Each compares performance to goals. Each can the difference. However, they also differ from each other. Quality control has as its primary purpose to maintain control. Performance has evaluated during operations, and performance have compared to goals during operations. The resulting information was received, and have used by the operating forces. Quality assurance's main purpose is to verify that control have being maintained. Performance was been evaluated after operations, and the resulting information is provided to both the operating forces and others who need to know. Others may include plant, functional, or senior management, corporate staff, regulatory bodies, customers, and the public. Quality Assurance systems cannot guarantee with absolute certainty the production of quality products. But makes this more likely(Wentzel, 2010).

According to Parsons - GE (2002), defined the relation between Construction QC/QA as both,

- Describe guidelines for inspection and documentation of construction activities;
- Provide reasonable assurance that the completed work will meet or exceed the requirements of the construction drawings and specifications; and
- Describe how any unexpected changes or conditions that could affect the construction quality have been detected, documented, and have addressed during construction.

The International Organization for standardization (ISO DIS 9000:2000), formally defines quality as the degree to which a set of essential characteristics fulfills the requirement in the situation of quality assurance, quality is not a statement of excellence in a comparative sense. It is just a short cut for `desired quality` that should be arranged down as clearly as possible. The producer, on the other hand, attempts to attain the desired quality at an optimum cost while the

customer requires confidence in the producer's ability to deliver and firmly maintain that quality. (D.Ashok kumar, 2014)

However, quality in construction is more difficult to explain. Firstly, the product is not an automatic unit but a piece of work with specific characteristics. An example will be building construction, the product can be a whole building or just a prefabricated component that eventually forms part of a building. Besides, the need to fulfill includes not only the client but also the expectations of the community as a whole, into which the completion of the building will be taking part. The construction cost and time of delivery are also important characteristics of quality. In other words, all these things must have properly introduced in designing the building and the outcome should have expressed absolutely in drawing and specifications (Oyedele et al., 2015).

Besides, the building industries, it is a traditional practice to have different contracts for design to that of the construction with the designer taking up the responsibility of supervising the construction. The quality of the finished works will be controlled byways of checking and testing as the construction process. For instance, the quality of concrete and other materials on site was been judged by samples of tests, and detailed inspection of the finished work is done without any exclusion before final acceptance. (Takim & Akintoye, 2002) The major aim of this "inspectional scheme" of quality control is to identify the mistakes after the product have been produced. Even high strength of concrete can be defective if it is not properly compacted, cured and the potential hazard of steel corrosion will not surface until some years later. Because of this, many inadequacies have covered with the existence of succeeding construction, and consequently, the quality of the finished works cannot been assessed by the final inspection. Unlike consumer goods, problems in building work are very difficult to replace. The client have often left with no choice than to cover up the original, which is the source of recurrent difficulties and huge expenditure in some years to come.

From time to time, poor workmanship is disrespect to keep up with expected productivity or just labor. However, to show commitment to quality, the senior management of the companies should therefore provide enough resources on-site to avoid anybody cutting corners. Besides, an inclusive record of in-process inspection is to ensure that the intended confirmation have done.

The extra efforts are managerial and complementary to the functional techniques of quality control in assuring the quality of the product. (Oyedele et al., 2015)

2.2. Quality Assurance

Quality assurance is the planned and systematic preventive activity, which increases productivity by placing the importance of product and service (D.Ashok kumar, 2014). As noted by D.Ashok kumar (2014).quality assurance highlights defect prevention, focuses on the prevention of the production of non- conforming products to provide the confidence of organizational outputs, and ensures meeting customer satisfaction. Besides, it aims to control quality at all stages of production that have designed to confirm that the final product and service meets customer expectations. Quality assurance verified that quality have created in the design stage, but not in the control stage because all the activities has done before the manufacturing or planning process of a product or service respectively. Thus, it involves the development of new operating approaches that avoid or reduce the chances of defects in a product or service.

Quality assurance requires systematic preventive activities to confirm final products or services due to designing the business process of production to meet customer beliefs. Thus, quality assurance was done by a set of activities before the manufacturing process of product and service to control quality at all stages of production. It is necessary to provide confidence in organization outputs to maintain close links with customers(Mazher, Gharlegghi, Chan, & Fah, 2015). Therefore, customer needs and expectations determine by better design and development of new products. Quality assurance for product and service-related the planning process to avoid and reduce the cause of defects in the first place. Furthermore, it can be made by all movements and programs with the deep involvement of product development to assure quality enhancement. As reported by (Fatima & Wibisono, 2017). Quality assurance is concerned with continuous development in all the processes of production from the level of planning and preventive activities to the implementation of work. Focus on quality assurance will lead to fulfilling customer expectations and satisfaction that is determined by design, distribution, and development within a detailed process. The attitude behind the idea of quality assurance is the idea that defects can prevented. Thus, it refers to the enhancement of organizational output to increase customer value. Product operating in dynamic environment is able to carry up set of activities in quality assurance due to result of changes in client needs(Mazher et al., 2015).

2.2.1. Quality Assurance in Construction projects

Within the construction industry, it was having known that an increasing amount of time was have been spent in the preparation or inspection of contractual claims. A key to this is the increased complexity of clients in applying the requirements of the standard forms of the building contract. These contracts place the problem of proof on the contractor. The task of providing this proof, often in the form of documentary evidence have regularly complicated by a lack of relevant records (Salvi et al., 2020).

Quality assurance in construction involves all planning and systematic activities necessary to provide confidence that the facility will perform adequately in service. Quality assurance in construction addresses the overall problem of gaining the quality of the facility to build in the most efficient, economical, and satisfactory manner possible. Within this broad context, quality assurance involves continual evaluation of the activities of planning, design, development of plans and specifications, promotion and awarding of contracts, construction, and maintenance, and the interactions of these activities (Steinmann et al., 2014).

Quality assurance has defined as a set of techniques designed to ensure that quality standards and processes were have observed to, that the final product encounters or exceeds the required technical and performance requirements (Bianco et al., 2012). Whereas, (ISO 9001:2000) also defined Quality assurance as that part of quality management focused on providing confidence that quality requirement is satisfied. In other words, all those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality. Quality assurance, in short, refers to a program for systematic monitoring and evaluation of the various aspects such as design process and workmanship characteristics of a project, to ensure that standards of quality are being met (Quality Assurance-Wikipedia, 2010).

Regardless of all the wealth of site experience throughout the past years, one out of ten building contracts still leads to the client's disappointment and complaints against contractors. Researches made by the (Building Researches Establishment) in the United Kingdom indicate that 40% of building defects occur during the construction phase (Mane & Patil, 2015) In most cases, the defects found to be the following:

- Inadequate supervision and verification on site.

- Misinterpretation of drawing and specification.
- Ambiguous instructions or unqualified operators.
- Use of superseded drawing and specification
- Poor coordination of subcontracted work
- Poor communication with the architects, engineers, subcontractors, and material suppliers.

Perhaps, due to the above mention, it is understandable that poor management and communication mostly cause the following defects rising in construction. In this case, it was been assumed that mistakes occurring on-site usually made on site. These mistakes somehow can be drop back to the purchase of incorrect materials and failure to recover the outdated drawings. On the other hand, the result of site problems can be of disrespect or mismanagement in the head office. (Jha & Iyer, 2006)

Quality could be achieved when such preventable mistakes are avoided in the first instance. Serious measures must be taken to minimize the risk of managerial and communication problems; this is the basic concept of quality assurance. In addition, the conduct of an individual in an organization directly or indirectly affects the quality of a finished product. Responsibility for quality can therefore give from the principal executive right down to the person on the job. If determined quality is to be confident, all members in the organization, both in the head office and on-site must; have proper organization structure, clear lines of responsibility and communication, and to have good motivation. Before quality assurance can practice, an organization to established and maintain a quality management system in its day-to-day operation. A quality system contains, among other things, a set documented procedure for the different processes carried out by the organization (Bianco et al., 2012). Also implementing a quality system does not replace the existing quality control function, nor does it conclude in more inspection and testing. It just ensures that a proper type and amount of verification were having performed when and where it was have planned done. In short, quality assurance is concerned with towards prevention of quality deficiency. It also aims at minimizing the risk of making mistakes in the first place, therefore avoiding the necessity for rework, repair, or rejection.

2.2.2. Construction quality assurance system

To ensure the construction outcome of a project in compliance with the quality target of the design and specification, the client should establish a construction quality assurance, system and set up a quality management organization. Moreover, the quality management plan should have established for implementing the supervision of construction and material or equipment inspection operation. Further, the inspection result should have recorded for reviewing the efficiency and defect, through sustainable repair and improvement to achieve the target of an overall upgrading of construction quality assurance. (Chieh Tsung, n.d.,2019)

According to Wentzel, (2010), the quality assurance systems currently implemented in the building construction project sector are:

- Document Control: To ensure employees have the correct procedures and that the procedures were have properly maintained.
- Audits: To verify that quality procedures were have been followed.
- Non-conformance Tracking: To monitor and track quality issues and that defect kept from customers.
- CAPA (corrective action and preventative action): To correct flawed processes (i.e. quality procedures) when detected via audits and non- conformance tracking and to prevent defects from reoccurring.
- Management Review: Reviewing quality systems data (performance) (quality metrics) to determine if the quality system is working and if it is not, taking the appropriate action to improve the system.

2.2.3. Purpose of Quality Assurance and Role of Iso-9000 in Construction

ISO (International Organization for Standardization) 9000 facilitates the implementation of standards, activities, systems, responsibilities, etc. The advantage of ISO-9000 is, it improves the quality image of the company. It gives a marketing advantage. It improves efficiency, reduces wastage. It ensures customer satisfaction.

What is ISO-9000? ISO-9000 is a series of international standards for quality management and quality assurance system. ISO-9000 is a series, which were continuously updated ISO-9000

Quality Management and Quality Assurance Standards- Selection and Uses. This standard provides a guideline for selecting the appropriate standard from ISO 9001 and 9002 as follows,

ISO-9001- Model for quality assurance in design/development, production, installation, and service. ISO-9002- Model for quality assurance in production and installation.

The difference between ISO-9001 and 9002 is essential for design. If the organization designs buildings as per the customer's requirements, then the organization can go in for ISO 9001. ISO-9000 quality system standard describes what the requirement of a quality-oriented system is. It does not set out special requirements (Salvi et al., 2020).

Whether a company employs 10 or 10000 people, the principle of ISO-9000 could be applied. ISO-9000 in simple words means "DO WHAT YOU SAY AND WHAT YOU DO."

ISO 9001:2008 specifies requirements for a quality management system where an organization

- needs to demonstrate its ability to consistently provide a product that meets customer and applicable statutory and regulatory requirements, and
- Aims to enhance customer satisfaction through the effective application of the system, including processes for continual improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements.

All requirements of ISO 9001:2008 are universal and intended to apply to all organizations, regardless of type, size, and product provided. Where any requirement(s) of ISO 9001:2008 cannot be applied due to the nature of an organization and its product, this can be considered for rejection.

Where rejections were have made, claims of conformity to ISO 9001:2008 are not acceptable unless these rejections are limited to requirements within Clause 7, and such rejections do not affect the organization's ability, or responsibility, to provide a product that meets customer and applicable statutory and regulatory requirements. The approach to quality has evolved from Quality Control (QC) to Quality Management (QM) through Quality Assurance (QA) and reached policies like Total Quality Management (TQM). (ISO 9000: 2008) the developed countries, where quality systems have been establishing many years back, the principle has become to produce quality rather than to control it at the end. The new approaches are not only

beneficial to the customer but also to the manufacturer as the cost of quality have optimized to minimize the total loss. The results are less cost per unit of better quality, more shares in the market, and increased profits (Adamu Samaila, 2017). Quality assurance (QA) refers to the systematic activities implemented in quality systems so that quality requirements for a product or service was have been fulfilled.

(ISO 9001: 2000) Quality assurance ensures that a product has achieved its highest standard and that its production, modification, or repair (in the case of a manufactured item) has been complete in an efficient and timely manner. The purpose of quality assurance is there to assure a client that the standard of workmanship within the contractor's premises of the highest level of quality and that all the products leaving the industry is above a certain minimum level of specification. It should also further ensure that the company personnel, sub-contractors, and key suppliers are aware of customer requirements and that they are fully meet. Conformance with requirements of the detailed procedures developed following the Quality Manual has to be mandatory for all staff employed in the company. It is essential to the system that encouragement was having given to each employee to develop and maintain an attitude of continuing quality improvement and customer satisfaction (Mane & Patil, 2015).

Besides, to ensure that the standard of production is in order between the divisions or section and they have remained constant despite changes in personnel.

2.2.4. Benefits of Quality Assurance

Quality Assurance has become a basic part of most of the construction industries. Every construction industry nowadays faces tough competition and hence they need to provide goods or services of high quality at low cost to their clients. Different systems were have implemented in construction firms to improve upon the quality of the companies. Besides this does not only helps to satisfy the client requirements but also helps in reducing costs and increasing profits of the firms. Most of the construction industries understand the importance and necessity of maintaining good quality to survive in today's market and that is laying even greater emphasis on their QA systems. The first benefit is that it helps in understanding the wants and expectations of the client (Jha & Iyer, 2006).

It thus aids the industries to focus on its processes to satisfy those needs and expectations, to keep its client happy and satisfied. E.g. construction, companies that offer good quality of

buildings to their clients get many contracts from the community benefit from it. They can also overshadow their competitors and enjoy good sales and profits.

Secondly, quality assurance has increased the effectiveness of the construction industries. It requires that the construction industries give proper training to their employees so that they can understand their jobs better as well as trained on the new technology to work and perform better. The entire construction industry works in a predefined fashion with the aid of these procedures. It helps the employees in knowing and understanding their roles and responsibilities. They also make the employees understand the different inter linkages within the departments. Thus, the employees understand the importance of teamwork in improving the quality of products and thus improve the brand value of the company. Moreover; the quality assurance improves the flow of work within the companies. (Bianco et al., 2012)(Wentzel, 2010)] It helps to identify the problem areas within the companies very early.

Some regular inspections and audits pinpoint the problem areas of the companies. Not only the problems of the company but also the low quality and other problems of the vendors highlighted during these performance inspections. The aim of these systems continuously improves the entire quality of the companies, to attain high productivity while maintaining good quality. Last but not the least; quality assurance helps all the departments to work efficiently. There are fewer lags in the manufacturing of the products and as a result, the construction companies benefit from a short cycle time. E.g. if proper quality systems are implemented in a prefabricated company, it will benefit from fast and good products to its buyers. (Adamu Samaila, 2017) There are many big names in for instance the Danish companies that claim to serve their customers in a very short time. Such companies benefit tremendously from increased sales and client satisfaction.

In short, quality assurance is essential for companies to get a strong foothold in the market. These systems help the companies to work effectively, which then reduces the operational costs of the construction companies. Besides, it helps to infuse confidence in the employees through training and role clarity. All this helps the construction companies to serve their clients better every day.

2.2.5. How to Implement Quality Assurance

The construction industry has been struggling with its implementation of quality assurance for many years. The cost could potentially reduce reasonably, if the industry were to hold onto the

concept of quality assurance with the use of great success by the means of other companies. (Construction quality assurance white paper.) However, various case studies and initiatives have succeeded in introducing quality assurance to the construction industry on a small scale, but as a whole, it was mostly been ignored by the industries. The construction industry is unique and therefore the application of quality assurance requires implementing in the industry. Some of the major steps of this process is discussing below;(Fikreab M. et al., 2018)

1. First of all, project managers in various companies have to form a team or groups that will be dedicated to quality assurance. This team will be responsible to value and report on the evaluation regarding every part of the company. The team will be working individually having authority and freedom of work, at each point of their operation. The team has to report to the senior management of the company and keep all results in files.
2. Once the team has formed, the main responsibility of the team will be to define the tasks and assign them to respective persons. Some of these responsibilities are to review the products, tools, services as per the requirements, standards, and guidelines, audit project processes, suggest various methods, standards or tools to been used in the project, report the outcome of the evaluation, etc.
3. The team then defines the plans for the quality assurance process. In this case, it depends upon the nature of the company; the details of the plans in the company might change. However, its basic plan remains common for most of the companies. Mostly the list includes quality objectives, defining the tests and verification activities, process evaluation, defining the individual responsibility of the team members, identifying training requirements, budgeting and funding for quality control jobs, scheduling all activities, documenting, etc.
4. Generating the test process, checklists, and related activities to explain the way quality assurance will perform is the next step.
5. The team in a simple sense has to perform according to the plans made to ensure the next steps of the quality assurance process. These resources could have acquired to perform the procedures when the team starts evaluating the project. Tools required for this evaluation were have identified depending on the nature of the project. Any non-conformance with the standards or requirements notified and reported to the appropriate department. The problems were have then

corrected and again sent for testing to the quality control team. This way, testing and correcting go on until the project was having proven to be in conformance with the standard.

6. The next step is to identify the training requirement for the team members to perform the evaluation processes as specified in the quality control plan.

7. The performance of the team should have monitored regularly by the project manager against the plans, schedule, and budget. In case the progress of the team is not doing a good job, then corrective actions should take.

8. The team activities and results were have reviewed by the senior management of the company and their stakeholders at regular intervals; any unsolved issue for the team procedure is taken care of by the senior management at this point.

9. The team collects review information from various sources. Again, suggestions for improvement at any step of the quality assurance process is accepted and implemented in the next session, if it satisfies the various limitations. Recommendations have accepted from any level of the company for future use.

10. The team refines the total process to give it a defined structure with the team's descriptions, templates, and checklists. This structure could have reused as a model for the future or might become an example to other companies or organizations.

2.2.6. Quality Assurance Implementation in Construction Sector

The Investigation function will generally include:

- a) Monitoring laboratory and field-testing of construction material and completed works. Reviewing contractor's compliance with specifications, the requirement for construction methods, and personals.
- b) Monitoring or performing pre-operational tests or both.
- c) Preparing and maintaining quality assurance manuals.

The administrative functions will include:

- a) Initiating, analyzing, and approving design clarification or changes in contract documents.
- b) Documenting all project-related tests, inspection, and visits by official visitors.

- c) Maintain photographs of construction progress and other relevant construction events.
- d) Maintain a record of job oriented communication like telephonic conversation memorandum and letters et.(Salvi et al., 2020).

2.3. Quality in Design Criteria of Building

The design and construction of a building structure is a process with a close relationship viewed as an integrated one which involves people who generally understand the roles and have professional relationships with one another throughout the project (Concepts E.1, 2012)

The design is a process of creating the description of a new facility, usually represented by detailed plans and specifications, whereas construction is the implementation of a design envisioned by architects and engineers. To implement any design requires construction planning which is a process of identifying activities and resources required to make the design a physical reality (Concepts, 2012). Thus understanding the concept of the elements involved in building design and construction helps in the determination of a practical, attractive, safe, and economical design solution where despite the varied opinions of the end-user will still meet a workable solution. The principal elements of any product are the materials, processes, forms, and appearance affected by marketing analysis and brand (what the product should be), technical constraints (controlling standards and realistic investment cost) as well as commercial viability (potential for sale and profit)(‘Quality management practices in construction’, no date). Quality at each of these individual stages ought to be maintained to meet design objectives as; accessibility, aesthetics, cost-effectiveness, functional or operational needs historic preservation, productive, safe and secure as well as sustainability(US. Green Building Council, 2005).

2.4. Conformance of Quality Standards

The cost of quality control may be classified into two groups(Barrie & Paulson, 1992):

1. The cost of skilled labor, equipment, materials, methods, and supervision to produce quality output.
2. The costs of monitoring and verifying the quality output and correcting or replacing defective work. To achieve the increasing quality of conformance directly from the resources and methods, more money should be investing in them, and hence direct cost goes up. On the other hand, as the reliability of the methods and resources improves, less investment is required for monitoring

their performance and for correcting and replacing defective work, so the cost of quality control goes down. To optimize conformance costs, the sum of the direct construction costs and the quality control costs should be minimized (Barrie & Paulson, 1992)

2.4.1. Quality Inspection

Quality inspection is a set of activities, which include measuring, examining, testing, gauging one or more characteristics of the products and services, and comparing all the results with specified requirements to access each characteristic through determining conformity. On the other hand, 'Inspection' works as an effective and efficient way of discovering defects of the product and service at the required level. Hence, it is necessary to examine, test, and measure within industries and organizations. Therefore, inspection is using to grade the final product to ensure the desired quality. (Reddy, 2014),

Quality inspection contributes to quality improvement by experienced employees. Measurement, the examination can have handled more efficiently due to experienced employees implemented. Skilled staffs help to organization towards managing quality improvement ideology in the process of production. Quality inspection equips the work process with the level of activities and techniques of quality improvement. As well as it is argued to be an effective activity of quality improvement in the achievement of its customer requirement (Bianco et al., 2012). Through testing, quality inspections can identify opportunities, as it is direct at providing high quality for products and services to be able to contribute to the ongoing quality improvement process. Therefore, manufacturing work focuses on the inspection of whether inspection jobs have created by skilled workers. Inspection requires the organization to keep product quality same time committing resources to measure how it has been successful in improving quality. (Mazher et al., 2015)

The contractor shall establish a program for the inspection of activities affecting quality and shall cover all construction site and laboratory operations, including both onsite and offsite operations. Inspections shall have performed to verify compliance with documented instructions, drawings, procedures, and specifications as required by the contract. (Parsons - GE, 2002)

A four-phase inspection program shall have followed for each definable feature of the work.

The four phases of inspection are:

1. Preparatory Inspection

The contractor and the CM perform preparatory inspections before beginning any work on any definable feature of the work.

- Ensure that preparatory inspections include a review of contract requirements.
- Ensure that all materials and /or equipment have been tested, submitted, and approved.
- Ensure that provisions have been made to provide required testing.
- Examine the work area to ascertain that all preliminary work was been completed.
- Examine materials, equipment, and samples to ensure that they conform to approved shop drawings or submittal data, that all materials and/or equipment are on hand, and that all monitoring and measuring equipment was have properly calibrated and in proper working condition.
- Record preparatory inspections in the contractor's QC documentation as required by Specification.

2. Initial Inspection

The contractor and the CM perform an initial inspection as soon as a representative portion of the particular feature of work have accomplished.

- Examine the quality of workmanship.
- Review control testing for compliance with contract requirements.
- Review dimensional aspects of the work.
- Record initial inspections in the contractor's QC documentation as required by Specification

3. Follow-Up Inspection

The contractor and the CM perform follow-up inspections daily.

- Ensure continuing compliance with Contract requirements.
- Ensure continuing compliance with control testing until the completion of a particular feature of work.

- Contractor CQM records follow-up inspection in daily QC reports.
- The CM inspection staff records follow-up inspections in their daily inspection report.
- Conduct final follow-up inspections and correct test deficiencies before the addition of new features of work.

4. Completion Inspection

The contractor and CM perform a complete inspection of the work.

- Develop a “punch list” of items that do not conform to the approved plans and specifications.
- Include the punch list in the construction QC documentation. As required by Specification, including the estimated date by which the deficiencies will have corrected.
- Perform a second completion inspection after punch list items have be completed and the contractor has notified the CM.

The daily inspection reports shall identify inspections conducted, results of inspections, location, and nature of defects found, causes for rejection, and remedial or corrective action taken or proposed. Additional QA inspections may include inspection of third-party lab testing facilities, fabrication facilities, and suppliers.

2.4.2. Quality Inspection and Testing

Quality is synonymous with cost traditionally has emerged the reporting of quality-related costs associated with inspection and testing. As the full range of quality-related costs began to has be defined, several facts emerged:

- (i). Quality-related costs are much larger than had been traditionally reported, generally in the range of 20 to 40% of revenues.
- (ii). Quality related costs are not only related to manufacturing operations, but to ancillary services such as purchasing and customer service departments as well.
- (iii). Most of the costs are the result of poor quality and are avoidable.

The American Society for Quality Control (ASQC) divides quality costs into four separate categories (Leong et al., 2012):

1. Prevention costs: - costs incurred to prevent the occurrence of nonconformance in the future.
2. Appraisal costs: costs incurred in measuring and controlling current production to assure conformance to requirements.
3. Internal failure costs: costs generated before a product is shipping because of nonconformance to requirements.
4. External failure costs: costs generated after a product is shipping because of nonconformance to requirements.

These cost categories allow the use of quality cost data for a variety of purposes. Quality costs could have used for measuring progress, analyzing problems, or budgeting. By analyzing the relative size of the cost categories, the company can determine if its resources have properly allocated. Quality costs are an important means for directing management action. They also can help management track the success of its quality improvement efforts. Ideally, the total cost of quality will decline over time. Crosby recommends a 10 percent per year goal for reducing the total cost of quality (Amer, 2002). The key to improving quality and profitability is prevention. A fundamental approach of total quality assurance is that an increase in prevention expenditures will generate larger savings in all other cost categories. Better prevention of poor quality will reduce internal failure costs since fewer defective items have be made. External, failure costs have also been reduced. In addition, fewer appraisals will be required, since the products have been made correctly the first time. (Amer, 2002).

2.5. Quality Control

Quality control is concerned with operation techniques and activities that have used for checking and reviewing work to manage quality. Quality control involves product design, operation process, and outputs to ensure all activities have mainly done according to the required standard. (Oni et al., 2019). Moreover, quality control is a regulatory process required in an organization to achieve the quality requirements to meet the quality standards (Oni et al., 2019)Quality control focuses more on operational processes to measure actual quality performance and check whether products can meet the desired requirements. It has related to the inspection process, which aims as a basic requirement to get through a customer. However, as quality control focuses on lowering defect incidence and stabilizing the process control, it does not set the benchmark to

create standards. The process of quality control is to maintain the standard of the product or service through a mode of selection, measurement, and prevention of defects to ensure high-quality output associated with the product and service.

There are three quality management processes to improve quality such as quality planning, quality improvement, and quality control. (Juran et al., 1999) In this process, quality should have two aspects; products and services without or with fewer defects, which required different processes of quality planning, control, and improvement. Moreover, as reported by Reddy, (2014) quality is the integration of marketing, engineering, production, and service that allow fulfilling customer satisfaction as well as it's a systematic approach that requires the involvement of all functions such as quality control, quality maintenance, and quality improvement. According to Steinmann et al., (2014), quality control is a business method rather than technical activity it is because technical activities that involve material, machines, and process and operating. He further emphasizes that human relationship is a basic element in quality control activity to generate gradual commitment to TQM such as top management, employee involvement, supply management, open communication and measuring quality cost. Effectiveness of quality control has become the most important guide to organizational growth and success due to quality control moved from technical method to a business method. Thus, quality control defined as an effective method for integrating the quality development, quality maintenance and quality improvement. Quality control involves manufacturing, processes, outputs and services leading to customer satisfaction (Mazher et al., 2015).

2.5.1. Quality Control Implementation, Regulation, and Criteria in Construction Sector

Quality control can have maintained by the consumption of sound engineering practice, professional attitudes, good construction practices, and quality. In the context of engineering structures. It may have understood as a function of making men, materials, machines, and methods operate at the standards calculated to confirm that the result of the construction conforms to the agreed specifications as well as meets the owner/users requirement. Quality control is a management activity applied to the construction processes to set purposes. Purpose in this case is the achievement of a prescribed standard of performance and cost. (Mazher et al., 2015)

To achieve optimum quality at minimum cost, we have to consider all the factors that help to build quality assurance into a product or service in the construction industry where the contractor responsibility of quality control executes the majority of works is in the hands of the contractor and he is responsible to the designer and the owner. The main problems facing the development of construction projects and structures are the technological improvement of their fabrication, the improvement of their quality, reliability, and factory finishing- These problems have been solved by developing and applying efficient and continuous quality control at each stage of production and by testing products and structures using the latest instruments and machines. In the present day competitive market of the construction industry, if a contractor has to survive, he should be able to see the quality requirement of the owner/user and satisfy his needs as well as meet the conformance standards. The various processes involved to be able to see the above requirement should be cost-effective (Salvi et al., 2020).

From Figure 2.1 according to Chieh Tsung (2019.) The criteria and regulation of quality assurance as the regulation standards and technical standards concerned on process plan and management, and material product. The process plan was the guide for all regulations standards and management, who regulates and responsibility.

The process concerned on output of pre-process material, product human resources and environmental based on the above process the output of standards was driven or formed.

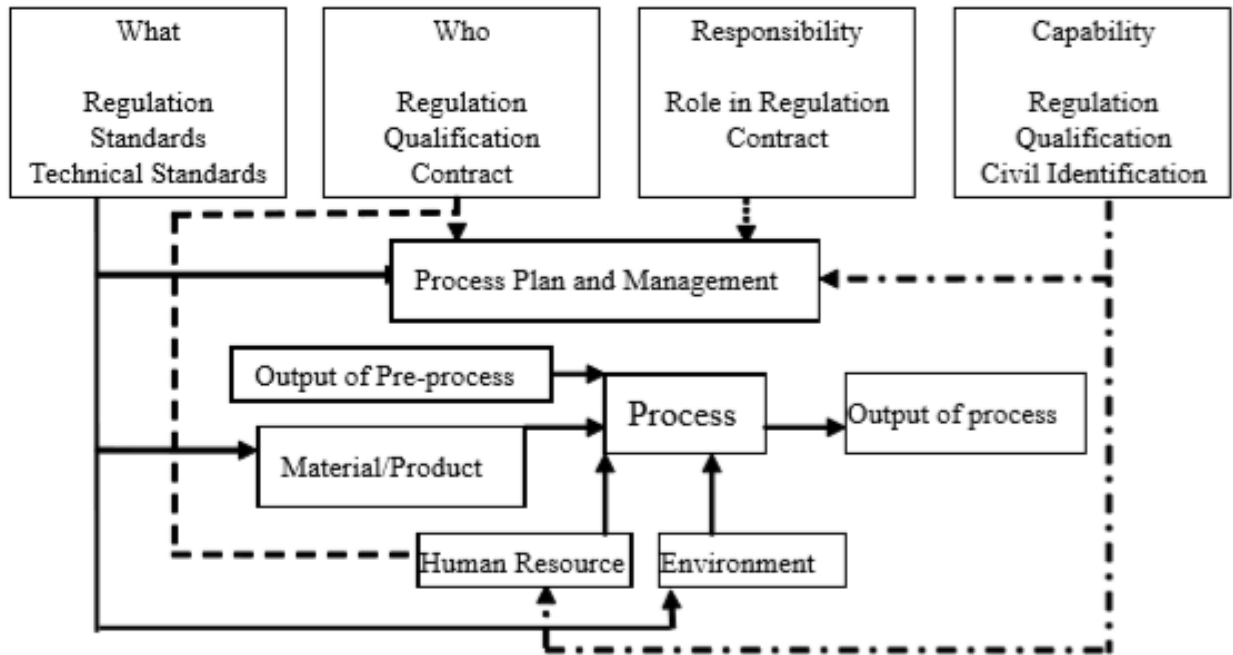


Figure 2. 1 the criteria and regulation of quality assurance(Chieh, Tsung, n.d, 2019.)

2.5.2. Requirements for Quality Control

According to Sahil et al., (2020) The Quality Control process includes quality planning, training, providing clear decisions and directions, constant supervision, immediate review of completed activities for accuracy and completeness, and documenting all decisions, assumptions, and recommendations. In the construction, plan development process, it is the clear responsibility of the designer to ensure all project elements are economical, accurate, properly prepared, coordinated, checked, and completed. For the project, to consistently have been meet. The needs and expectations of our citizens, quality must be as important as the schedule and budget. Design personnel shall follow established design policies, procedures, standards, and guidelines in the preparation and review of all design products. Design consultants are agents for the project with the primary responsibility for the preparation of construction plans. Consultants must ensure quality and adhere to established design policies (Parsons - GE, 2002).

2.6. Total Quality Management

According to British Standard (1998),Total Quality Management (TQM) is a management philosophy embracing all activities through which the needs and expectations of the customer,

community, and the objectives of an organization are satisfied most efficiently and cost-effectively by maximizing the potential of all employees in a continuous drive for improvement.

According to Habtamu Eshetie(2012) from Bahir Dar university deals, TQM consist of both quality assurance (QA) and quality control (QC). In designing a TQM framework, one should devise the system to have be developed, the activities have been carried out, and the ultimate vision of the new style of managing quality in an organization. Once the framework has designed, assessment tools and performance measures have integrated within the system. At present, there is different classification of TQM frameworks: consultants and expert-based, award-based, and academic-based. Consultant-based frameworks are those derived from personal opinion and judgment through experience in providing consultancy to organizations starting the TQM journey. Academic-based frameworks are those developed by academics and researchers mainly through their study and experience in the field. An award-based framework is a self-assessment tool that companies use once TQM has started(Yusof & Aspinwall, 1999)

The rapid growth of the industry along with the 21st-century technological improvements has combined equivalence excellence to create quality assurance awareness, which has gained significant acceptance in the construction process. Quality assurance management within the construction sector has led to improvements in quality, productivity, and affordability through efficient management of the process for value formation in the highly dynamic market(Cao, 2010). Thus, TQM has contributed to the sustainable growth of construction industries with strategic advantages to improve the competitive abilities of the firms through a strong and positive impact on industrial performance (Mazher et al., 2015). Therefore, TQM as a management approach focuses on value creation that has become a source of sustainable competitiveness. In addition, construction sectors still face major challenges in implementing such good quality for customer needs, which has become the primary focus in modern business success.

There is a strong relationship between TQM and market orientation in the outlook of customer satisfaction as market orientation is concerned with consumer satisfaction by implementing the best of quality. Furthermore, According to Cao, (2010), market orientation aimed to create a set of activities and greater value for customers. Temporarily, TQM has improved product quality for value creation looking for customer satisfaction. Due to the appearance of the global market,

customer demands have increased for a high-quality product, which can be assumed as a sustainable value in the competitive market (Marasini & Quinnell, 2010). Besides, the firms have adopted TQM keeping in mind the current or future challenges to bring a positive impact on industrial performance. As an example, Saudi construction sectors have adopted TQM to achieve long-term profitability, sustainability, and competitiveness (Albert, 2012). Thus, TQM in construction sectors brings a whole percentage of benefits to improve business quality, increase customer satisfaction, and reduce construction costs.

2.6.1 Quality Management System in the Construction Project

In the real world, project-based QMS does not exist since any quality system is an organization concerned. Nevertheless, this condition is not applicable in the construction industry since construction is a project-based industry that hires various parties to collaborate to achieve the desired quality of the final products, other than that, the construction project is unique from one to another, which makes them always different from others. A single system definitely will have a problem to suit a different project (Samsudin et al., 2012).

The QMS implementation during its early phases in the construction industry is very dependent on relationships, attitudes, communication, and not the documented framework in which the QMS processes are controlled, basically, according to (Samsudin et al., 2012) There are three levels of quality management system in the construction industry. Namely QMS for the construction industry, QMS for a construction company, and quality plan for a project.

2.7. Factors Affecting Project Quality Assurance

Numerous challenges have been made by different researchers to determine critical success factors in construction Quality assurance. The literature overflows with lists of variables influencing the quality of a building construction project. There are some variables common to more than one list, but there is surely no general agreement on the variables. A review of these previous research variables tells some common threads of variables affecting the quality of a building project Chan & Tam, (2000), stated that generally supposed factors that influence quality performance can be grouped under the headings of the client, project environment, project team leaders, project procedures and project management procedures. The managerial system is primarily concerned with decision making for planning and controlling the organizational industry. The managerial subsystem can be seen as covering the entire

organization by relating the organization to the environment, setting the goals, developing comprehensive strategic and operational plans, designing the structure, and establishing a control process. An integral element of the managerial task is organizational decision making, choosing an overall strategy, setting specific objectives, designing structures and processes, selecting people, assigning responsibility, evaluating results, and initiating changes. The degree of project management actions can have reflected in the range and type of control mechanisms set up for a particular problem. At one end of the range, there will be a very low control condition, if a professional design team, drawings, specifications, documentation, and standard form of contract do not exist. Minor works may fall into this category. On the other hand, a high control condition may exist if detailed documentation has administered through a system of regular meetings, monitoring, and examinations Rashed, (2014), stated that the construction process consists of construction inputs, construction processing, and construction outputs. Construction inputs have defined as all resources and parties involved in the construction process. Construction processing is the implementation process, which can have defined as activating construction inputs for executing construction activities.

According to Birhanu & Daniel (2014), thus identified the root causes or factors which affect the construction project quality. Shows that the quality of work quality management practices were depend on first leadership problem, weakness of policy and strategy, inefficient resource management, in efficient process management, limited focus on customers' requirements and weak business performance.

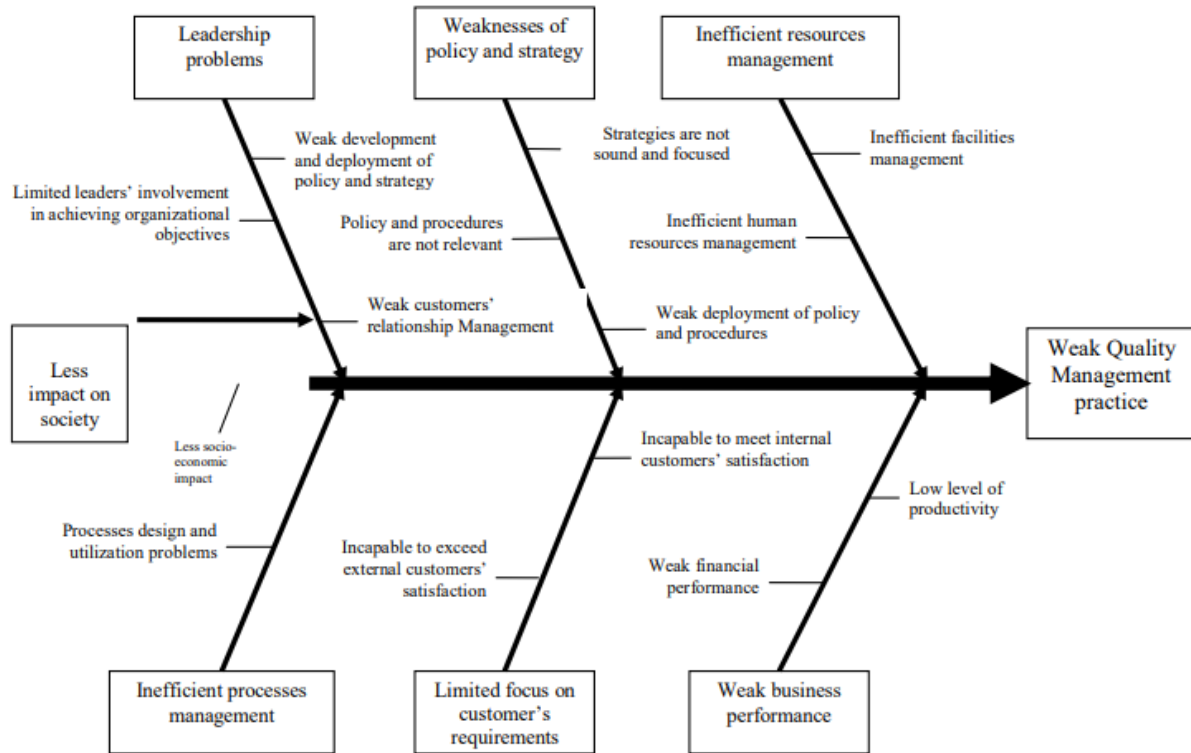


Figure 2. 2 Root Causes of Quality problems in Ethiopian Construction Industry: source (Birhanu & Daniel, 2014)

Construction output in the construction facility (project). The main parties involved in the construction phase are (1) owner, (2) designer (3) general contractor, (4) material supplier, (5) owner's site team, (6) contractor's site team. The elements (factors) affecting quality assurances of the construction process are the components of both construction inputs and construction processing. These elements are collected as follows:

1. Design: includes all things related to design- come from the designer and/or the owner side.
2. Contract: is the prime contract between the owner and the contractor.
3. Material: includes all things related to raw material and its suppliers.
4. Labor: includes all the main working labor in the project.
5. Equipment: includes the main working equipment in the project.
6. Subcontractors: includes the main subcontractors in the project.

7. Site layout planning is the planning of the project site area.
8. Systems: includes any system, which cannot put under the other nine elements.
9. Site staff: includes the management teams and their shared tasks.
10. Execution: includes all things required to activate the above elements and to execute the project activities.

In another study Amer (2002), identified the factors affecting construction quality assurance. These factors can be summarized in the following sixteen elements:

1. Design and planning during the pre-construction phase.
2. Developing and improving quality assurance and control systems.
3. The financial level and standard of living of employees.
4. The accuracy of cost estimates.
5. Proper classification of contractors, consultants, and projects.
6. Employees' consciousness.
7. Training for contractors, owners, and consultants.
8. Encouraging ISO 9000.
9. Contractors' technical and managerial efficiency.
10. Maintenance systems during and after construction.
11. Utilization of resources.
12. Specialization in construction work.
13. Co-operation between the construction industry and scientific organizations.
14. Participating and cooperating with advanced international organizations.
15. Defining responsibilities between project parties.
16. Encouraging innovation for simpler and more accurate work methods.

According to Chieh Tsung (2019.), most of the factors claimed to the construction quality assurance are 1. Market – low pricing in biddings 2. Money – insufficient money that constructors should survive with additional projects 3. Management –domination without professional management 4. Men – personnel is lack of technical training 5. Materials – no integration of different working interfaces for various materials 6. Motivation – apply only used method without any pursuit of innovation 7. Machine and Mechanization – improper timing of

machine and mechanization application 8. Modern Information – related work plan fails to catch up with the information technical 9. Mounting Product Requirement – apply lower grade material or process skipping operation.

According to Oni et al., (2019) identified top factors that affect project quality assurance management practices in construction is ranked as

- Lack of adequate approval by the standard assurance organization,
- Non-implementation of National Building Code,
- Lack of proper inspection at every construction stages,
- Award of contract to the unqualified contractor,
- Lack of construction quality control inspection Programme,
- Lack of effective quality policy implementation,
- Inadequate personnel and craftsmen training,
- Poor specification,
- Bribery and corruption,
- Usurpation of role among professional,
- Unrealistic project cost,
- Unrealistic project time,
- Non-Compliance to Quality control,
- Inadequate workers motivation,
- Inadequate and poor coordination of project resources.

A systematic literature review was have conducted to identify the factors that affect quality assurance in construction projects and are recognized by different researchers and specialists in this field of study by combining the factors as the main factor and sub factor as the following group.

According to Amer (2002) the Factors Affecting QA management for the Construction Building Project as major and sub facto as indicated.

1. Project: - Scope of the project (type and nature), Location of the project, Site access and Period of the project.

2. Design: - Completeness and consistency of design documents, Drawings are prepared in full details, Conformance to codes and standards, Adherence to specifications and The Bill of quantity is very detailed and accurate.
3. Contract: - Cooperation between parties involved in contract, previous successful relations between parties, a written contract with clear conditions, using a standard contract and Types of the awarding system.
4. Material: - Using a comprehensive material management system, Cooperation between the contractor and material suppliers, Availability of good quality construction materials, Using storage and handling system and Construction materials monopoly.
5. Labors: - Labor management system, using labors with high experience, using motivation system, Training courses for labors and Income level and wages of labors.
6. Equipment:-Availability of equipment, Equipment management system, Measurement of equipment productivity, Good utilization of equipment and Equipment maintenance.
7. Subcontractor:-Company's procedures for selecting subcontractors, High cooperation between subcontractors and general contractor, Using a system to evaluate subcontractors performance and Good and fair subcontract conditions.
8. Site layout: - The site layout is large, the site layout has organized well, the site layout has storage areas for materials and the site layout is clean.
9. Systems: - Using computer software and applications, implement quality control and assurance system, using schedule, using a cost control system and implementing a safety program.
- 10.Site staff:- Cooperation between Supervision and Contractor's staff, Understanding of contract administration by Supervision, Skill and experience of Supervision staff, Skill and experience of Contractor's staff.
11. Execution:-Using a complete execution system, testing for final products only, a clear procedure for accepting performed activities and Preparing and using shop drawings.
12. Financial issues: - Amount of contractor's cash flow and No delay of interim payments.

13. Owner: - Nature of Owner's organization (Public or Private), Owner's quick response (no delays in making decisions), Owner's contribution to the design and Owner's emphasis on quality.

13. Owner: - Nature of Owner's organization (Public or Private), Owner's quick response (no delays in making decisions), Owner's contribution to the design and Owner's emphasis on quality assurance.

14. Environment: - Socio-economic environment, Stability of Political environment, Closure of Gaza Strip and The relations between the construction industry and other industries.

2.8. Mechanisms to improve project quality assurance

According to Agbenyega et al., (2014), for minimizing or reducing the factors that affect project quality assurance in construction the following mechanism should be considered for each project. The mechanism was ranked as 1. Management commitment, 2. Communication between managers and employees, 3. Employee Involvement, 4. Detailed and logical work program, 5. Regular inspection and audit of the quality report, 6. Training and education of team members, 7. Review/analysis used to improve performance, 8. Well-defined roles and responsibilities of project participants, 9. Clearly defined goals and objectives, 10. Incentives for good performance, 11. Subcontractor's involvement in the quality process and 12. Regular meetings of project participants.

According to Kidanu (2014), The following steps describe the implementation process for the mechanism to improve quality assurance management practices in the construction project.

Step 1: Define the need for implementing an ISO quality system

Step 2: Educate top management

Step 3: Commitment from top management

Step 4: Select a management representative

Step 5: Select the implementation team (QA task force)

Step 6: Understand the current system and processes

Step 7: Understand the standard

Step 8: Conduct gap Analysis

Step 9: Create an implementation plan

Step 10: Develop standard procedures and instructions

Step 11: Employee training

Step 12: Monitor

Step 13: Internal auditor training

Step 14: Internal audits

Step 15: Select registrar

Step 16: Management reviews

Step 17: Define key performance indicators to monitor continual improvement

Step 18: Pre-assessment audit

Step 19: Registration audit

2.9. Research Gap

To summarize the above literature and finding the gap the researcher assessed different literature there are so many findings the quality assurance management systems, implementations, factors that affect quality management, techniques and mechanisms of total quality management in different way of perception and understanding. For example the literature's shows that the mechanisms to improve quality assurance and the factors identified in the performance of quality in construction industry.

The basic feature of the researcher basic outcome uniqueness or gap fill was identify the basic or major techniques that were implement in the public construction project, the major factors that affect in the construction of public building projects and also the researcher identified the major improving mechanisms for public construction project for public construction. This implies that to achieve a good performance of quality assurance and used for different stakeholders to implement in their organization

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1. Introduction

This chapter includes the methodology that have used in this research. It provides brief information about the research method, research design, population, and sample size, various approaches to data collection or data gathering, and data analysis. It would also identify the questionnaire design, validity content, and reliability.

The research methodology was a way to systematically, solve the research problem. It may have understood as a science of studying how research is also done scientifically. In this study, the various steps will generally adapt to solve problems. The researcher also needs to understand the assumptions underlying various techniques and to know the criteria by which the research can decide that certain techniques and procedures would apply to certain problems and others would not. All this means that the research must design the methodology for the problem as the same may differ from problem to problem.

3.2. Study Area Description

The study area used for this research is Bahir Dar city, which is the capital city of the Amhara Region. Bahir Dar is also located from the capital city of Ethiopia, Addis Ababa around 565 km. It has a latitude and longitude of 11°36'N 37°23'E with an elevation of 1,800 m (5,900 ft) meters above sea level with an area of 27,000/km² (69,000/sq mi). In this study area, the questionnaires will be prepared and distribute for the main stakeholders who are actively involved in the construction of public building projects in the city.

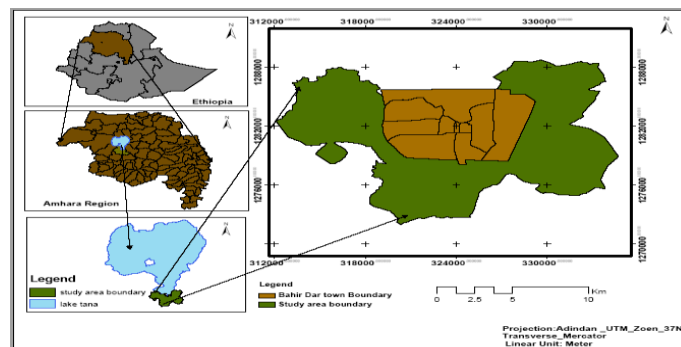


Figure 3. 1 Location of Bahir Dar (source https://www.researchgate.net/figure/Bahir-Dar-Metropolitan-City-study-area-map_fig1_280933812)

3.3. Research design

The strategy in this research follows first started with the identification of the title that have been done through an unstructured literature review and then the research design formulated. The data and information sources would be determined based on the formulated research design. So the research design was a comprehensive design, the comprehensive design uses both descriptive and explanatory research design. Based on the data and information sources the research instruments have been decided; and available documentary sources relevant to the research would be reviewed. The review includes books, journals and articles, internet sources, and archival documents. Finally, after an in-depth review of the literature, questionnaires would have been designed and distributed to the main stakeholders such as contractors, consultants, regulatory body and clients especially those who have been involved in the construction of public building construction projects in Bahir Dar city. Upon obtaining the desired data, checking and sorting of data would be done. The data would be also then analyzed for crosschecking the conformity of the information through the overall research work. This would follow through discussions to draw a conclusion and to forward recommendations to the stakeholders based on the findings of the study.

To undertake this research, a mixed approach was having adopted. The mixed approach used for the study was concurrent that was being used both quantitative and qualitative simultaneously at the same time for stakeholders. The objective of the research was to investigate quality assurance and management practice in public building construction projects in Bahir Dar city. It was concentrating on current and existing quality assurance methods and practices in the Bahir Dar public construction projects; and Identifying Major factors that affect overall QA management practices in public construction projects in Bahir Dar; identify mechanisms to improve quality assurance management practice and to develop quality assurance management framework for the construction project.

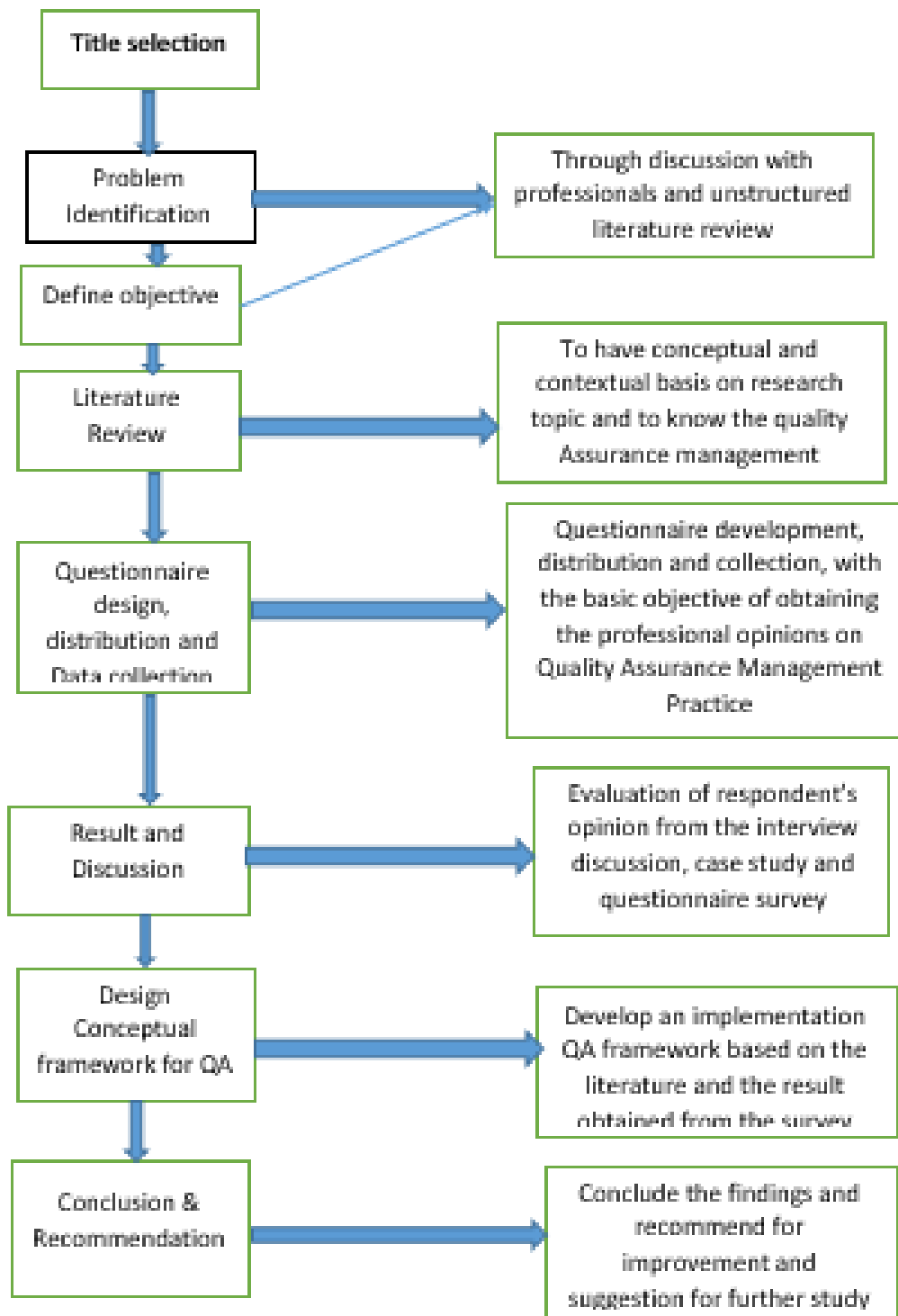


Figure 3. 2 Flow chart of the brief Research Methodology

3.4. Sample Technique and Sample Size Determination

3.4.1. Target population

The research needs to target populations to answer the research questions. The population was the number of active projects who have been directly involved in the construction of public building construction projects.

3.4.2. Sampling Technique

Sampling means selecting a given number of subjects from a defined population as representative of that population. In general, sampling techniques can be divided into two types: Probability or random sampling and Non- probability or non- random sampling(Taherdoost & Group, 2017). The sampling technique was be used in a non-random sampling technique. Because the population was known and the number of population is less than 50 then taking the hall population and the type of Purposive or judgmental sampling technique would have used for selecting the public building projects. Purposive or judgmental sampling is a strategy in which particular settings persons or events were have selected deliberately to provide important information that cannot be obtained from other choices (Maxwell, 1996). It is where the researcher includes cases or participants in the sample because they believe that they warrant inclusion. (Taherdoost & Group, 2017).

3.4.3. Sample Size Determination

Sample size refers to the number of items to be select from the universe to constitute a sample. It was a major issue before a researcher headed to the collection of data. The size of the sample should be optimum, and this optimum sample is one, which would fulfill the requirements of efficiency, representativeness, reliability, and flexibility. In deciding the size of the sample, it was necessary to determine the desired precision as also an acceptable confidence level for the estimate and hence 95% confidence level used to calculate the sample size((Kish, 1965.). However, for very small populations (50 or less), the researcher need almost the entire population to achieve accuracy. (<http://uregina.ca/>). Since the total population, less than 30 (Kish, 1965).For this research taking of the hall population for this study because of the number of active public projects under execution in Bahir dar city was twenty-six (26) based on Bahir dar municipality office. Then the researcher takes the hall project that was be actively executed

from the year 2007 up to 2012 E.c the total questioner distributed for 104 respondents. Who were thus consultant, contractor, client, and regulatory body?

3.5. Data Collection

3.5.1. Sources of Data

To achieve the intended objective and to answer the research questions of the study, different sources of data would have used. As a primary data, questionnaire, semi-structured interview, and site observation sources would have used. To collect secondary data literature, archival documents would have used. .

3.5.2. Data Collection Tools/Instruments

In collecting the necessary data, self-administered questionnaires and interviews would have used. Primary data would have collected through questionnaires and interviews, while those of secondary data would be collected through archival documents/literature (reports, researches, textbooks). For data collection this study, the major stakeholders and regulatory bodies would have participated. Then the researcher takes the sample for 26 projects and for each project one client, one consultant, one contractor, and the regulatory body for each project with a total sample of 104 samples have taken.

3.5.3. Questionnaire

A questionnaire is a series of questions asked to individuals to obtain statistically useful information about a given topic. When properly constructed and responsibly administered, questionnaires become a vital instrument by which statements can have made about specific groups of people or entire populations. In designing the questionnaire, the objectives of the study would have first established. This was to help in determining what questions to ask and how to ask them.

A suitable questionnaire would be prepared to attain the aim of the study. The questionnaire would have structured based on the objectives set before, quality assurances management practices and methods in public building construction projects, the major factors that affect the quality assurances management practices in public building construction projects performance and identify the mechanisms to improve quality assurances management practices in public construction projects.

To undertake this study type of questioners were:

1. Status of public construction projects on the performance, technique, and management method and adoption of their quality assurance management system.
2. To determine the major factors that affect quality assurance and management practice and identify the most important mechanisms to improve quality assurance management practices.

3.5.4. Interview

The Informal interviews would have used to fulfill some missing data from the questioner in the archival documents and questionnaires. An informal interview is an interview that takes place in a casual setting, such as over coffee or lunch. The interviewees would be any concerned body (stakeholder) available at the organization office who has been involved in the construction of public building projects by the time of document analysis. To undertake this interview first outline the guiding questions and the specific questions administer step by to examine stakeholder's quality assurance implementation.

3.5.5. Case study

Besides, conducting a questionnaire survey on the selected twenty-six projects, this research would also use some case study on randomly selected projects for identifying factors affecting quality assurance in public building projects, to identify mechanisms to improve quality assurance and to know the methods, tools, and techniques of quality assurance management used in their projects. A case study is an ideal methodology that would have used in the projects when a holistic, in-depth investigation would have needed. Case studies emphasize detailed contextual analysis of a limited number of conditions and their relationships and tend to be selective. In doing the case study, data such as a progress report of the ongoing projects will be collected. Based on the current progress and condition of their building performance of quality assurances, the identified factors affecting quality assurances management performance of public building projects, the mechanism to improve quality assurance and the measurement methods would be analyzed.

3.5.6. Data measurement

To be able to select the appropriate method of analysis, the level of measurement must be understood. For each type of measurement, an appropriate method can be applied and not others. In this research work, Likert scales would have used. Ordinal scales are a ranking or rating data

that normally use integers in ascending or descending order. The numbers assigned (1, 2, 3, 4, 5) do not indicate that the interval between scales are equal, nor do they indicate absolute quantities. They are merely numerical labels.

Based on the Likert scale the researcher has the following rating scale for measuring the techniques for implementing quality assurances, as (strongly disagree, I do not agree, neutral, agree, and strongly agree). For data related to major factors affecting quality assurances management practices in the public building project, as (Very low Important, Low important, Medium important, important, Very important) and for the mechanisms to improve quality assurance management practices was (lowest, Lower, high, Higher and highest) and rated based on scale 1 up to 5 respectively as shown in the table below.

Table 3. 1 Techniques for implementing QA

techniques	Strongly disagree	I don't Agree	Neutral	Agree	Strongly agree
scale	1	2	3	4	5

Table 3. 2 Rating scale for factors affecting QA management practices

Factors list	Very low Important	Low important	Medium Important	important	Very important
Scale	1	2	3	4	5

Table 3. 3 Rating scale levels for mechanisms to improve QA management and practices

Improving mechanisms	lowest	Lower	high	Higher	Highest
Scale	1	2	3	4	5

3.5.7. Data Analysis

The relative importance index method (RII) would have used to determine and rank the factors that affect QA management practices in public buildings, the mechanisms to improve quality assurance and management practices and quality assurances management methods and practices in construction projects and all data would have analyzed by using the Programme MS-Excel and SPSS software. The relative importance index has computed as using the equation below:-

$$RII = \frac{\sum w}{AXN}$$

Where:

RII is relative importance index,

W is the weight given to each factor by the respondents and ranges from 1 to 5

A = the highest weight = 5

N = the total number of respondents

The researcher also used the IDEF0 modeling software to identify the major techniques of quality assurance management, major factors that affect quality assurance, and identify the most important improving mechanisms of quality assurance and management practices for public projects and the researcher would show the conceptual framework for quality assurance management framework.

IDEF (Integrated Definition) diagrams were have introduced in 1981 as part of the Integrated Computer-Aided Manufacturing (ICAM) project. There are numerous IDEF methods, but two of them serve as the basis for business process models: the IDEF0 method that focuses on activity modeling and the IDEF3 method that accomplishes process description and could have used to rapidly, generate discrete-event simulation model specifications (Mayer et al., 1998). The IDEF0 method has designed to model the decisions, actions, and activities of an organization or other system and has targeted to communicating and analyzing the functional perspective of a system (Mayer et al 1998).

3.6. Validity Test

The validity test indicates the degree to which an instrument measures what it has supposed to measure. In other terms, Validity deals in how questions in the questionnaires were prepared in terms of being clear and not vague. Therefore, the term refers to the extent to which an instrument asks the right questions in terms of accuracy. For a research instrument to be considered valid, the content selected and included in the questionnaire must be relevant to the variable being investigated (Miller, 2006). Among the different ways of testing the validity of the questionnaire, the content validity test would have be utilized for this research work. Therefore,

Content validity refers to the extent to which a measuring instrument provides adequate coverage of the topic or contents under study.

Accordingly, the researcher assessed the validity of the instrument with professionals or experts concerning the language clarity, one language translator expert; from the Bahir dar Peda campus checked it. Five persons from Public construction participants, who have good practices in the area of quality assurance and management practices, were involved to check the face validity of the instrument from AWSCOD, DESIGN OFFICE principals, and three teachers from Bahir Dar University who know the area of expertise was some sort of modification has made accordingly. This has done to validate the extent that measurement instrument items were relevant and representative of the target construct. Finally, the advisor, the core supervisor of this research looked it, and then the instrument has carried as per the advisor.

Validity concerning questionnaires refers to the ability of the questionnaire to measure what have intended to measure. This means that it is concerned about what was found with the questionnaire represents the reality of what to be measured (Mahajan, 2017). This is due to providing adequate coverage of the investigative measurement questions in the questionnaire. The judgment of what is 'adequate coverage' would have made through the careful definition of the research through the literature reviewed.

Finally, the researcher conducted the validity of questions and answers based on parson's correlation coefficient. Based on this as indicated from Appendix and the parsons correlation coefficient indicates between 0 and 1 it shows a positive correlation and if correlation between the variables was less than 0 the relation was bad or negative relation, based on this the researchers found a positive relation

3.7. Reliability Test

Reliability refers to consistency. Reliability is a measure of the degree to which a research instrument yields consistent results after repeated trials (Tiberius, Mwanja, and Mwinzi, 2016). For a questionnaire to be valid, it must be reliable. Respondents may consistently interpret a question in a questionnaire in one way when it means something else. Because of this, although the question is reliable, it does not matter as it has no internal validity and so will not enable the research question to have been answered. Therefore, Reliability is concerned with the strength of the questionnaire and, in particular, whether or not it would produce consistent findings at

different times and under different conditions, such as with different samples or, in the case of an interviewer-administered questionnaire, with different interviewers.

The reliability of an instrument is the measure of the degree to which a research instrument yields consistent results or data after repeated trials. In this research, internal consistency would be used, which involves correlating the responses to each question in the questionnaire with those to other questions in the questionnaire. It measures the consistency of responses across the questions from the questionnaire. To test the reliability of the questionnaire as a research instrument, a pilot study would be carried out and a Cronbach Alpha Moment Co-efficient would have used in this case.

Based on this the researcher founds the cronbach's alpha of subscale for the pilot study was found.703 (Techniques for implementing quality assurance management), .608 (Factors affecting Quality assurance in construction projects), and .701 (Mechanisms to improve quality assurance practices) all were found above the minimum acceptable threshold $r=.671$ suggested by scholars in the area. Therefore, item-total statistics were having computed for the final study without deleting any item. In addition, to maintain the internal consistency of the items, the reliability analysis was being conducted after the data was being collected from all sample respondents. (See Appendix A). Similarly, the reliability of the items was above the minimum acceptable level.

3.8. Ethical consideration

Regarding the ethical considerations, the following issues were have dealt: There was asking permission to the principals of the sample public construction projects, and a letter of permission was having taken from the department chair of Construction technology and management. Besides, the researcher protected the confidentiality of all participants by ensuring that none of them would write the name in the data. The purpose of the study have pre-informed to the participants and Participants of the study were informed as filling the questionnaire was based on voluntariness; they can withdraw if they cannot participate in the study at any time. Informed participants, as their response were be used only for research purposes than other issues, their confidentiality has prevailed, and the research would be reported honestly and hopefully. In addition, all the sources the researcher has used acknowledged and referenced as expected.

CHAPTER FOUR

4. DATA PRESENTATION, ANALYSIS, AND DISCUSSION

4.1. Introduction

In the previous chapter, the methods, which were having employed in this research study, were have discussed. In this chapter, the data from the questionnaires and interviews would have be presented and a discussion of the findings delivered to draw up various conclusions to the problem statement, hypothesis, and objectives. In the previous chapter, the methods, which employed in this research study, were have discussed. In this chapter, the data from the questionnaires and interviews would have presented and a discussion of the findings delivered to draw up various conclusions to the problem statement, hypothesis, and the objectives.

The data collected were have analyzed using the statistical package for social science (SPSS) to provide answers to the questions of the study. Means frequencies, standard deviations, one-way analysis of variance (ANOVA), was be used to find out descriptive statistical analysis. To analysis the findings, the researcher used the following scale to represent the estimation level of contractors, consultants, regulatory bodies, and clients concerning quality assurance management techniques, methods factors of quality assurance, and mechanism to improve quality assurance. The measurements were being taken as different from questioner type and analysis was be done as their item.

4.2. Result of the Study

This section mainly concerns with the presentation of the results of the study based on the collected data-using questionnaire. To make it clear, the presentation of the results was be organized in line with the basic research questions.

Table 4. 1 Response Received From Survey

Respondents	Questionnaires Administered	Number Returned	Percentage (%) Of Response
Client	26	24	92.3%
Contractor	26	24	92.3%
Consultant	26	25	96.15%
Regulatory body	26	23	88.46%
Total	104	96	92.3%

As shown in table 4.1, The total number of questioner distributed for client, contractor, consultant, and the regulatory body was 26 for each, and the number of returned from the total respondent is also (24, 24, 25, and 23) respectively. The researcher also defined the total percentage of respondents for client, contractor, consultant and the regulatory body was (92.3%, 92.3%, 96.15%, and 88.46%) and the total respondents in percentage 92.3%. the remaining 7.7% were not returned by thus parties involved for public construction projects.

From the total questioner, eight questioners not used for the data interpretation, among thus three questioners have no full information, which the researcher was be rejected from the analysis, and from the total questioner the rest five question papers have not returned by different cases of respondents were not available for at their office.

4.2.1. Current QA management practices in public construction projects

Assessing the current quality assurance and management practices in the case of Bahir dar public construction projects was the first basic research question designed to be examined in this research. To examine this basic question the respondent's background, data acquisition method, companies' work experience about quality assurance, and organization's perception about quality assurance and management practices were have presented in detail from table 4.2, 4.3, 4.4, and 4.5 respectively.

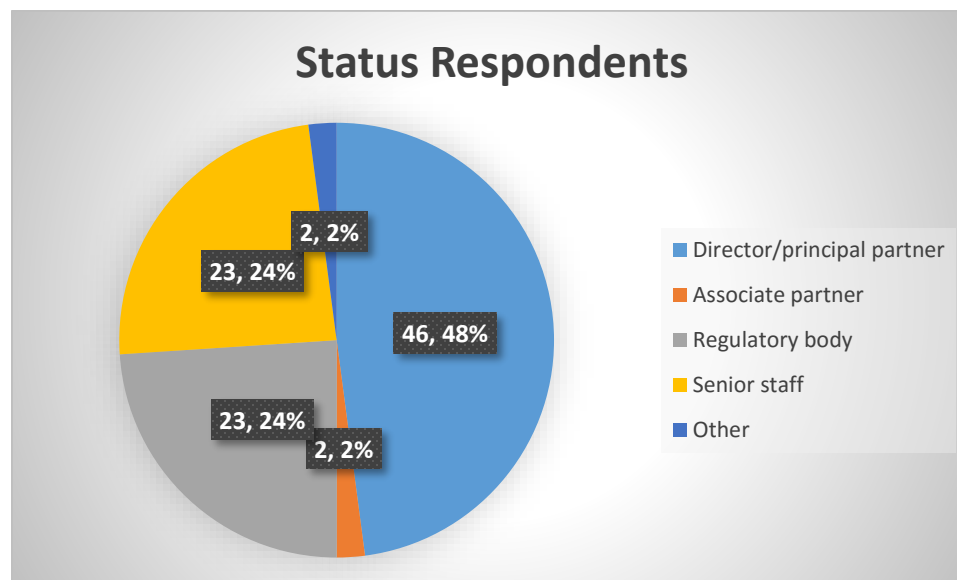


Figure 4. 1 General status of respondents

From Fig 4.1. the analysis chart shows that the background of respondents status of respondents with their company is from the total 47.91% of respondents were Director/principal partner, 23.95% senior staff 23.95% Regulatory body, 2.08% Associate partner, and the rest 2.08% were another status.

Table 4. 2 Respondents Experience and Type of Client

Item	frequency	percentage
Experience		
<5 years	42	43.75%
5-10 years	34	35.41%
>10 years	20	20.83%
Client entity		
Primary	65	67.71%
Secondary	31	32.3%
Type of client		
Developer	7	7.29%
An Investor		
Owner-occupier	4	4.17%
Government Agency	74	77.08%
Quasi-government	11	11.45%

As shown in table 4.2, Also, the position of respondents with the company was 43.75% working for 5 years 35.41% of respondents work for 5-10years and the rest 20.83% of respondents work for more than 10 years. Thus, frequencies and percentages show that when the number of frequencies and percentages increase the experience of the employees or respondents have good quality assurance management.

The type of client from the total respondents was Government Agency takes 77.08%, developer 7.29%, and the rest 4.17% Owner-occupier and Quasi government 11.45% with respectively.

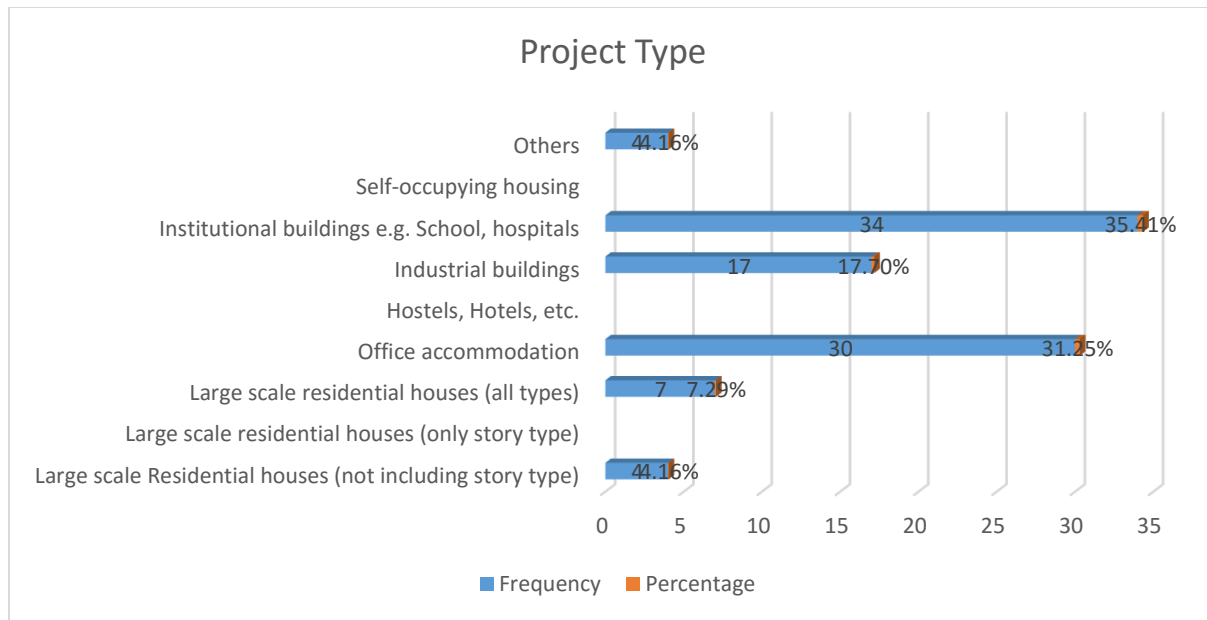


Figure 4. 2 respondents project type

From the above figure 4.2. the respondents project type they undertake the buildings they normally undertake were 35.41%, 31.25%, 17.7%, 7.29%, 4.16% Institutional buildings, Office accommodation, Industrial buildings, Large scale residential houses, and others respectively.

Table 4. 3 Response of Sample According to Independent Variables of the Company

Item	frequency	Percentage
Organization		
Contractor	48	50%
Consultant	25	26.04%
Regulatory body	23	23.95%
Grade		
Grade 1-5	57	59.375%
Grade 5-10	24	25%
None	15	15.625%
Establishment		
Before 2000 E.C	53	55.21%
After 2000 E.C	34	35.41%
Other	9	9.375%

No of Employees		
Less than 50	27	28.125%
50-100	30	31.25%
100-200	13	13.54%
Greater than 200	7	7.3%
Other	19	19.79%
Type of Project		
Infrastructure	35	36.46%
Construction	36	37.5%
Administration	25	26.04%
Executed Project		
Less than 10	19	19.79%
11 to 20	17	17.71%
21to30	4	4.17%
More than 30	36	37.5%
Others	20	20.833%

As shown in table 4.3. From the total respondents, 59.375% were the contractors or consultant's grade below grade 5 the rest above grade 5 was 25% and others were 15.625%. In addition, the year of establishment of the company was 55.21% before 2000 E.c. the other 35.41% have established after 2000 E.c and others said was 9.375%.

The number of employees involved in the company was 50-100 (31.25%), less than 50 (28.125%), 100-200 employees (13.54%) and more than 200 employees (7.3%) was an employee the remaining was 19.79% who were not workers for the construction but they were at the office from the different stakeholder. The number of constructions executed in the last 10 years 37.5% was greater than 30 projects, 19.79% up to 10 projects, 17.71% was 11-20 projects and the rest 4.17% was 21-30 projects was executed by different public construction companies. The other 20.833% of respondents said that they have directly done for the construction but they were regulatory bodies.

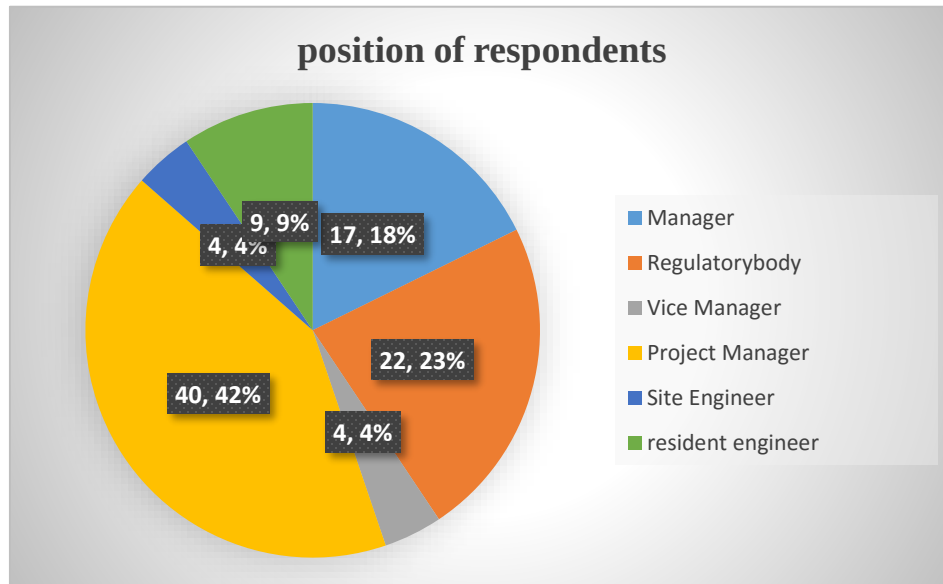


Figure 4. 3 position of respondents

From figure 4.3. Also shows that the position of respondents was 41.67% was Project Manager, 22.91% Regulatory body, 17.71% of Manager and 9.375% resident engineer respectively. The rest 4.17% was the vice manager and site engineer. This shows that the questioners distributed for a large amount of project manager as both consultant and contractor side the second respondent was for regulatory and the manager of the parties implies they have good trained for the quality assurance management.

From the above chart the respondents were manager, regulatory body, vice manager, project manager, site engineer and resident engineer are the respondents. Since the researcher distribute to the main players but the above respondents also the representative of the contractor, consultant, contractor and regulatory body stakeholders.

Table 4. 4 Analysis of Response to the Data Acquisition Method

Item	Frequency	Percentage
Collect Data		
Yes	38	39.58%
No	53	55.21%
Don't know	5	5.21%
Satisfaction		
Not measured	23	23.95%

Questioner survey	16	16.67%
By the number of complaints	49	51.04%
Others	8	8.33%
Customer Satisfaction		
Yes	55	57.3%
Sometimes	32	33.33%
No	9	9.375%
Company Performance		
YES	61	63.54%
No	18	18.75%
Sometimes	17	17.71%
Rate of Employers		
notsignificant	8	8.33%
ModeratelySignificant	28	29.2%
Slightly Significant	10	10.45%
VerySignificant	34	35.42%
Extremely Significant	16	16.67%
QA performance rate		
Yes	47	48.96%
No	13	13.54%
Sometimes	22	22.91%
Don't Know	14	14.58%
Punishment for defect		
Yes	39	40.625%
No	23	23.95%
Sometimes	28	29.17%
Don't Know	6	6.25%

As shown in Table 4.4. From the total respondents, 55.21% said that there is no collection of data to measure quality assurance performance with their organization 39.58% was said there is collection of data with their company, and the other 5.21% respondents they don't know whether the company collect data for quality assurance or not. Moreover, the customer satisfaction by

quality assurances management system was have known based on 51.04% by the number of complaints, 23.95% was not measured, 16.67% by Questioner survey and the other 8.33% was differently.

The respondent's knowledge about the Relation between the quality implementation in construction projects and increasing the customer satisfaction was that 57.3% said that there is strong relation and the other 33.33% there was sometimes relation between them. 9.375 % of respondents also said there is no relation. From table 4.4. In addition, 63.54% argue that there was a strong relationship between the quality implementation in construction projects and increasing the company performance, the other 18.75% of respondents said there is No relation and 17.71% sometimes there was a relation between quality implementation in construction projects and increasing the company performance.

Besides, the respondents indicated from the table 4.4 rating the contractors or suppliers based on quality assurance performance was 35.42%, 29.2%, and 16.67% said that Very Significant, Moderately Significant, and Extremely Significant respectively. And the practical measurement of contractors based on quality assurance performance was that of 48.96% said there was rated based on quality assurance performance, 22.91% said there was sometimes rated based on their quality assurance. The other 14.58%, 13.54% of respondents argue that there have be no practical rate, contractors or consultants, and others they do not know whether to measure or not

In addition to this, the practice has shown in table 4.4. about 40.625% of the respondents said the suppliers or contractors pay for the defects made concerning quality assurance, 29.17% of respondents there was sometimes pay for the defects, and the other 23.95%, 6.25% of respondents said no pay for the defects and they don't know whether pay or not defects come by quality assurance respectively.

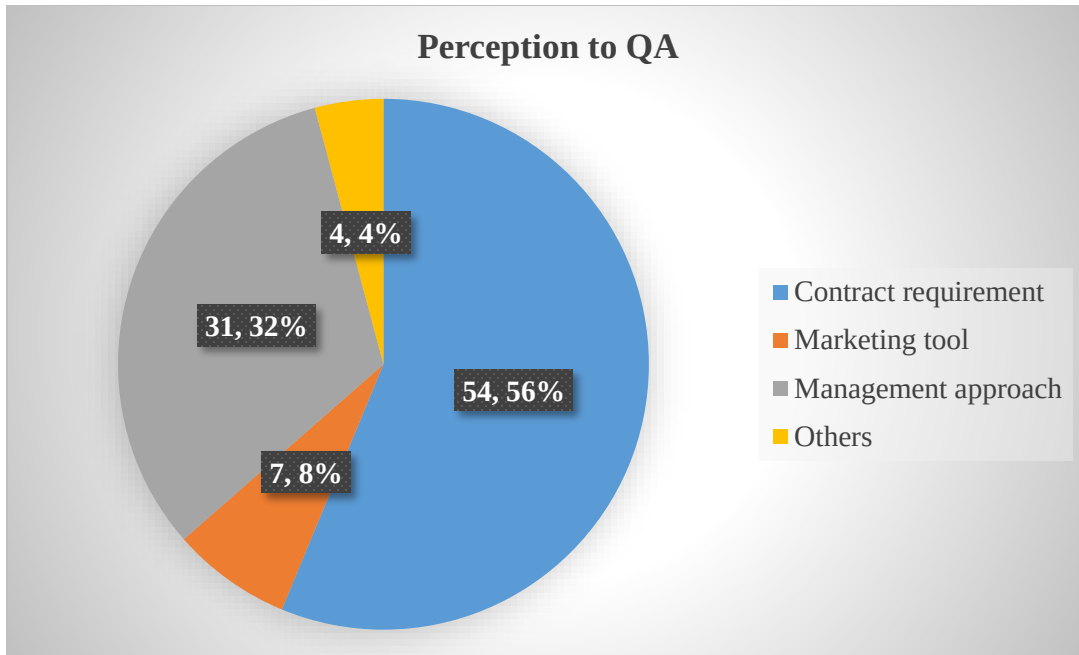


Figure 4. 4 Pie chart for respondent's perception to QA

From Figure 4.4. The respondent's general perception about quality assurance was 56% said that quality assurance as a contract requirement, 32% said that it was a Management approach and the other 8% marketing tool. The basic understanding from this chart was the quality assurance was seen as contract requirement for the purpose of achieving good quality, the other quality assurance should be seen as management approach.

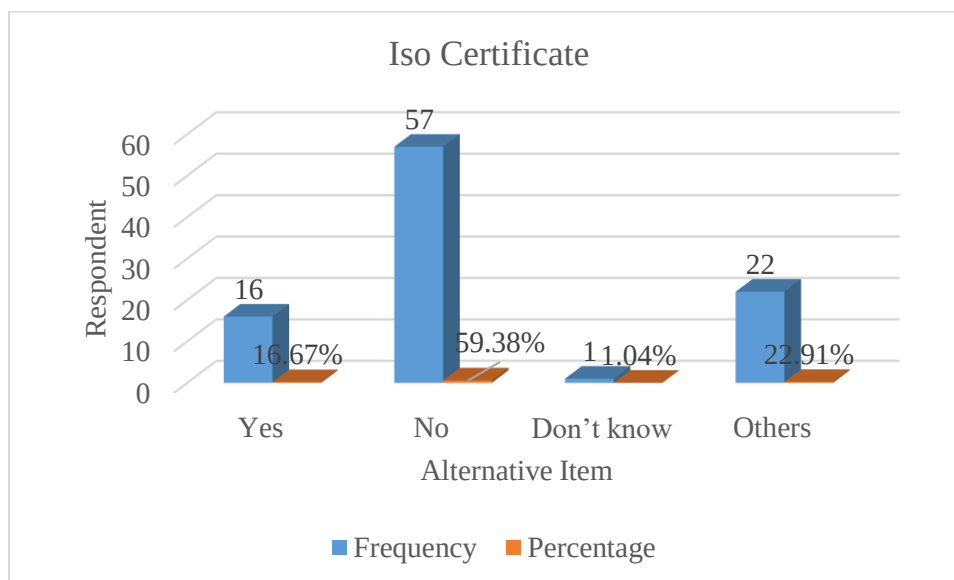


Figure 4. 5 projects have ISO Certificate

From figure 4.5. the respondents of, 59.375% said that there was no ISO certificate given by regulatory bodies of their company and only 16.67% of respondents have gotten ISO certificate with different years.

Table 4. 5 Analysis for quality assurance management practices.

Item	Frequency	Percentage
QA System		
Yes	35	36.45%
No	47	48.95%
In process	8	8.33%
Don't know	6	6.25%
QA Department		
Yes	20	20.833%
No	45	46.875%
In process	19	19.79%
Other	12	12.5%
Management support		
Yes	45	46.875%
No.	19	19.79%
Cannot say.	32	33.33%
Year of ISO		
Before 2000 E.C	12	41.37%
After 2000 E.C	17	58.62%
Clear Definition		
Yes	58	60.41%
No	17	17.71%
Can't say	21	21.875%
Improvement Plan		
No	21	21.875%
Such a plan is under consideration	41	42.71%
It has been implemented recently	19	19.79%
It has been implemented for some time now	15	15.625%

As shown in table 4.5. From the respondent's around 48.95% of the respondents also deal that there was no quality assurance system with their organization, 36.45% of respondents said there was a quality assurance system in their construction company and the rest 8.33% said that there was in process. From table 4.5 from the total respondent, 46.875% said there was no quality assurance department in their company, 20.833% said that there was quality assurance and the remaining 12.5% of respondents said in process for quality assurance department.

Of the total respondent, 46.875% said that there was a quality improvement plan with the full support of top management, 33.33% of the respondent cannot say about full support of top management and the remaining 19.79% said there was no full support of top management about quality assurance practice.

In addition to this weather, the organization developed a clear definition of quality assurance 60.41% of respondents argue that there was a clear definition of quality assurance, 21.875% of respondents cannot say about the definition of quality assurance in their organization, and the rest 17.71% said that there was no clear definition of quality assurance.

In addition to this weather organization, have quality assurances improvement plan was responded by respondents 42.71% said such a plan is under consideration, 21.875% No quality assurance improvement plan, 19.79% of respondent said It has been implemented recently and the rest 15.625% of respondent said It has been implementing for some time now.

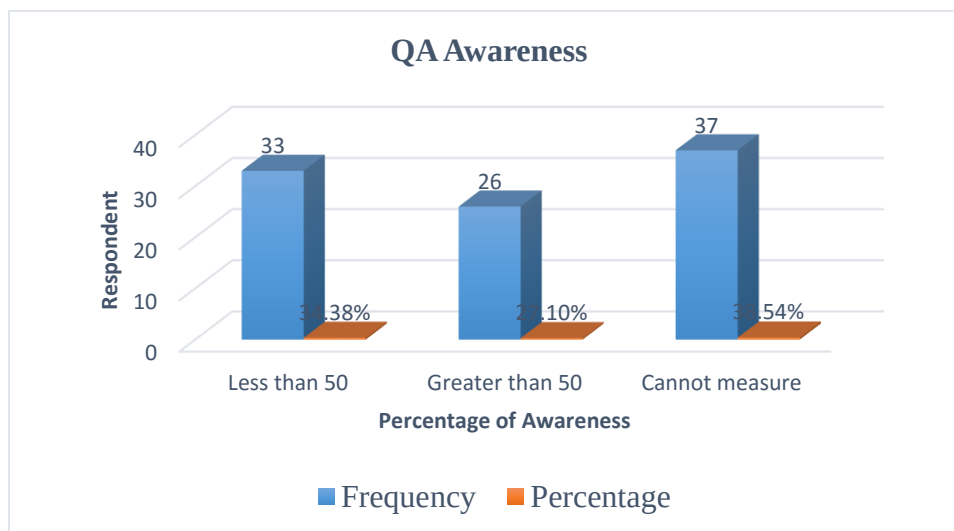


Figure 4. 6. Employer's awareness of QA in their project

From figure 4.6. As shown among 34.375% respondent said that the Percentage of employees who are aware of the importance of quality assurance was less than 50% and only 27.1% of respondents said the Percentage of employees who are aware of the importance of quality assurance was greater than 50% and the other 38.54% cannot measure.

4.2.1.1. Techniques used for QA management practice

This section was an analysis of the implementation of the quality assurance and management technique used for the construction of public construction projects in the case of Bahir dar project participants by the client, contractor, consultant, and regulatory body. This was had shown that the practical technique used for quality assurance and management practice.

Table 4. 6 Techniques for implementing QA management practices

No	The techniques	Level of importance					Total	A*N	RII	Rank
		SD	D	N	A	SA				
1	Project quality control management	7	11	3	41	34	372	480	0.775	1
2	Daily report	14	10	8	29	35	349	480	0.72783	9
3	Weekly or bi-weekly site report	6	16	9	36	29	354	480	0.7375	8
4	Work method statement	8	7	10	45	26	362	480	0.7567	7
5	Inspection	7	6	17	32	34	368	480	0.7667	3
6	Laboratory experiment	14	7	6	28	41	363	480	0.75625	6
7	Direct supervision	11		16	32	37	372	480	0.775	1
8	Involvement of workforce	6	7	26	35	22	348	480	0.725	10
9	Stakeholders communication	5	9	17	33	32	366	480	0.7625	5
10	Following instructions, standards and codes	8	5	18	29	36	368	480	0.76667	3

As shown from table 4.6. The Techniques for implementing quality assurances management practices was ranked as Project quality control management, Inspection, Direct supervision,

Following instructions, standards, and codes and Laboratory experiment takes the highest rank with one up to five and relative importance index value of (0.775, 0.766667, 0.75625, 0.775, and 0.766667) respectively. Besides, the rest was rank as Stakeholders' communication, Involvement of workforce, Work method statement, Weekly or bi-weekly site report, and Daily report rank from highest value to lower the value of (0.727083, 0.7375, 0.754167, 0.725 and 0.7625) respectively.

The techniques that we implement for quality assurance management practice as shown from the above table project quality control management was rank as the first this means that in the performing of construction projects one should consider the control mechanism, daily and site inspection for better performance, the direct supervision of works also should be consider for the implementation of quality assurance.

Recruitment of the Involvement of workforce or skilled labor in the construction project is another technique for quality assurance and in the project different parties shall be communicate each other for the sake of quality assurance management.

4.2.2. Major Factors That Affect QA Management Practices

The data were shown in table 4.7. Was the level of influence of factors with the relative importance index value of major elements by consultant, client, contractor, and regulatory body participated from Bahir dar public construction projects executed in the year 2007 up to 2012 E.c.

Table 4. 7 Major Factors of QA with Their level of Influence Based on RII Value

No.	Major quality assurance factors	Level of importance						A*N	RII	Rank
		VLI	LI	MI	I	VI	Total			
1	Project (type and complexity)		13	20	28	35	373	480	0.777083	5
2	Design		12	13	23	48	395	480	0.822917	2
3	Contract (method and agreement)		8	12	36	40	396	480	0.825	1
4	Material	12		10	30	44	382	480	0.795833	4
5	Labor	5	13	13	36	29	359	480	0.747917	9
6	Equipment	6	7	18	34	31	365	480	0.760417	7
7	Subcontractor	15	9	7	36	29	343	480	0.714583	14

8	Site layout	7	10	18	34	27	352	480	0.733333	12
9	Systems (quality control, cost control, safety program)	8	6	17	29	36	367	480	0.764583	6
10	Site staff	5	9	24	25	33	360	480	0.75	8
11	Execution(continuous,supervision, using shop drawing)	9		18	23	46	385	480	0.802083	3
12	Financial issues	5	10	22	29	30	357	480	0.74375	10
13	Owner(public, private)	5	11	21	30	29	355	480	0.739583	11
14	Environment(political, economic)	7	9	26	22	32	351	480	0.73125	13

As shown in table 4.7. The major factors that affect quality assurances management practice analyze by respondents were Contract, Design, Execution (continuous supervision, using shop drawing), Material, Systems (quality control, cost control, safety program) takes the first up to five ranks with a relative importance index value of (0.825, 0.822917, 0.802083, 0.795833 and 0.764583). this shows that Contract, Design, Execution (continuous supervision, using shop drawing), Material, Systems (quality control, cost control, safety program) was taken as a major factor for quality assurance management practices in Bahir dar public construction projects. According to the respondents contract is the first rank means that the contract agreement contract method and contract delivery method are the major factor that affect quality assurance.

And the other major factors Equipment, Site staff, Project (type and complexity), Site layout, Labor, Financial issues, and Owner(public, private) with a relative importance index value of (0.777083, 0.760417, 0.75, 0.747917, 0.74375, 0.739583 and 0.733333,) from highest value to lower the value of the level of importance of the major factors of quality assurance in public construction projects. Then from the result, the researcher concluded that public construction projects executed from Bahir dar should undertake the above major construction quality assurance management practices. In addition to this, the least major factors that affect quality assurance management practices Environment (political, economic) with the relative importance index value of 0.73125 and Subcontractor was 0.714583 relative importance indexes.

Based on the above result the major factors that affect quality assurance management practice the contract delivery and contract method takes the highest rank and also the design parameter also

another factor which was rank as the second and also execution of a given contract agreement by following continues supervision and using the detail drawing.

4.2.3. Mechanisms to Improve QA Management Practices.

The data presented in table 4.8. Shows that the mechanisms to improve quality assurance, management practices in public construction projects in the case of Bahir dar. The data shows that, the level of influence for mechanisms with the relative importance index value and rank was being provided.

Table 4. 8 Mechanisms to Improve QA with the level of Importance by the contractor, client, regulatory body, and consultant with RII value.

S. No	Mechanisms to improve QA	LS T	LR	H	HR	HST	Total	A* N	RII	Ran k
1	Employee involvement	6	7	30	28	25	347	480	0.722	17
2	Written program or policy	6	13	20	33	24	344	480	0.716	18
3	Criteria (pre-qualification in bidding process)	6	10	20	34	26	352	480	0.733	16
4	Regular meetings		9	23	40	24	367	480	0.764	9
5	Management commitment		7	22	30	37	385	480	0.802	3
6	Skilled workforce		7	24	25	40	386	480	0.804	2
7	Communication between managers and employers			24	33	39	399	480	0.83	1
8	Incentives for good performance		7	21	32	36	385	480	0.802	3
9	Regular inspection and audits		7	17	43	29	382	480	0.795	6
10	Review/analysis used to improve performance		15	19	31	31	366	480	0.762	10
11	Clearly defined goals and objectives	5	10	20	31	30	359	480	0.747 917	13
12	Avoid Complexity of Designs	5	11	18	26	36	365	480	0.760 417	11

13	Reduce Miscommunication Between Teams		7	29	39	21	362	480	0.754	12
14	Avoid Damaged and Low-Quality Materials		10	19	29	38	383	480	0.797	5
15	Well-defined roles and responsibilities		10	25	32	29	368	480	0.766	8
16	Adequate training and education on QA practices	6	17	8	30	35	359	480	0.747	13
17	Scope Creep (reducing)		10	30	34	22	356	480	0.741	15
18	Satisfaction of Contract Specifications		10	17	44	25	372	480	0.775	7
19	Reward scheme for innovative works	6	15	22	32	21	335	480	0.697	20
20	Follow Efficient Safety Programme	8	9	24	29	26	344	480	0.716	18

As shown in table 4.8. The mechanisms to improve construction quality assurances management practices respondents argue that Communication between managers and employers, Incentives for good performance, Avoid Damaged and Low-Quality Materials, Satisfaction of Contract Specifications and Follow Efficient Safety Programme was rank as the first and with a relative importance index value of (0.83125, 0.802083, 0.797917, 0.775 and 0.716667). This result shows the level of importance is highest than others. Thus, five items have equal rank due to their advantage of the quality assurance and management practices in public construction projects.

In addition to this, the mechanism to improve quality assurances management practice were ranked based on their highest value to lower value with their relative importance index. Accordingly, skilled workforce, regular inspection, and audits, well-defined roles, and responsibilities. Adequate training and education on QA practices, Scope Creep, and Reward scheme for innovative works ranked as the second mechanism to improve quality assurances management practices of public building projects with their relative importance index value of (0.804167, 0.795833, 0.766667, 0.747917, 0.741667, and 0.697917). In addition to this, the respondents also evaluate the mechanisms to improve quality assurances management practices

was Management commitment, Review/analysis used to improve performance, Avoid Complexity of Designs, Reduce Miscommunication Between Teams, Clearly defined goals and objectives, Regular meetings, Criteria used in pre-qualification in the bidding process, Employee involvement and Written program or policy ranked from third to last. In addition, with relative importance index value of (0.802083, 0.7625, 0.760417, 0.754167, 0.747917, 0.764583, 0.722917, 0.716667 and 0.733333). This takes the level of importance of mechanisms to improve quality assurances management practices from the relative importance of the highest value to lower value.

4.3. Summary of Interview

For the construction, industry like that public construction projects takes the highest amount of many due to this reason the research would include the perception of stakeholders with their understanding of quality assurance management practices in Bahir dar public construction projects. The interview was having conducted for contractors, designers, and Regulatory Bodies involved in public construction.

A. Summary of Contractor's Interview

When analyzing the interview conducted with the contractor, it is mention that workmanship quality in the public construction project is not up to standard and that it is dropping. Considerably taking in to account unrealistic periods and tight budgets allocated by the government as well as procurement systems being a major threat ultimately to poor workmanship quality. To improve these threats must be looked at, especially procurement systems which play major roles when it comes to factor such as time, cost and more so quality pressures exerted by the government such as time constraints and financial support, also have a major contribution towards poor workmanship in the construction process for the sake of quality assurance. Besides, the contractors will stress that benchmarking mechanisms are critical in achieving a good quality of workmanship and construction with intended quality assurance standards.

Per the contractor, it was having finally mentioned that the prospects of public construction projects in Bahir dar city promising. However, it requires continual monitoring and support from the government as well as developing communities, gaining the trust and full confidence in one another to make these developments as a success of good construction quality assurance.

B. Analysis of Interview by the Designer

The designer defined that quality and quality assurance has closely related to each other. It is mentioned that the word quality is interpreted very differently by each individual based on their, perspective. In the designer perspective, the word quality looking at public construction projects variety means a project, which is fit to live in, and serves its purpose. In addition to this, the designer's perspective the word quality assurance refers or tells to a policy or promise put in place to achieve a quality product. The designer further mentioned that there are certain factors, which the designer ascertains public construction projects in Bahir dar. For example, governments inconsistency when it comes to decision making as to what face public constructions represent to the public and so to the world. The current construction of housing in general also affects the design and development of public construction projects with the intended quality.

From the perspective of the designer, the public construction projects in Bahir dar put the government under tremendous pressure which in turn is passed down to the designers who need to generate certain model designs in a stipulated period within a tight budget. The designer also further mentions that the periods and budgets allocated to public constructions like office accommodation's, industries, and institutional buildings is can ultimately give rise to a selection of inappropriate materials, approving a defective product, and a demanding client (government) forcing their decisions on certain construction products causing the design process to fall.

It was being gathered that the regulation of design models was being constantly employed, which was politically incorrect.in terms of the construction of public buildings. one of the major issues stand, was the delivery of the bureaucratic process was one of the major threats concerned for the design process of public construction project implementation and the major issues on quality assurance management problems.

The designer or supervisor also further mentioned that the procurement management system for a public construction project could have incorporated as a problem, affecting design quality because coherent design processes with their checks and balances are not in place. They lack different principles or those they were not sometimes following the regulations and standards this leads to redesign projects.

The designer however suggests that more self-help methods involving local skills should have employed to reduce costs as well as to minimize procurement misfortune. Lastly, the designer postulates that international appropriate benchmarking is important to achieve good design quality and through all of this, he believes that quality assurance would have achieved in public construction projects in Bahir dar for years to come.

C, the Regulatory Body

Based on the interview done with the regulatory body, it was mention that public construction projects and the problems it faces within Bahir dar have not yet have adequately mastered. Due to the project buildup, land availability becomes a problem causing conflict between community members. The regulatory body also adds that the government has set unrealistic periods to eliminate or better the buildup at present. It is, however, not achievable if one analyzes the amount of skilled labor and construction companies available. This puts quite a lot of pressure on construction and design companies but more so government itself.

Lastly, the regulatory body adds that to achieve a product with maximum quality of public construction projects, one need to establish better procurement measures as well as labor that is more skilled to bring about a quality product with the continuous support of well-established construction companies.

Generally when the interview conducted for contractor, consultant, and regulatory body which thus, directly involved in the construction of public building construction said that, the quality assurance management practice were have been under consideration.

but the government should have a serious control on the achievement of good quality of construction performance, on the other hand the quality assurance management was depend basically on the labor skilled and work methodology of the project. Then the interview conducted for thus parties, it has an additional point for the supporting of, the respective parties fill a questioner.

4.4. Results of the Selected Case Studies

For in order to select the case study the researcher first assessed the hall project and by time concerning the problem of quality assurance and identified the top three projects among the total

26 projects and considering the researcher gets enough information on the project status, project control mechanism and the seriousness of the issue.

A case study has been collect from three public building construction projects from Bahir dar city that have been under execution from the year 2007 E.C. to 2012 E.C. The data has been collect from archival documents, Discussion with participants on the project site, and monthly progress report from contractors and consultants. The general profiles of the projects such as project location, commencement date, completion date, contract period, contract amount, contractor, consultant, building purpose, building height, and project status, were included in the case studies. The case studies' findings are quality assurance and management practices and major factors affecting the quality assurance of the projects. The table shows the results of the selected case studies.

Project A

Location..... Bahir Dar

Commencement date..... 07-March -2019

Completion date..... 8-Jun-20

Contract period..... 458 calendar Days

Contract amount..... 70,026,711.57

Contractor..... Aa

Consultant..... AAA

Building purpose..... Workshop and office

Building height..... G+2

Project status..... 58%

In this project, the contractor is providing selected material from the query but due to the weather condition slow delivery of the material. In addition to this, the contractor faces the problem of Material delivery, Cash flow statement, and Manpower availability at the full site. This leads the project with poor quality and reduces the project age the contractor has no power to the next

work because of the cash flow problem, even the work may not continue unless this problem has solved cooperatively.

The consultants have no problem by itself. However, should follow the cases. That happened with the contractor issues of material, financial, and labor recruitment for ensuring the quality of construction projects with a different condition. In addition to this, the contractor faces for this project was the contractor has not submitted the requested schedule and has not mobilized enough labor to the site

Project B

Location..... Bahir Dar
Commencement date..... 04 Jan 2009 E.c
Completion date..... 2 Jun 2011 E.c
Contract period..... 879 days
Contract amount..... 89, 276, 000 ETB
Contractor..... Bb
Consultant..... BBB
Building purpose..... Office accommodation
Building height..... B+G+6
Project status.....65%

This project is having so many offices and it is a huge structure. It requires wide control all over the project status. Then I have already taken as one of the case studies for my paper and I get enough information about the quality problem. Those are in contractor case, the contractor has already not started with project mobilization time due to the contractor have so many projects from another place so he was a delay from the beginning time then the owner claims to the contractor, argue by the third party, and precede the task. This delay causes the construction work for the quality assurance problem. The consultant also does not approve payment certificates to the contractor due to poor laboratory experiments and the material that the

contractor uses was not specified on the specification they agree. The contractor also has material inflation in the year 2010 E.c. like the cost of cement, reinforcement is increasing from time to time. Based on the information they provide to me. The client also bankrupt.

Then according to the data, that I interview the project will complete for the future 300 days that means for the future one year postponed. Therefore, the quality of construction in this project was under risk. The regulatory body also observes the problem of this contractor case and provides an agreement with the client, contractor, and consultant.

Project C

Location..... Bahir Dar
Commencement date..... 21 September 2008 E.c
Completion date..... 15 Sep 2011 E.c
Contract period..... 1090 calendar days
Contract amount..... 132, 000,000 ETB
Contractor..... Cc
Consultant.....CCC
Building purpose..... Office and assembly
Building height..... B+ G+8
Project status.....82%

Generally the case study would have to support the analysis of questioner's and interview conducted by the respondent and the case study also shows that detail investigation of quality related issues that the project faced for the public project. Then the three project case studies were have summarized as the following table for the practice and thee problem of each individual on the trained of performance problem on the material availability contractor performance and site related issues were discussed.

Table 4. 9 Summary of projects with the QA perspective

Criteria	Projects		
	Project A	Project B	Project C
Problem of QA	✚ Unavailability of quality materials ✚ Conformance to specifications ✚ Unavailability of equipment ✚ Speed of delivering the project to the owner ✚ The contractor has not provided enough materials for the work activity needed ✚ Contractor poor management has made the construction progress behind the schedule ✚ Design changes happen after 20 % of work have executed	✚ Conformance to specification ✚ Unavailability of quality materials ✚ Sequencing of work according to schedule ✚ Number of that claims submitted from the contractor ✚ The performance of the contractors is a tolerable ✚ The machinery and manpower on the site is not sufficient and the material on the site is not satisfactory ✚ The contractor is not on the site for a successive month	✚ Unavailability of workmanship ✚ Cash flow ✚ Manpower ✚ Falling of materials from the building on peoples' moving near the site ✚ The contractor has not provided enough materials for the work activity needed ✚ The contractor has not mobilized enough manpower to the site ✚ Rejection of work ✚ Change in scope of work ✚ Material escalation ✚ In Accuracy of the data and methods

4.5. Discussion of the Findings

In this part of the research, the findings of the study were have discussed with the support of the relevant literature review, which was thrash out under chapter two. Therefore, the discussion was conducted in line with the three basic research questions that the research-based

4.5.1. Current QA Management Practices in Public Construction Projects

The current quality assurance and management practices, methods, and techniques were the first basic question for the researcher. Therefore, the current construction management practices based on findings show that overall organizations do not collect data to measure the performance of quality assurance. In addition to this, the researcher gets the measurement of customer satisfaction was measure by the different number of complaints arise this shows that there was no enough trained for ensuring customer satisfaction by conducting good quality of construction.

In the quality assurance management, practice the quality implementation and customers' satisfaction have a positive relationship so the need for rating suppliers or contractors have based on quality assurance performance. Therefore, the practice indicated for the overall organization has based on quality assurance performance. The other finding was suppliers or contractors pay for the defects com by themselves. Researchers also show organization perception about quality assurances management practices, the majority of organizations view or look us, it was a contract requirement and a management approach,

In addition to this, the overall organization's quality assurance practice shows that there was no enough quality assurance and management system for their project and in their organization. There was no quality department, but there was full support of top management for the construction quality assurance when we look the overall employees' understanding of trained and practice the majority of employees have less than 50% of knowledge about the quality assurances management practices and the basic definition of quality assurance. When we look at the quality assurance certificate for the ISO international standardization organization the majority of organizations have no ISO system.

Exploring Quality assurance management practice in public construction projects was using different techniques of management approach. The major techniques identified by the researcher was performing good project quality management, an inspection of site activities, direct supervision, conducting different laboratory experiment and following of appropriate instructions

standards and codes have ranked with one up to five and with high relative importance than other quality assurance management techniques.

4.5.2. Major Factors that affect QA Management Practices

Examining the current quality assurance management practice the researcher's basic question was the major factors that affect the quality assurance management practices in public construction was under consideration. Therefore, the researchers found that top or major factors affect quality assurance management practice in public construction contract takes the first rank among others this implies that the contract type and method affect the project quality assurance.

The second major factor that affects quality assurance based on the findings indicated that the design, material, system (quality control, cost control, safety program), and execution (continues supervision, use of shop drawings). The other equipment, site staff, financial issues, labor and project type, and complexity take the highest rank following the first and the second major factors that affect quality assurance and management practices in public construction projects.

on the other hand (M.Amer, 2002)) identified the major factors affecting construction quality assurance was Design and planning during the pre-construction phase, Developing and improving quality assurance and control systems, The financial level and standard of living of employees, The accuracy of cost estimating, the proper classification of contractors, consultants, and projects, Employees' consciousness.

The other researcher founds the major factors that affect quality assurance management practice (Rashed, 2014) identify the top five factors like Design: includes all things related to design-come from the designer and/or the owner side. Contract: is the prime contract between the owner and the contractor, Material: includes all things related to raw material and its suppliers, Labor: includes all the main working labor in the project, and Equipment: includes the main working equipment in the project.

Based on this the above researcher and the findings of the researcher major factors affecting quality assurance management practices summarized as a contract, design, equipment site staff financial issues, labor and project type, and complexity were the major factors affect quality assurance management practices.

4.5.3. Mechanisms to Improve QA Management Practices

This concept was the last basic question for the researcher was the basic issues that rose from different organizations to improve the mechanism of the quality assurance and management practice in public construction projects.

Therefore, the researcher's basic question to answer, the most important mechanisms to improve the quality assurance management practices were the first rank by the organizations was 1. communication between managers and employers, 2. Incentives for good performances, 3. Avoid damaged and low-quality materials, 4. The satisfaction of contract specifications and 5. Follow efficient safety program rank as the first with a high amount of relative importance index value.

In addition to this skilled workforce, regular inspection and audits, well-defined roles and responsibilities, adequate training and education on QA practices, scope creep, and reward scheme for innovative workers for their organization labeled as the second rank with their relative importance index.

On the other hand, good management commitment, review, or analysis used to improve performance, avoid the complexity of designs, reduce miscommunication between teams, and clearly defined goals and objectives was rank from their relative importance index value with respective of the above first and second mechanisms. In addition to this According to (Agbenyega et al., 2014) top mechanism to improve quality assurance management practices was ranked as Management commitment, Communication between managers and employees Employee Involvement, Detailed and logical work program, Regular inspection and audit of the quality report, Training and education of team members.

On the other hand, According to (Kidanu, 2014) the most important mechanisms to improve quality assurance management practices was ranked as Define the need for implementing an ISO quality system, Educate top management, Commitment from top management, Select a management representative, Select implementation team (QA task force) and Understand the current system and processes.

4.6. Construction QA Management Framework

One of the basic methods of analyzing the construction quality assurance and management framework for the researcher first identified the major quality assurance techniques, major factors that affect quality assurance management, and the improving mechanisms for quality assurance management for the construction of public building projects.

The conceptual framework was have done by IDEF0 software application for linking the factors mechanisms and techniques of quality assurance. IDEF0 or the **IDEF (Integrated Definition)** diagrams were having introduced in 1981 as part of the Integrated Computer-Aided Manufacturing (ICAM) project. Its features were

1. easy to use with drag and drop interface, premade symbols, and automatic formatting tools
2. accompanied by a plethora of well-designed templates and examples
3. designed with broad file format compatibility

The Benefits of Using IDEF0 to Model Industry Processes

1. Understanding - modeling helps discover the nature of the industry has modeled; that is, what was being done in the industry.
2. Communication - once understanding has been reached, the nature of the industrial processes can have documented and these documents easily communicated.
3. Enlightenment - modeling helps to uncover variances, redundancies deficiencies, and inefficiencies in the existing (as-is) industry process.
4. Improvement - a model allows you to select deficient areas of the industry and its processes and improve them.
5. Redesign - a model provides a tangible basis for redesigning the process, performing simulations of the redesigned (to-be) industry process as defined by the strategy. This means that strategies could have tested before implementation takes place.

Based on this the researcher finds the techniques, major factors, and improving mechanism and then formulated the first draft conceptual framework indicated in figure 4.10. Below

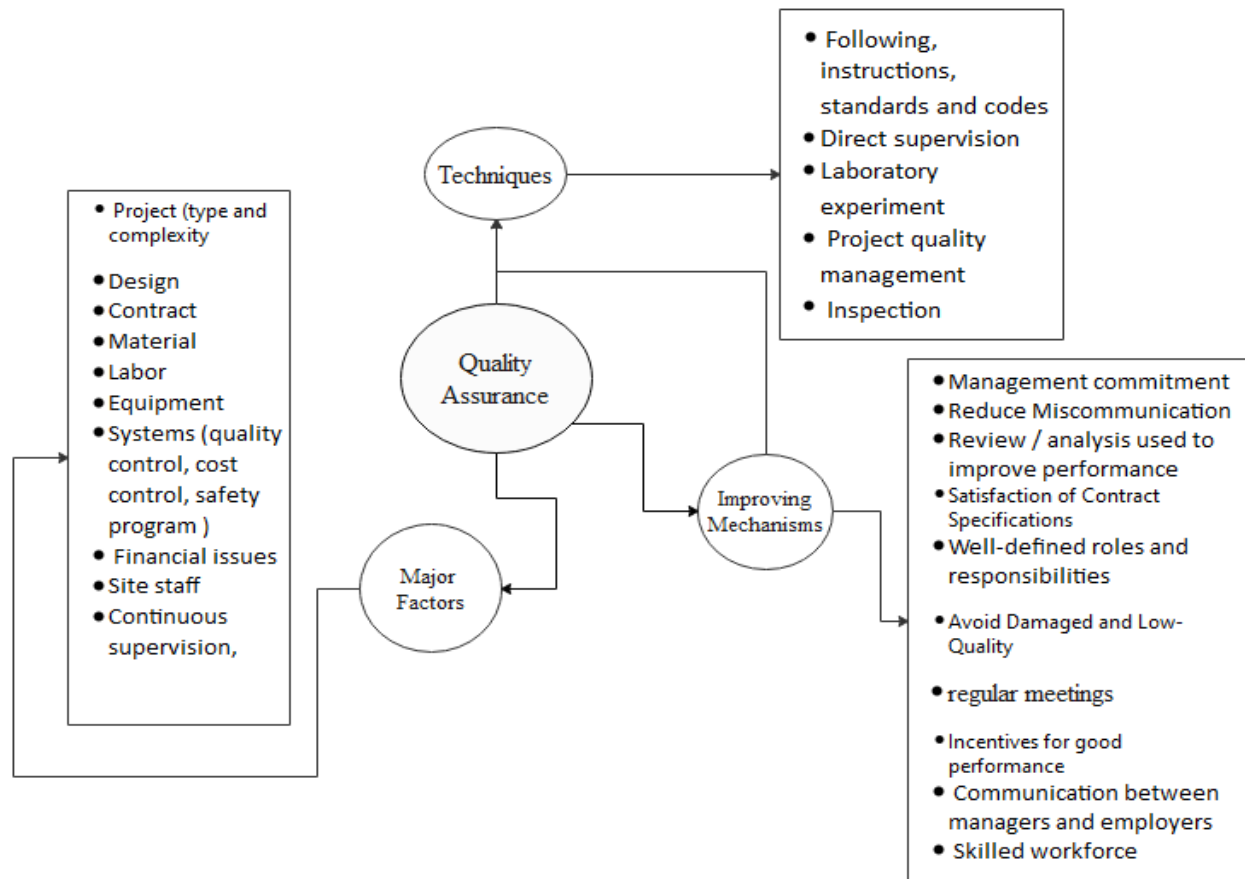


Figure 4. 7. First Draft Conceptual frameworks for quality assurances management practices

4.6.1 Checking validity of conceptual frame work

The conceptual framework for the QA management practices was formulated by the researcher first and then the validity checked by different experts who thus participated from the first questioner filled by thus and from interviews and university instructors who have long period of involvement in the construction industry. Then the researcher wants to validate the first draft-formulated framework and redesign based on experts opinions based on their experience among the researcher identifies two experts from public construction from Bahir Dar City and two from instructors from university which have individuals work for a long period for the construction project.

Expert 1. The expert one was from Amhara building works and enterprise offices and work as a consultant for more than 10 years. So his judgment about the framework as it was very good but he gave suggestion for the technique project quality control management should be replaced by as quality control manual and the other as an additional for improving mechanism using work methodology for each project.

Expert 2. He was from both university instructor and work as per timer for construction projects as a project manager, he suggest or gave a comment only the format of arrows. He tells both the technique and improving mechanisms were positive to QA then the arrows in into QA and the factors as indicated from the first draft since it was factor for Quality Assurance.

Expert 3. The expert three was from Amhara waterworks construction office and he was resident engineer and work as for morethan15 years in the construction. He also commented for the framework as the same as expert two and he also gave an additional for improving mechanism preparing work methodology and work schedule.

Expert 4. He was from university instructor and he was working for a long period as university lecturer and different construction projects. He looks the framework very well and an additional point he suggest as the technique using quality control manual, and the arrows should be in into QA and the improving mechanisms basic point as work methodology.

Expert 5. The expert selected from Amhara housing development office, and he was working for morethan11-13 years as regulatory body for different construction projects. He was admire about the QA management framework done by the researcher and he adds an additional point for major factor as periodic evaluation of site report and improving mechanism was using of methodology of work schedule.

Generally, after an in-depth validation the researcher also formulated the revised conceptual framework as indicated below by using IDEF0 software.

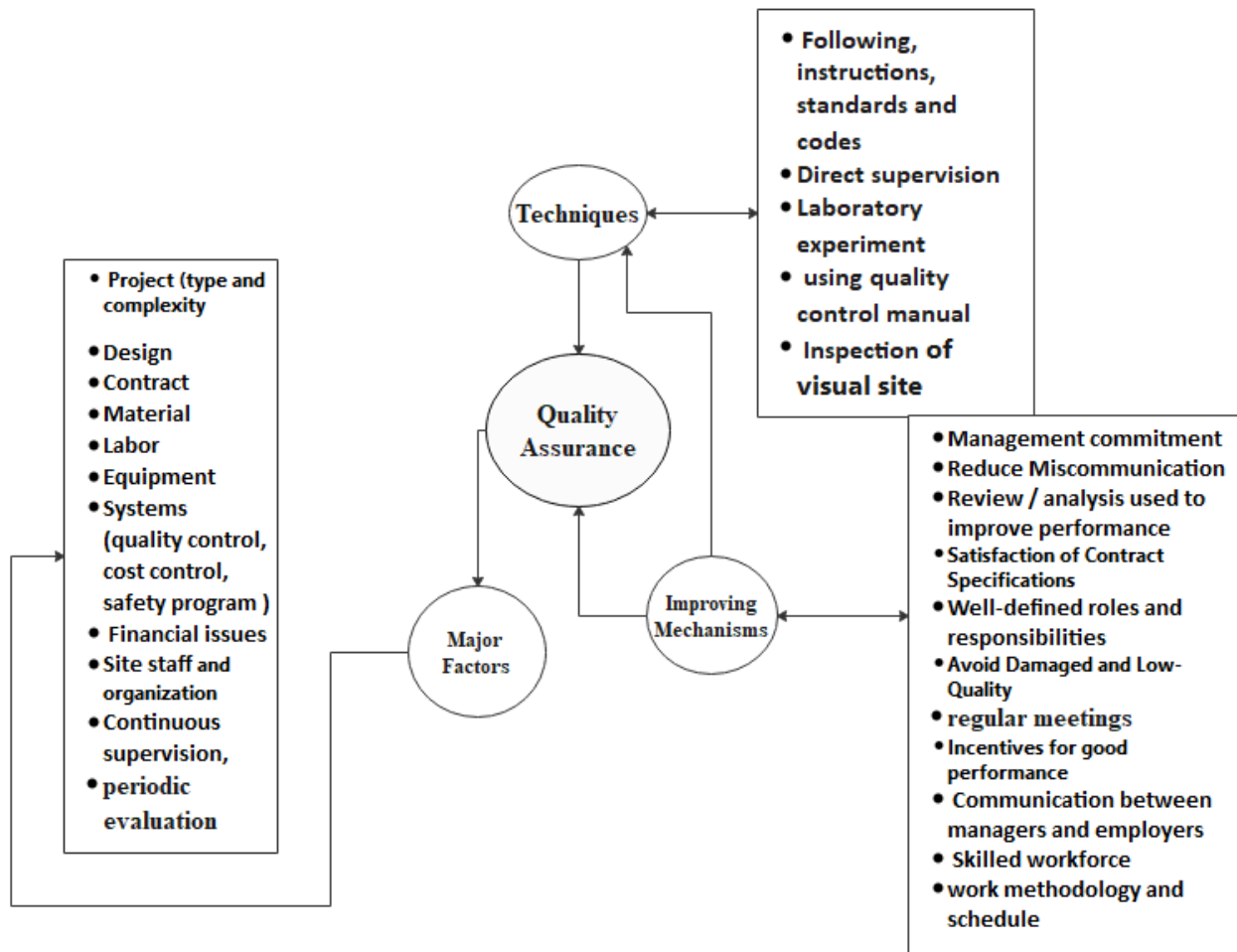


Figure 4. 8 Revised conceptual framework for Quality Assurance management

Finally the researcher assessed also the implementation of the conceptual framework in different projects. Since the project techniques, the improving mechanisms and the factors should consider for each activity. The project managers and contractors should also implement the above framework as a guide and perform or achieve quality assurance management. So in order to implement the stakeholders should consider the major factors that affect the quality assurance, and improve their project quality assurance by using the above improving mechanism and the techniques shall be implementing.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

This chapter points up the conclusion and recommendation of the study based on the findings obtained in the study area.

5.1. Conclusion

After the detailed analysis of the questionnaire, observations, case studies, and informal interviews conducted, with regards to investigation of QA management practices in public construction projects in the case of Bahir Dar City the following conclusions were drawn:

- Generally, current construction management practices in public construction projects from Bahir Dar city show that the overall organizations do not collect data to measure the performance of quality assurance. In addition to this, the researcher concludes that the measurement of customer satisfaction was measured by the different number of complaints arise this shows that there was no enough trained for ensuring customer satisfaction by conducting good quality of construction.
- The major techniques for QA management practices were performing good project quality management, an inspection of site activities, direct supervision, conducting different laboratory experiments and following of appropriate instructions standards and codes have ranked with one up to five and with high relative importance than other quality assurance management techniques.
- The researcher also concludes that the major factors that affect quality assurance management practice in a public project, construction contract takes the first rank among others this implies that the contract type and method affect the project quality assurance. While second major factor that affects the quality assurance indicated that the design, material, system (quality control, cost control, safety program) and execution (continuous supervision, use of shop drawings) have ranked by the relative importance index value.
- The most important mechanisms to improve the quality assurances management practices ranked as 1.communication between managers and employers, 2. Incentives for good performances, 3. Avoid damaged and low-quality materials, 4. The satisfaction of

contract specifications and 5. Follow efficient safety program rank as the first with a high amount of relative importance index value.

5.2. Recommendation

In all, the results of this study identified the practice of QA management, the major factors that affect QA management practices, improving mechanisms of QA management practices, and the techniques for QA management practices in the Bahir Dar public Construction Industry. Because of the above findings and conclusion, the following recommendations have made:

- Public construction industries shall provide the QA management department, should satisfy international standards like ISO certificate for their company. In addition to this, the researcher recommends that considering the technique and improving mechanisms for their project QA management practices.
- Quality Assurance cannot achieve without Management Commitment. Management responsibility should adequately resource the Quality Control Officer/ department to be able to function effectively and efficiently. In effect, the study recommends that Management should be highly committed to the achievement of Quality Assurance management practices in the Bahir Dar public construction firms.
- Based on findings, Quality Assurance cannot be achieved by the use of unskilled labor for any work that requires the expected of skilled labor. In most Bahir Dar public Construction firms, Contractors employ unskilled labor to execute the work of skilled labor, which in most cases results in poor workmanship, and hence, excessive non-conforming activities. Therefore, the study recommends the need for local Contractors in Bahir Dar public construction should always employ skilled personnel, and Consultants must properly evaluate professionally evaluate the human resource of the local Contractors.
- Education and training (seminars) are ways to improve upon knowledge and skills of the main stakeholders in the public Construction Industry. Therefore, Bahir Dar public project Consultants and Contractors should organize educational and training programs like the International Standard Organization 9001, 2008 on Quality Assurance to equip personnel to maintain Quality Assurance practices as part of organizational culture;

5.3. Implications for future researchers

Finally, the researcher recommends the following issues for future researchers and works.

- ✓ Develop a model framework for quality assurance and management practice for public construction projects.
- ✓ Comparative study on Ethiopian construction trained to other country on QC and QA on different international standards, codes and techniques.
- ✓ Evaluate major stakeholder's performance on the base of quality assurance and management practices.

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Appendix:

Appendix 1. Reliability test of the questionnaire

<i>Variables</i>	<i>No of items</i>	<i>Crombatch alpha</i>		<i>No of items deleted</i>	<i>No of the items used</i>
		<i>Before the final study</i>	<i>After the final study</i>		
Techniques for implementing quality assurance management	10	.703	.705	-	10
Factors affecting Quality assurance in construction projects	14	.608	.708	-	14
Mechanisms to improve quality assurance practices	20	.701	.713	-	20
Total crombatch alpha	44	.671	.714		44

Reliability

Case Processing Summary

	N	%
Valid	96	100.0
Cases Excluded	0	.0
Total	96	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.714	44

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Project quality management	336.1563	942.891	.434	.707
Daily report	336.4479	951.366	.196	.711
Weekly or bi-weekly site report	336.3021	956.866	.178	.712
Work method statement	336.4167	952.119	.226	.710
Inspection	336.1667	951.993	.260	.710
Laboratory experiment	336.0833	944.793	.327	.708
Direct supervision	336.0313	938.683	.543	.706
Involvement of workforce	336.6146	947.439	.371	.708
Stakeholders communication	336.2708	933.379	.582	.704
Following instructions, standards, and codes	336.1771	936.084	.498	.705
Project (type and complexity)	336.3021	955.876	.173	.712
Design	335.8229	948.063	.419	.708
Contract	336.0313	951.252	.352	.710
Material	335.7292	948.284	.397	.709
Labor	336.2708	952.179	.245	.710
Equipment	336.2813	946.036	.364	.708
Subcontractor	336.4375	930.438	.509	.703
Site layout	336.4688	952.904	.208	.711
Systems (quality control, cost control)	336.2396	940.268	.396	.707
Site staff	336.4167	936.540	.484	.705
Execution (continuous supervision,)	336.1250	940.595	.378	.707
Financial issues	336.4479	933.260	.546	.704
Owner(public, private)	336.5625	949.407	.280	.709
Environment(political, economic)	336.5521	932.860	.465	.704
Employee involvement	336.6667	949.888	.313	.709
Written program or policy	336.7188	944.141	.358	.708
Criteria used in pre-qualification in bidding process	336.5729	944.984	.341	.708
Regular meetings	336.4792	950.715	.329	.709
Management commitment	336.2813	944.899	.425	.708
Skilled workforce	336.2292	947.526	.356	.709
Communication between managers and employers	336.1458	953.431	.294	.710
Incentives for good performance	336.1979	958.645	.174	.712
Regular inspection and audits	336.2604	968.468	-.003	.715
Review / analysis used to improve performance	336.3438	954.228	.223	.711
Clearly defined goals and objectives	336.3646	946.066	.332	.708
Avoid Complexity of Designs	336.3021	938.655	.418	.706
Reduce Miscommunication Between Teams	336.5104	953.179	.312	.710
Avoid Damaged and Low-Quality Materials	335.9688	949.778	.390	.709
Well-defined roles and responsibilities	336.3021	946.318	.437	.708
Adequate training and education on QA practices	336.3125	938.554	.397	.706
Scope Creep	336.6771	956.537	.212	.711
Satisfaction of Contract Specifications	336.3958	943.589	.466	.707
Reward scheme for innovative works	336.7813	956.467	.177	.712
Follow Efficient Safety Programme	336.7188	955.615	.159	.712

Appendix 2. Correlation check

Inter-Item Correlation Matrix										
	Project quality management	Daily report	Weekly or bi-weekly site report	Work method statement	Inspection	Laboratory experiment	Direct supervision	Involvement of workforce	Stakeholders communication	Following instructions, standards and codes
Project quality management	1.000	.617	.453	.629	.397	.472	.416	.407	.633	.661
Daily report	.617	1.000	.535	.501	.227	.326	.176	.124	.313	.479
Weekly or bi-weekly site report	.453	.535	1.000	.552	.590	.253	.418	.173	.280	.400
Work method statement	.629	.501	.552	1.000	.643	.744	.422	.344	.619	.759
Inspection	.397	.227	.590	.643	1.000	.534	.434	.300	.317	.567
Laboratory experiment	.472	.326	.253	.744	.534	1.000	.491	.460	.559	.726
Direct supervision	.416	.176	.418	.422	.434	.491	1.000	.582	.493	.544
Involvement of workforce	.407	.124	.173	.344	.300	.460	.582	1.000	.513	.429
Stakeholders communication	.633	.313	.280	.619	.317	.559	.493	.513	1.000	.762
Following instructions, standards and codes	.661	.479	.400	.759	.567	.726	.544	.429	.762	1.000

Summary Item Statistics							
	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.067	3.719	4.302	.583	1.157	.033	10
Item Variances	1.071	.781	1.703	.921	2.179	.076	10
Inter-Item Correlations	.473	.124	.762	.637	6.129	.025	10

Techniques for QA	Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Project quality management	96	1.00	5.00	4.1771	.94027	.884
Daily report	96	1.00	5.00	3.8854	1.30481	1.703
Weekly or bi- weekly site report	96	1.00	5.00	4.0313	.99951	.999
Work method statement	96	1.00	5.00	3.9167	1.11135	1.235
Inspection	96	1.00	5.00	4.1667	.99119	.982
Laboratory experiment	96	1.00	5.00	4.2500	1.13323	1.284
Direct supervision	96	1.00	5.00	4.3021	.88401	.781
Involvement of workforce	96	1.00	5.00	3.7188	.90266	.815
Stakeholders communication	96	1.00	5.00	4.0625	.97130	.943
Following instructions, standards and codes	96	1.00	5.00	4.1563	1.03952	1.081
Valid N (list wise)	96					

Major factors

Descriptive Statistics						
	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Project (type and complexity)	96	1.00	5.00	4.0313	1.09979	1.210
Design	96	2.00	5.00	4.5104	.78129	.610
Contract	96	2.00	5.00	4.3021	.78297	.613
Material	96	1.00	5.00	4.6042	.81408	.663
Labor	96	1.00	5.00	4.0625	1.03428	1.070
Equipment	96	1.00	5.00	4.0521	.97732	.955
Subcontractor	96	1.00	5.00	3.8958	1.19190	1.421
Site layout	96	1.00	5.00	3.8646	1.13897	1.297
Systems (quality control, cost control, safety program)	96	1.00	5.00	4.0938	1.12463	1.265
Site staff	96	1.00	5.00	3.9167	1.05298	1.109
Execution (continuous supervision, using shop drawing)	96	1.00	5.00	4.2083	1.16001	1.346
Financial issues	96	1.00	5.00	3.8854	1.03486	1.071
Owner(public, private)	96	1.00	5.00	3.7708	1.06107	1.126
Environment(political, economic)	96	1.00	5.00	3.7813	1.21571	1.478
Valid N (listwise)	96					

Improving Mechanisms**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Employee involvement	96	1.00	5.00	3.6667	.93659	.877
Written program or policy	96	1.00	5.00	3.6146	1.06987	1.145
Criteria used in pre-qualification in bidding process	96	1.00	5.00	3.7604	1.08332	1.174
Regular meetings	96	2.00	5.00	3.8542	.85814	.736
Management commitment	96	2.00	5.00	4.0521	.88698	.787
Skilled workforce	96	2.00	5.00	4.1042	.93448	.873
Communication between managers and employers	96	3.00	5.00	4.1875	.81192	.659
Incentives for good performance	96	2.00	5.00	4.1354	.87803	.771
Regular inspection and audits	96	2.00	5.00	4.0729	.71443	.510
Review / analysis used to improve performance	96	2.00	5.00	3.9896	.98936	.979
Clearly defined goals and objectives	96	1.00	5.00	3.9688	1.06082	1.125
Avoid Complexity of Designs	96	1.00	5.00	4.0313	1.12814	1.273
Reduce Miscommunication Between Teams	96	2.00	5.00	3.8229	.78129	.610
Avoid Damaged and Low-Quality Materials	96	2.00	5.00	4.3646	.76941	.592
Well-defined roles and responsibilities	96	2.00	5.00	4.0313	.81374	.662
Adequate training and education on QA practices	96	1.00	5.00	4.0208	1.18747	1.410
Scope Creep	96	2.00	5.00	3.6563	.88053	.775
Satisfaction of Contract Specifications	96	2.00	5.00	3.9375	.85609	.733
Reward scheme for innovative works	96	1.00	5.00	3.5521	1.03486	1.071
Follow Efficient Safety Programme	96	1.00	5.00	3.6146	1.19973	1.439
Valid N (listwise)	96					

APPENDIX



Appendix 3. Questionnaires

Preamble

Quality Assurance has become a very popular subject in recent years due to conceptual changes in the construction industry. However, it appears that there is a lack of compromise among stakeholders on the practice.

Now I am conducting a study on quality assurance and management practice in public construction in the case of Bahir Dar City.

Attached is the survey of the schedule of interviews and information obtained from this survey will be kept secret and completely confidential? Only findings in aggregate form have be submitted to the relevant authorities.

Your participation in this survey is much need and I will be grateful if you could answer these few questions.

I would like to convey my appreciation for your cooperation in completing these questions. If you have any questions and contributions about this research, please mail

Me at zegeyeabrham12@gmail.com or call 0923524824

Thank you in advance for your participation and assistance with this study.

Respondent Background

1. Kindly indicate your status in your organization

Director/principal partner ☐

Associate partner ☐

Senior staff ☐

Trainee/intern ☐

Other (please specify _____)

2. For how long have you been working in this position?

<5 years ☐

5-10 years ☐

>10 years ☐

3. What type of client is your entity?

Primary ☐

Secondary ☐

4. Which type of Client are you?

a) A developer ☐

b) An Investor ☐

c) Owner-occupier ☐

d) Government Agency ☐

e) Quasi-government ☐

5. Which types of buildings do you normally undertake? Please select as many as are applicable.

a) Large scale Residential houses (not including storey type) ☐

b) Large scale residential houses (only storey type) ☐

c) Large scale residential houses (all types) ☐

d) Office accommodation ☐

e) Hostels, Hotels etc. ☐

f) Industrial buildings ☐

g) Institutional buildings e.g. School, hospitals etc. ☐

h) Self-occupying housing ☐

Others (Please state)...

Section I: Company profile

Please cross the appropriate response

1, please classify your organization

☐ Contractor

☐ client

☐ Consultant

☐ regulatory body

2. If you are contractor/consultant side which grade is your organization?_____.

3. Year of establishment_____

4. Title of position of respondent

- ☐ Manager ☐ Vice Manager ☐ Project Manager
☐ Site Engineer ☐ resident engineer

5. Number of employees ☐ less than 50 ☐ 50-100
☐ 100-200 ☐ Greater than 200

6. Type of projects your company dealing with

- ☐ Infrastructure
☐ Construction

Others (Please specify)_____

7. Number of projects executed in the last five years

- ☐ Less than 10 ☐ 11 to 20 ☐ 21 to 30
☐ More than 30

Section II: Quality assurance management methods, techniques and practices in your Organization.

1. Has your organization developed a clear definition of quality assurance?

- ☐ Yes ☐ No ☐ cannot say

2. Percentage of employees who are aware of the importance of quality assurance.....

3. Does your organization have a quality assurance, improvement plan?

- ☐ No ☐ Such a plan is under consideration
☐ It has been implemented recently ☐ It has been implemented for some time now

4. Below are several techniques for implementing quality assurance management in a construction projects. Please evaluate how each one can be beneficial for the projects and for the firm (please mark just one appropriate box)

1= strongly disagree 2= I don't agree 3=neutral 4= agree 5= strongly agree

The techniques	1	2	3	4	5
Project quality management					
Daily report					
Weekly or bi-weekly site report					
Work method statement					
Inspection					
Laboratory experiment					
Direct supervision					
Involvement of the workforce					
Stakeholders communication					
Following instructions, standards, and codes					

If other any please specify.....

5. Do you have your organization collect data to measure quality assurance?

☐ Yes, ☐ No ☐ don't know

6. How do you measure customer satisfaction?

☐ Not measured ☐ questioner survey

☐ By the number of complaints ☐ others specify

7. If your company has a quality system, do you think there is a relation between the quality implementation in construction projects and increasing customer satisfaction?

☐ YES ☐ Sometimes ☐ No

8. If your company has a quality system, do you think there is a relation between the quality implementation in construction projects and increasing the company performance?

☐ YES ☐ No ☐ Sometimes

9. Do you think that rating the suppliers/subcontractors based on quality assurance performance is?

☐ Not Significant ☐ Moderately Significant ☐ Slightly Significant
☐ Very Significant ☐ Exceedingly Significant

10. Our suppliers/subcontractors rate based on quality assurance performance?

☐ Yes ☐ No ☐ Sometimes ☐ Don't Know

11. Did the suppliers/subcontractors pay for the defects they made concerning quality assurances?

☐ Yes ☐ No ☐ Sometimes ☐ Don't Know

12. What is your organization's perception of quality assurance?

☐ Contract requirement

☐ Marketing tool ☐ Management approach ☐ others

13. Do you have a quality assurance system in your organization?

☐ Yes ☐ No ☐ In-process ☐ do not know

14. Does your company have a quality department?

☐ Yes ☐ No ☐ In-process ☐ don't know

15. Does your quality improvement plan have the full support of top management?

☐ Yes ☐ No. ☐ Cannot say.

16. Does your company have an ISO certificate?

☐ Yes ☐ No

17. If the answer is yes, mention the year of having ISO certificate? _____

SECTION A:

Main Factors affecting Quality assurance in construction projects during the construction phase.

1. Please identify (carefully) the degree of importance of elements that affect quality assurance in your construction project: Very important = 5 Important = 4 Medium important=3 Low important =2 Very low important = 1

No.	Main quality assurance elements	Degree of importance				
		5	4	3	2	1
1.	Project (type and complexity)					
2.	Design					
3.	Contract					
4.	Material					
5.	Labor					
6.	Equipment					
7.	Subcontractor					
8.	Site layout					
9.	Systems (quality control, cost control, safety program)					
10.	Site staff					
11.	Execution (continuous supervision, using shop drawing)					
12.	Financial issues					
13.	Owner(public, private)					
14.	Environment(political, economic)					

If any other elements please specify it.....

Section B:

In your experience, which factors are necessary to improve Quality Assurance practices in Bahir Dar public construction project? Please indicate the level of influences of each factor by ticking the appropriate boxes.

1-Lowest, 2-Lower, 3-High, 4-Higher, 5-Highest

S. No	Factors (mechanisms) to improve quality assurance practices in Bahir Dar public construction projects	Level of Constraint				
		1	2	3	4	5
1.	Employee involvement					
2.	Written program or policy					
3.	Criteria used in pre-qualification in the bidding process					
4.	Regular meetings					
5.	Management commitment					
6.	Skilled workforce					
7.	Communication between managers and employers					
8.	Incentives for good performance					
9.	Regular inspection and audits					
10.	Review/analysis used to improve performance					
11.	Clearly defined goals and objectives					
12.	Avoid Complexity of Designs					
13.	Reduce Miscommunication Between Teams					
14.	Avoid Damaged and Low-Quality Materials					
15.	Well-defined roles and responsibilities					
16.	Adequate training and education on QA practices					
17.	Scope Creep					
18.	The satisfaction of Contract Specifications					
19.	Reward scheme for innovative works					
20.	Follow Efficient Safety Programme					

If other any factor please list down.....

Thank you in advance for your time and participation!!

STRUCTURED INTERVIEWS

For consultant and contractor

1. As a designer/contractor what does the words quality and quality assurance mean to you?

2. Are there any problematic issues relating to the design/construction processes for public projects for quality assurances? If yes state what these problems are?

3. To you as a designer/contractor what can be done to achieve good workmanship?

4. Is Government an influential player in the cause of these problematic issues?

If Yes or No please, state the reasons why?

5. Based on these issues what can be done to achieve a good design?
