AN EVALUATION OF APPLICATION OF QUALITY ASSURANCE IN CONSTRUCTION OF PRIVATE BULDING PROJECTS IN TANZANIA

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AN EVALUATION OF APPLICATION OF QUALITY ASSURANCE IN CONSTRUCTION OF PRIVATE BUILDING PROJECTS IN TANZANIA

By

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CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by the Ardhi University a dissertation entitled "***An Evaluation of Application of Quality Assurance in Construction of Private Building Projects in Tanzania*****"** in fulfillment of the requirements for the degree of Masters of Science in Construction Economics and Management of the Ardhi University.

……..……..

Dr. Harriet Eliufoo

(Supervisor)

Date …….

DECLARATION

AND

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I **Karima Ameir Ahmed,** hereby declares that this dissertation is my own original work and has not been presented to any other University for similar or any other degree award.

……..

Karima Ameir Ahmed

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DEDICATION

My work is humbly dedicated to my family who gave me support in the whole period of taking my Master's Degree. Also I would like to devote this dissertation to all who have participated in this study, thanks.

ABSTRACT

In Tanzanian, most of the privately owned residential apartments start to deteriorate few years after the practical completion, some of which need so many maintenance works to be done, as a result making the maintenance costs to be higher for the life of a building. Quality Assurance (QA) is a mechanism which is used to ensure that the quality of the project which is constructed conform with the specified requirements set prior to the execution of the project.

This study aimed at evaluating the implementation of quality assurance in construction of private building projects in Tanzania. Achieving the objective, the study has examined the implementation of quality assurance, challenges towards the implementation of quality assurance and recommending ways of enhancing the implementation of quality assurance in construction of private building projects in Tanzania. The dimension of quality assurance implementation under the study includes preparation of quality assurance plan, the use of quality assurance techniques and other requirements needed in co-operation with the technique.

Selection of projects was done purposively basing on the category of multi-storey residential apartments building projects which are currently in progress owned by private individuals, located in Dar es Salaam and are in a range of 2 storey up to 20 storey. Questionnaire survey was the main tool used to gather data relating to this dissertation. Total numbers of questionnaires were 67, only 44 were responded. Analysis of raw data was done using SPSS version 25.

The study reveals that, many of the supervisors are not familiar with some other techniques of implementing QA with the exception of inspection technique and implementation is done without considering other requirements in co-operation with the technique used. Preparation of QA plan, site meetings, and quality peer reviews, frequency of site visit and adequate time of approving material are not fully considered when assuring quality at site.

The study recommends ways that can be used by project supervisors so as to enhance the implementation of QA in construction of private building projects in Tanzania

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ACRONYM AND ABREVIATION

ACRONYM	DEEFINITION
ASQ	American Society of Quality
CQA	Construction Quality Assurance
CRB	Contractor's Registration Board
ISO	International Standard Organization
PDRI	Project Definition Rating Index
PS	Project Supervisor
QA	Quality Assurance
QC	Quality Control
QFD	Quality Function Deployment
SPSS	Statistical Package for the Social Science

CHAPTER ONE
INTRODUCTION

1.1 Introduction

Chapter one is the introductory part of the research which includes background, research gap, objectives, significance, scope and limitation of the study. It also illustrates the existing problem behind the study and explain a briefly methodology used in the study.

1.2 Background of the Study

In construction Industry the key goal of Architects and Engineers is to design construction projects which are of good quality and which can satisfy client's needs, and also on the other hand the goal is to make sure that the constructed projects are according to the design, standards, specifications and quality set during the design stage. According to Ashokkumar (2014), one among the critical factor for the achievement of construction works is quality.

The ISO 9000 definition of quality control states that, quality control is a part of quality management focused on fulfilling quality requirements. According to GE Company (2007), the contractors are the ones who are supposed to conduct construction works according to standards and specification and at the same time making sure that the construction works are exactly as the drawings provided by the consultants. On the other hand, the consultants' duty is to perform the Quality Assurance independently and on daily basis in order assure the quality of the works and to confirm the effectiveness of the contractor's Quality Control program.

The ISO 9001:2000 definition of Quality Assurance states that quality assurance is part of quality management focused on providing confidence that quality requirements will be fulfilled. It is also defined as a mechanism which is used to ensure that the quality of the project which is constructed conform with the specifications set prior to the execution of the construction works. QA can be determined as the method of evaluating and assessing how the construction project is being performed on a regular basis so that to give confidence that the project's quality standards will be achieved. The principal purpose of QA is to meet contract requirements during construction works. Quality assurance personnel on a daily basis has to make sure that the contract requirements are being achieved by the contractor's work (Ashokkumar, 2014).

Clients have to make sure that they have QA personnel because they cannot oversee the operations during construction by themselves. There must be a third party who is responsible to assure quality of the project and check if the contractor is performing according to the requirements or not, so that to provide confidence to the client that the work has conformed to the standard and specification and thus the quality product.

In public owned building projects there is a great involvement of Construction Quality Assurance (CQA) Consultant who is permanently engage for the work to ensure that the quality of the construction works is well assured. According to Zegeye (2021), Quality Assurance practice in public construction projects is done by using different techniques of management approach, the major technique used is inspection of site activities, direct supervision, conducting different laboratory experiment and following appropriate instructions.

On the other side, there is less attention and effort towards assuring quality of construction work in privately owned building projects. Fernandez (2015), mention that there is absence of specific quality assurance plan which will help to perform the task. Much less emphasis in assuring the finish quality of the construction works in privately owned building works since the repairing of defects do not imply serious consequences, despite the usual complaints and dissatisfaction of the clients.

Miller (2019) has mentioned that, the Construction Quality Assurance (CQA) Consultant/personnel is a party who is working independently with the contractor, subcontractors, suppliers at the site. The CQA personnel may be the engineer, the architect or a quantity surveyor. The responsibilities of CQA personnel is to manage, coordinate and implement the CQA activities and making sure that the construction drawings and specification set are being followed by contractors during the construction works.

Hoonakker et al, (2010) have identified that, there are existing barriers which challenge the improvement of quality in construction works. The barriers include, many of the construction works are very large, they include so many labourers and stakeholders in one location, each of which have their own perception about the same project and the nature of the projects process together with so many changes involved in construction works during the process. The existence of many changes can cause completion delay, quality complaints and rework.

Construction projects are subjected to so many changes during the construction process, these changes may be due to unclear identification of client's requirements, incomplete details drawings such that some of the details may be produced during the construction. Quality of construction project is at risk if there are changes in the details of the design of a project which are done frequently throughout the construction process.

According to Rumane (2018), for the better implementation of QA in any construction site has to be conducted on time and as per requirements mentioned in well prepared QA plan. Furthermore, Miller (2019), has mentioned that the key aspect of enhancing the QA implementation is by preparing and having QA procedures before starting construction activities. Mane & Patil (2015), have indicate that construction project checklist are used as quality tool in construction works as quality in workmanship and due importance to be given for customer satisfaction.

1.3 Research gap

Literature review was done in different researches which were conducted before, hence a gap was obtained. The summaries of previous researches done relating to implementation of quality assurance in construction are as shown in table 1.1 below.

Table 1.1 Summary of previous researches done relating to implementation of QA

Title	Author Details	Key issues researched	Finding	Remarks
Quality Control and Quality Assurance in building construction	Lakshmi, 2015	The research intended to evaluate the use of Quality Function Deployment (QFD) as a management tool to benefit project managers in the United States	The quality of buildings was ensured through an integrated system of quality assurance performed by the Construction Manager and quality control provided by the contractors.	The research did not look on the extent of implementation of QA, problem faced during the implementation and ways of enhancing the implementation of QA in construction of residential apartments which are privately owned in Tanzania.
Quality Assurance and quality control for project Effectiveness in Construction and Management	Salvi et al, 2020	To identify the prerequisites for QA and QC and develop the concepts and procedures. Also to understand the concept of QA and QC specifications and apply to building construction	The process of implementing Quality Assurance and Quality Control System is clearly understood that quality doesn't happen by chance, it has to be managed at every stage of the product.	The research did not look on the extent of implementation of QA, problem faced during the implementation and ways of enhancing the implementation of QA in construction of residential apartments which are privately owned in Tanzania.

Comparative study on Quality Assurance of Construction Project in Taiwan and Japan	Tsung – Chieh et al, 2010	This study made the comparison of different concepts on quality assurance of construction project in Taiwan and Japan.	In Taiwan, the process is concerned as important. But in Japan, the qualification and who is in charge may be concerned as important.	Paper concentrates on comparing the QA of construction between Taiwan and Japan but it did not look on extent of implementing QA, problem faced during the implementation and ways of enhancing the implementation of QA in construction of multi-storey residential apartments in Tanzania
Construction Quality Assurance/ Quality Control Plan - Groundwater Source Control Measure	Robinson et al, 2011	To present the Construction Quality Assurance/Quality Control requirements for construction of the Groundwater Source Control Measure (GW SCM) in Portland.	The requirements for the preparation of construction quality assurance and quality control plan has been identified.	The study only looked on the requirements of construction QA and QC for construction of Ground water source control measure but it did not look on the extent that the construction supervisors are implementing QA, problem faced during the implementation and ways of enhancing the implementation of QA in construction of multi-storey residential apartments in Tanzania.
Analysis of construction quality assurance procedures on Federally Funded Local Public Agency Project	Konrath et al, 2016	To document the quality assurance requirements and specific areas needing improvement on Local Public Agency projects in the United States and identify any existing best practices that could resolve the shortcomings.	The findings of this study showed that smaller LPAs often lack the resources to perform construction QA and to consistently complete the QA documentation required on federally funded projects	Paper only considers the QA procedures on Federal Funded local Public Agency Project, but it remain silent on the extent of implementing QA, problem faced during the implementation and ways of enhancing the implementation in construction of multi-storey residential apartments in Tanzania.

Source: Research gap

1.4 Statement of the Problem

The construction industry has been struggling with quality issues for many years. Faulty construction is taking place in many of the construction works since the quality product of the construction projects are not according to the quality standards set prior to the commencement of the construction works (Ashokkumar, 2014). It is of great importance

to focus on establishment and implementation of quality assurance system so as to be able to upgrade the construction quality (Tsung-Chieh, 2010).

In Tanzanian building construction projects there is involvement of technical and professional personnel from the beginning to the end of the projects. But, most of the privately owned residential apartments start to demand replacement of components few years after the practical completion especially for service items, some buildings are requiring premature maintenance and others shows malfunction of items. All these results to maintenance costs to be high over the life of a building.

In addition, quality problems which are as a result of poor quality assurance implementation are experienced even before the practical completion, as it was noted in 2013 in Tanzania a privately owned 16 storey residential apartment which was under construction had collapsed in Dar es Salaam. The reasons noted which led to the collapse was substandard concrete and steel bar reinforcement (Simbeye, 2013).
Hence, the study aimed at evaluating the implementation of quality assurance in construction of private building projects in Tanzania.

1.5 Objectives of the study

1.5.1 Main objective

To evaluate the implementation of quality assurance in construction of privately owned building projects in Tanzania.

1.5.2 Specific objectives

The specific objectives of the study are:

i. To examine the quality assurance implemented in construction of privately owned building projects in Tanzania.
ii. To examine the challenges towards implementation of quality assurance in construction of privately owned building projects in Tanzania.
iii. To recommend ways of enhancing implementation of quality assurance in construction of privately owned building projects in Tanzania.

1.6 Research questions

i. How quality assurance is being implemented in construction of privately owned building projects in Tanzania?

ii. What are the challenges towards the implementation of quality assurance in construction of privately owned building projects in Tanzania?

iii. What are the appropriate ways of enhancing the implementation of quality assurance in construction of privately owned building projects in Tanzania?

1.7 Significance of study

Since the study has aimed in evaluating the implementation of quality assurance in construction of privately owned building projects in Tanzania, it will help to identify as to what extent the quality assurance personnel/supervisors/consultants are implementing the quality assurance in construction of residential buildings in Tanzania.

In addition, the study will help to enhance the implementation of quality assurance, which intern will lead to reduce maintenance needs of the buildings, mitigate any possible risk which can happen during and after construction and improving quality of buildings at large. The study will also be useful to the students and other stakeholders on conducting research concerning quality assurance issues in construction of residential buildings in Tanzania.

1.8 Scope and limitation of study

The study aims at evaluating the implementation of quality assurance in construction of buildings with a limited focus of privately owned multi-storey residential apartments in Tanzania, since many privately owned residential apartments are subjected to quality problems. Also the study is only limited to the construction phase.

In addition to the above, the study will focus on those privately owned multi-storey residential apartments which are in Dar es Salaam only. This is due to the fact that in recent years there has been rapid growth in population in Dar es Salaam which has resulted to an increase in construction of multi-storey residential apartments owned by private individuals.

1.9 Research methodology

The research design for this study is the descriptive research design. The studies used to describe the characteristics of a group or particular individuals are known as descriptive research studies (Kothari, 2004). The research approach used is the qualitative research approach. According to Hammarberg et al, (2016), qualitative research approach used to answer questions about experience, meaning and perspective.

The target population of the study are the multi-storey residential apartment buildings projects which are in the past two years have been constructed or currently are in progress, owned by private individuals and have been registered by CRB to be constructed in Dar es Salaam, since it will be easy to obtain relevant and current data for the study from the projects registered in the past two years in which some of them may still be under construction, thus respondents could be easily available. Also since population in Dar es Salaam is increasing day by day and according to Andreasen (2013), Dar es Salaam is a prime example of a rapidly growth city in sub-Saharan Africa, it has an average growth rate of 5.8% per year. Thus, many residential apartments are being built currently.

The projects registered by CRB which are located in Dar es Salaam are 80 projects. The unit of analysis are the multi-storey residential apartment building projects. The respondents include the Architect, Engineer or Quantity Surveyor who is currently employed by the Client to supervise the construction works.

Sampling procedures; sampling technique used is purposive sampling, the project samples were selected basing on the category of multi-storey residential apartments building projects which are currently in progress. The sample size is 67 which was calculated using formula form Yamane (1967), which is, $n = N/ (1+ N(e)^2)$. Where; N = Population size, e = sampling error (i.e the desired precision, eg 0.05 for 95% confidence level) and n = sample size. Both primary and secondary data collection tools were used. The primary data collection tool used was the questionnaire survey and the secondary data were collected through published books, journals, papers and articles. The secondary data were used for the purpose of conducting and composing an intensive literature review. The data were analyzed by using the IBM SPSS statistical version 25.

1.10 Organization of the Dissertation

The first chapter of this research gives the background in a nutshell, research gap, statement of the problem, objective of the study, significance of the study, scope and limitation of the study and as well as the brief methodology.

The second chapter provides brief illustration of construction projects, quality in construction industry, factors to consider for a good quality construction works, quality assurance concept, implementation of quality assurance in construction works, barriers in implementing quality assurance and lastly the conceptual framework.

The chapter three of the study illustrates the methods, tools and techniques of the study which includes, research design and approach, the population of the study, sampling design and sample size, data collection methods and data analysis method used.

The fourth chapter presents the presentation of the data obtained, illustration of the data together with the analysis and discussion of the data. The fifth chapter gives the conclusion which was drawn from the analysis done in chapter four which reflect each specific objective and the recommendations.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

Literature review is an extensive search-related survey of prior investigations. Even if it may frequently be extensive, up to decades, maybe reaching centuries of content, it has to be closely made to address the scholarship directly linked to the search issue (Kothari, 2004). This chapter aimed at reviewing the existing literature on Quality Assurance concept, implementation of Quality Assurance in the construction industry.

2.2 Definition of terms used in the study

Private Clients: - These are individuals apart from the government and private organizations who own the building which is under construction or which has been constructed (Harvie, 2021).

Project Supervisors: - These are technical personnel who have been engaged by clients to supervise and ensure that the construction of buildings conforms to the standards and specifications and as well as satisfying client's needs (Harvie, 2011).

Quality: - In this study the term quality is defined according to t Mane & Patil (2015), is the fulfillment of expectations (i.e. the satisfaction) of the project participants.

Quality assurance: - In this study Quality Assurance (QA) is all the whole process of planning the systematic activities and implementing them so as to give confidence that the facility is constructed as specified in design and that the material used in construction are according to specification (Wilson, 2018).

Quality assurance implementation: - It is the whole process of performing quality audits and quality systematic activities so as to guarantee that the product conforms to the standards and specifications set and as well as satisfying client's needs (Ashokkumar, 2014).

2.3 Construction projects

Projects which involved the renovation, refurbishing, erection and construction of buildings, bridges, roads are the construction projects. Construction projects involve the activities of assembling the infrastructure and buildings (Harvie, 2011). According to Safa et al (2015), construction projects can be small or mini projects and large scale projects. Usually in small or mini projects supervision may not be considered since the

work is small which can be performed by skilled labourers without any supervision. On the other hand, in large scale projects supervision of the work is crucial and cannot be escaped by any chance.

In large scale projects, technical personnel in construction works must be involved in both stages, during the design stage and as well as in construction stage. Safa et al (2015) has identified that, in the design stage the architect and engineers are supposed to design the project, whether it is an infrastructure or a building, the design should consider clients' needs, the existing environment condition of the site in which the project is going to be erected and as well as the laws and regulations governed in the construction industry at that particular area. During the construction stage, these projects are supposed to be supervised by the architect, engineers and/or quantity surveyor making sure that the projects are constructed according to the design, standard and specification set during the design stage.

2.3.1 Types of construction projects

The construction projects are categorized into, building construction projects, infrastructure and industrial construction projects. According to Safa et al (2015), using Project Definition Rating Index (PDRI) projects in construction industry can be classified into three, which are; projects in the category of buildings, infrastructure and industrial.

Most of the infrastructure construction projects are public owned. The building and industrial construction projects can be privately owned or public owned. All of the projects falling under these categories whether public or privately owned if in large scale are supposed to be supervised by a technical personnel who have knowledge in construction works.

2.3.1.1 Building construction projects

According to Safa et al (2015), these are construction projects which are normally constructed so as they can be used for living, as offices or social interaction activities. The building construction projects includes houses, apartments, hospitals, schools, banks, shopping centers, warehouses, offices and the like. Normally, these types of construction projects are designed and supervised during construction by architects, engineers and quantity surveyor. Most of these construction projects are not complex in nature.

2.3.1.2 Infrastructure construction projects

These types of construction projects are normally designed and supervised by Structure Engineers. These projects are constructed so as to provide facilities like transportation of goods and people, also transmission, distribution and collection of goods (Safa et al, 2015). The infrastructure construction projects include bridges, mass transit, highways, rail roads and canals, power generation and transmission and the like. These types of construction projects are complex in nature thus careful and proper supervision of construction work is needed, most of these kind of projects are public owned.

2.3.1.3 Industrial construction projects

The industrial construction projects as defined by Safa et al (2015), are types of construction projects which includes water treatment plants, power plants, manufacturing industries and the like. These kinds of projects are normally designed and supervised by architects, mechanical and structure engineers as well. Normally, the industrial construction projects can be owned by the private organization or can be owned by public. The construction of industries is complex which needs careful design procedures and proper supervision of works during construction.

2.4 Quality concept

2.4.1 Quality definition

The international Organization for standardization (ISO DIS 9000:2000), formally defines quality as the degree to which a set of inherit characteristics fulfils the requirement. Many authors defined quality, for instance, Juran (1998) has define quality as fitness to use. Juran has concentrated on the end product if the product is fit and can be used without any defect then it is of good quality. According to Crosby (1979), a product is said to be of good quality if it conforms to the requirements and/or specifications. Quality has been also defined by Deming (2000) as the enjoyment that someone get after using a product or service.

Abusa (2011), has mention that, the definition of quality can be classified into five. The definition of quality can be transcendent (excellence) based definition, product based definition, user based definition, manufacturing based definition and value based definition.

i. **Transcendent (excellence) based definition:** In this type of definition quality product is the product in which its goodness can be noted. According to Al-Tayeb et al (2008), this type of definition is very subjective.

ii. **Product based definition:** In this type of definition quality of a product can be described using measurable variable. Any differences that occur between the products reflect the existing differences in some ingredients or attributes that each possess. According to Syaj (2015) **i**f the product has got some measurable characteristics than the other, then it is said to be of good quality.

iii. **User based definition:** In this definition, quality can be defined as the extent in which a product satisfies user's needs (Syaj, 2015). If the user of certain product is satisfied, then the product is said to be of good quality. This kind of definition is more subjective since a product can satisfy one user's needs but cannot satisfy the needs or requirements of the other user. According to Rabaya (2013), user-based definition of quality is widely accepted and considered one of the key concepts of Total Quality Management.

iv. **Manufacturing based definition:** In this definition, the focus is on the conformance of specifications. Quality is the desirable outcome of manufacturing practices, or conformance to specifications (Rabaya, 2013). In other words, it can be described as, if the end product conforms to the standards and specification set before producing it then it is said to be of good quality. According to Syaj (2015), this definition of quality has an internal focus, in contrast to the external focus of the user-based approach, and quality is considered as an outcome of manufacturing practices. Deviations from design specifications result in inferior quality, and consequently increased costs due to rework or product failure.

v. **Value based definition:** Syaj (2015), has mentioned that the value-based definition of quality equates quality with performance at an acceptable price, or alternatively conformance at an acceptable cost. The value based approach regards quality as relative to price (Claessens, 2018). A product is said to be of a good quality if its price is much higher than the other product. An expensive product can be defined to be a good quality product rather that a cheap product.

2.5 Quality in construction industry

Any project in construction works is termed as a good quality project if the constructed parts meet the standard and specification set before the execution of the works. According to Rumane (2011), construction work is said to be of good quality if it satisfies owner's need in a determined budget and schedule. Quality in construction means that a project is completed within the defined guidelines set out in the scope of work (Ellis, 2021). Setting the scope of works, standards and specifications is the guideline of how the project is intended to be achieved, it also give the guideline on how to achieve the required project.

There are several factors to consider in determining the construction quality. The major factor is that if the final product performs its intended purpose, others are like if during the construction works the standards and specifications are fulfilled, if the project have been completed within time scheduled and if owner's requirements are met within the budget. If all the mentioned factors are met without any conflicting events, then the construction work is said to be of good quality.

Lack of construction quality is a situation in which the product in construction say building, bridge or road does not meet standards and specifications set before, does not fulfill owner's requirements and even during the construction process does not comply with the contract.

2.5.1 Factors to consider for a good quality construction works

According to Ellis (2021), having proper quality planning, oversight supervision, proper communication, skilled labourers and training will ensure that the end product in construction is of good quality.

2.5.1.1 Planning

Ellis (2021), has explained that to achieve a good quality product in construction, proper and comprehensive plan that identifies exactly what are the client and the contract requirements and how these requirements can be fulfilled is needed. The responsibilities of each personnel involved in the project should also be clearly mentioned and the respective personnel should know the extent of their responsibilities.

2.5.1.2 Oversight

Quality auditing/quality assurance is needed to as to achieve high quality construction work. Not only contractors who have less experience can make mistakes during construction process, but also most experience contractors can make hidden mistakes too. According to Ellis (2021), a third-party inspector or auditor who is qualified and expert in construction works has greater chance of finding and spotting quality issues during construction so as to avoid serious quality problem to occur.

2.5.1.3 Communication

Plangrid & FMI (2021), has discussed that communication chain which describes who to communicate with and how to communicate should be clearly described in the contract document for a construction work of good quality. Miscommunication can create quality problems during the construction work and eventually can cause delay of works. A breakdown communication between construction project team members leads to quality loss.

2.5.1.4 Training and labor

Skilled labourers are required in any construction site so as to conform with the quality standards and specification of the specific construction project (Ellis, 2021). In addition, training concerning quality issues, how to avoid quality problems, how quality of the specific project can be achieved is needed to both skilled and unskilled labourers.

2.6 Quality assurance

2.6.1 Definition of quality assurance

The ISO 9001:2000 definition states that quality assurance is part of quality management focused on providing confidence that quality requirements will be fulfilled. According to Savale (2016), quality assurance covers matters which influence the quality of the product. It is all the organized arrangements aiming to ensure that the end product is of the desired quality.

Quality assurance is the whole process of planning the systematic activities which can be implemented so as to provide adequate confidence that the product will meet quality requirements (Ashokkumar, 2014). Myhub (2019), has defined quality assurance as the end-to-end process of monitoring and evaluating the performance of products or services.

2.6.2 Implementation of quality assurance in construction

Quality assurance is concerned with planning and developing the technical and managerial competence to achieve the desired objectives set by the client. It is also concerned with the management of people, addressing the roles, duties and responsibilities of individuals. Quality assurance is primarily the Quality assurance must also be actively employed throughout the total building process, from initial feasibility, briefing and conceptual stages, throughout the assembly process, to the completion of the project and the operation of the asset (Howarth & Greenwood, 2018).

For QA to be in good practice assessment of the quality of constructed work and identification of areas in which improvements and corrective actions are needed and can be made is required. It is advised to review the constructed works in parts and not in a whole, because some problems could be hidden and could not be seen if the review of works is to be done in a whole after fully completing the construction activities of a building.

The Quality assurance personnel is supposed to conduct quality peer review before handing over the construction works to the client in order to make sure that the works has no defect and make corrections where needed. According to Kerzner (2001), it is the quality assurance function that attempts to ensure that the project scope, cost, and time function are fully integrated. Quality assurance is important in many reasons, which includes: -

i. It helps to ensure customer expectations are satisfied.
ii. Enhancing the reputation of the entity responsible for the construction works in a way that if in the QA process and quality audits, the quality of the constructed part being audited is good and meeting the requirement, then the entity responsible for the construction activities is gaining reputation.
iii. It helps in controlling cost and also minimizing unnecessary cost which are as a result of reworks.

2.6.3 Techniques used in implementing Quality Assurance

Ashokkumar (2014), has mentioned the techniques which can be used in implementing quality assurance in construction works. The techniques are process checklist/project audits, check sheet, flowcharts and pilot survey.

2.6.3.1 Checklist/project audits

Checklist can be used in the project quality audit of quality assurance, in checklist all items to be checked and audited are listed, this can help the quality assurance personnel not to skip any item in construction work in the whole process of quality audit (Ashokkumar, 2014). Checklist is a tool which helps to identify if all steps required in construction works have been followed or not. Project audits is a thorough review of a process involved in creating deliverable parts or products. This helps the auditors which are the quality assurance personnel to determine whether steps have been followed to maintain and improve quality in construction works or not. In construction works and through auditing the process the auditor could be able to track and identify whether the correct procedure has been followed or not so as to attain quality. By reviewing steps in the construction process, an auditor can identify possible quality issues from unfilled assurance standards.2.6.3.2 Quality Check sheet

Check-sheet is a method which can be used in assuring quality in construction, the checklist helps to record events which conforms to quality and those which did not conform to quality in construction works (Ashokkumar, 2014). The quality check sheet is usually prepared in advance so that it can help in problem identifying how often the problem has occurred and solving the problem.

2.6.3.2 Flowchart

Flow chart is a diagram/chat which use symbols to provide a clear picture of the work flow or process. The flow chart is used to elaborate each stage and events in construction work. The data obtained in the flowchart can be analyzed and eventually show if there are problems or not (Ashokkumar, 2014). A flowchart is used in assuring quality in construction by verifying the steps and procedures set before if they have been followed or not in conforming to the quality of the construction works.

2.6.3.4 Inspection

Inspection is the whole process of examining the quality of ongoing and completed construction works. By using inspection method material to be used can be determined if they conform to the standard and specifications so that they can be used in construction works without causing any problem.

2.7 Barriers in implementing quality assurance

Syaj (2015), has mentioned that there are several barriers that are encountered in implementing quality assurance as part of quality management in Palestine construction sector. Among the barriers that have been mentioned are: -

i. Lake of owner's awareness about the importance of quality in projects
ii. Lack of communication between project's parties
iii. Lack of education and training to drive the improvement process
iv. Insufficient attention to achieve quality by workers in project
v. Absence of advance planning for projects
vi. Lack of employees'& workers' commitment/understanding & resistance of quality programs

Other researchers like Hoonakker et al (2010), has also mentioned that the nature of construction process is one among the problem which can cause difficulties in the whole process of assuring quality in construction works. The nature of construction is a complex system which involves many individuals, each of which have their own perspectives and interests, in which when are brought together may cause several changes during construction works. The changes can cause delay of construction works, complaints from the client and also rework.

On the other side managerial and employee recognition of quality is other barrier in implementing management system with the purpose of perusing quality. It has been suggested by Beckford that management team in construction work have to recognize the importance of having good quality work. Quality should not be scarified in lieu of meting customer demand (Beckford, 2016).

2.8 Conceptual framework

A conceptual framework is a structure which the researcher believes can best explain the natural progression of the phenomenon to be studied (Camp, 2001). According Grant & Osanloo (2014), to conceptual frame work show the relationship between the concepts concerned in a study. It elaborates in a diagrammatic way so that it can give a clear picture of the concepts in a study relate to each other. A researcher could easily identify the concepts in the research by the use of conceptual frame work (Luse et al, 2012). Conceptual frameworks can be in a diagrammatic representation, graphical representation

or even in a narrative form elaborating clearly the key variables in a research to be studied (Miles and Huberman, 1994).

According to Akintoye (2015), conceptual framework is the simplest way of presenting problem in question and ideas of how to overcome the problem. On the other hand, the conceptual framework also show reason as to why the research topic is worth studying and clearly identifies how the researcher conceptualize the ground of his/her approach (Evans, 2007). A conceptual frame work is a researcher's own constructed diagram which shows clearly the existing relationship between the variables of the study (Adom et al, 2018).

Independent variables are variables that the experimenter manipulates or changes and is assumed to have a direct effect on the dependent variable (McLeod,2019). Symeou & Lamprimou (2008) mentioned that the independent variables usually the variable that produces an effect of a result on a dependent variable. In this study the independent variables are the production and implementation of quality assurance plan, the use of quality assurance techniques and other requirements needed in co-operation with the technique used which are sample approval, testing, conduction of peer reviews. The implementation of the variables will ensure the quality of buildings constructed.

The multi – storey residential apartments which are privately owned building are mainly characterized to have low quality. Excessive rework and loss to client has continuously occurring during the construction of the buildings. In addition, since the end product is of low quality the owner experiences excessive needs of maintenance when the buildings are in use.

Dependent variables are those variables which have to be tested and measured in a particular research. The dependent variables are variable whose values are modified by an independent variable (Symeou & Lamprimou, 2008). In this study the dependent variables which are the output of implementing quality assurance are the project performance which includes performance with regard to quality, time and budget, other dependent variables include minimum maintenance needs, mitigating risk of building to collapse and clients' satisfaction.

The Figure 2.1 below shows the existing relationship between dependent and independent variables. Mitigating the problem of having low quality work, excessive rework during construction, loss to clients, delay of works during construction, ending up with substandard work and excessive needs of conducting maintenance after finishing the construction, supervisors should implement the QA during the construction as required. This can be done by having QA plan at site, by the use of QA technique at site together with other requirements needed in co-operation with the technique used. Eventually project performance will be achieved, maintenance needs and risk of having substandard buildings will be reduced and finally clients will be satisfied with the end product after the construction.

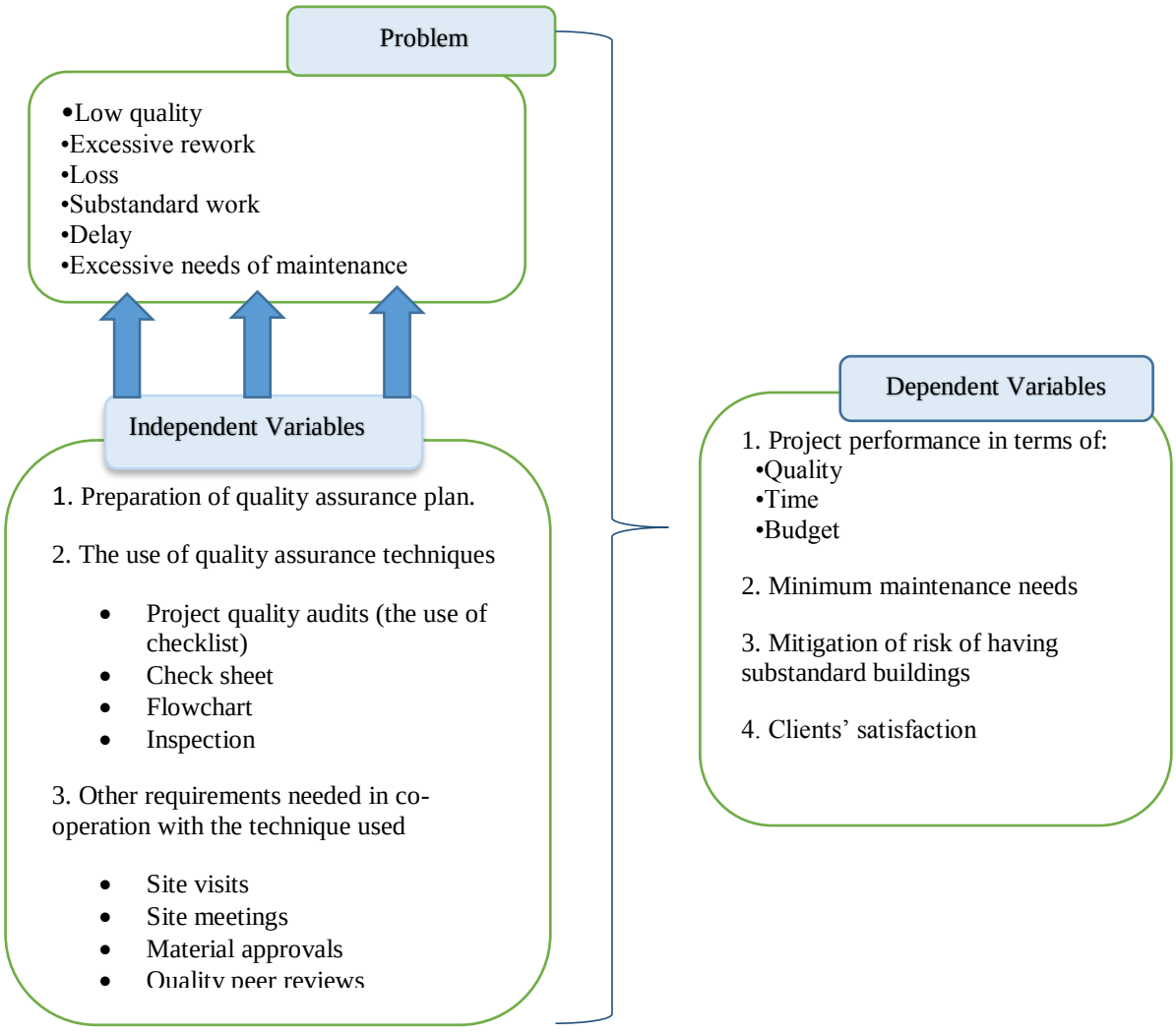

Figure 2.1: Research Conceptual Framework

Source: Own construction

2.9 Chapter summary

This chapter explains all the quality aspect which relates to the study in question. The chapter gives the explanation of construction projects, quality concept which includes quality definition and quality in construction industry. Also in this chapter the quality assurance concept, implementation of quality assurance in construction and barriers in implementing quality assurance have been discussed.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

According to Kothari (2004), research methodology is a science of studying how research will be conducted and the methods used to accomplish a research work. It can be determined as the process of solving the research problem. Various steps are identified logically by a researcher in solving the problem in question.

This chapter explains how the research was carried out and consists of research approach, research design, population and unit of analysis, sampling design and sample size, data collection methods, how data will be analyzed and as well as the validity and reliability of the research instrument.

3.2 Research Design

A research design is the procedure used in a research process for collecting and analyzing data, it is a conceptual structure in which the researcher designs to conduct the research. (Kothari, 2004).

The descriptive research design is used in this research. The studies used to describe the characteristics of a group or particular individuals are known as descriptive research studies (Kothari, 2004). Moreover, Orodho (2003) mention that in many of the descriptive design, data is being collected by the use of questionnaire survey and interviewing the intended sample. Therefore, this type of design can describe clearly the characteristics of technical personnel who have been employed by client to supervise the work, on how they are implementing the quality assurance during the construction of multi-storey residential apartments which are privately owned buildings in Tanzania.
The aim of this study is to evaluate the implementation of quality assurance in construction of private building projects in Tanzania.

3.3 Research approach

In this study the research approach to used is qualitative research approach since the data collected will not be a numerical data. In addition, the data collected will give clear information about the experience, perspective and characteristics of the technical personnel (supervisor) who have been employed by client to supervise the work, on how

they are implementing the quality assurance in the construction of multi-storey residential apartments in Tanzania. Qualitative approach to research is concerned with subjective assessment of attitudes, opinions and behavior (Kothari, 2004). According to Hammerberg et al, (2016), qualitative research approach used to answer questions about experience, meaning and perspective.

3.4 Research process followed during the execution of the research

The first step is to know and identify the problem which exists so as to be able to come up with the study in relation to the existing problem. After identifying the problem, intensive literature review was done to obtain the gap. The first step in the research process is to identify a problem, once the research problem is identified, the next step is to review the existing literature related to the research problem (Singh, 2021). There that the research topic was formulated, followed by main objective, specific objectives and the research questions.

Literature review was then prepared by reviewing past journals, article and researches conducted in relation to construction industry as whole, quality in construction works, quality cost and quality assurance in building construction works. The existing problem and the intensive literature review conducted helped in the formulation of conceptual framework. After that research methodology together with the questionnaire was then formulated, addressing the objectives of the study and eventually help to find answers of the research questions.

The point of sample is to collect data from the sample members. Data is collected in a variety of ways depending on the research question, the study design and the nature of the sample, the most commonly used methods of collecting information are questionnaires, interviews and through observation (Arthur & Hancock, 2009). After collecting the first hand data from the answered questionnaire by the supervisors who are employed by private clients to supervise the multi-storey residential apartments, data analysis and discussion of findings was done which help in drawing the conclusions and recommendations concerning with the study. The research process is as illustrated in the Figure 3.1 below.

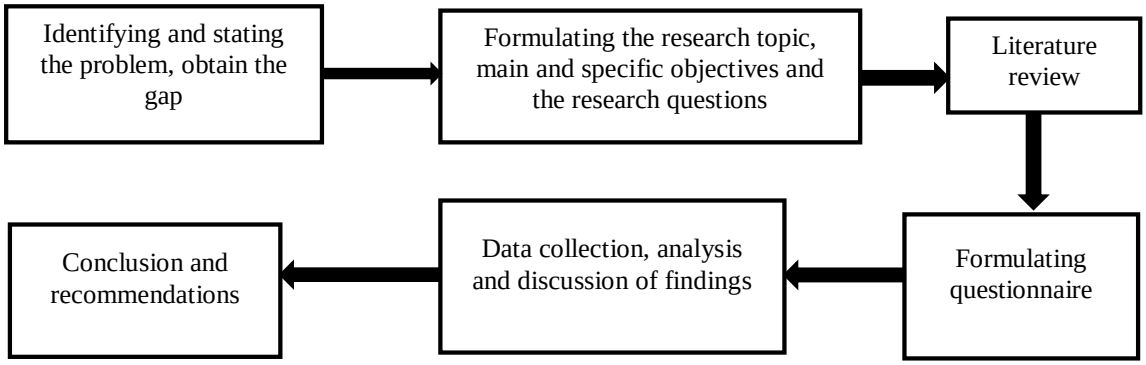

Figure 3.1: Research process

Source: Own construction (2021)

3.5 Population of the study

The unit of analysis are the multi-storey residential apartment building projects located in Dar es Salaam, owned by private individuals and have been registered by Contractors' Registration Board (CRB). According to Contractors Registration Board (2021), the experience shows that in Dar es Salaam the multi-storey residential apartment building projects are registered at a reasonable level.

Population of the study refers to set of individuals or objects or a group that is main focus for scientific inquiry, (Kumar, 2011). Since the study intends to evaluate the implementation of quality assurance in construction of private building projects in Tanzania, then the target population of the study are the multi-storey residential apartment building projects which are in the past two years have been constructed or currently are in progress, owned by private individuals and have been registered by CRB to be constructed in Dar es Salaam.

The required information can be easily obtained from the projects of the last two years and it was easy for the researcher to meet the respondents who are the supervisors at sites which are in progress. They include the Architect, Engineer or Quantity Surveyor who are currently employed by the Clients to supervise and make sure that the multi-storey residential apartments are constructed according to standards and specifications.

3.6 Sample size

According to Kumar (2011) sampling is the process of choosing few members from a certain intended group in which will become a basis of collecting relevant information

needed and which can represent the whole group. The process of selecting sample to the population is of advantageous because it saves time as well as financial and human resources.

A sample size is the number of few members selected forms the certain intended group. Always the sample size should be optimum; it should neither be too small nor large. An optimum size of sample is the size in which it can represent the whole group and all the required information could be obtained (Kothari, 2004). According to the list of registered projects from CRB the number of registered multi-storey residential apartments building projects in Dar es Salaam from 2019 to 2021 and which are currently in progress and are privately owned is eighty projects. This implies 80 projects have been selected to obtain the sample of this study.

To obtain the sample size, the study used the below formula form Yamane (1967), which is

$$n = N/ (1+ N(e)^2)$$

Where;

N = Population size

e = sampling error (i.e the desired precision, eg 0.05 for 95% confidence level)

n = sample size

$$n = 80/ (1+80(0.05)^{2)}$$

$$n = 66.66 \text{ approximately } 67$$

Therefore, the sample size is approximately 67 projects

3.7 Sampling Designs

According to Kothari (2004) there are different types of sample designs based on two factors, the representation basis and the element selection technique. On the representation basis, the sample may be probability sampling or it may be non-probability sampling.

In this study the non-probability sampling design has been used. According to Kothari (2004), non-probability sampling is the sampling procedure which cannot afford to have a probability of including each member of the population in the sample. The purposive

sampling has been used, selection of samples has been done deliberately to obtain samples in which the information needed, which is the whole process on how the site supervisors are implementing the quality assurance at site can be easily gathered.

From the list of registered projects from CRB, the purposive sampling techniques were used to select samples to be studied, the project samples were selected basing on the category of multi-storey residential apartments building projects which are currently in progress, owned by private individuals, located in Dar es Salaam and are in a range of 2 storey up to 20 storey. Then questionnaires were distributed to the sample in which the information needed will be obtained. The respondents included Clients' representatives in charge of supervising the projects which includes professionals such as the Architect, Engineer or Quantity Surveyor who are currently employed by the Clients.

3.8 Data collection method

Data collection method is the method used by the researcher in order to find data relevant to the research which is being conducted. According to Kothari (2004) the task of data collection begins after a research problem has been defined and research design plan checked out. There are two types of data, which are primary and secondary data.

3.8.1 Primary Data Collection

According to Kothari (2004), the primary data are the original information from the respondent and are unique in character. The primary data are those which are collected for the first time and are original for the research, the use of questionnaire survey were preferred for collection primary data.

3.8.1.1 Questionnaire Survey

The questionnaires were administered with respect to the specific objectives, so that the data obtained should reflect the study. The questionnaires were sent hand to hand by the researcher to the respondents. Questionnaire were distributed between early January 2021 and mid-February 2021.The advantages of questionnaire which have been mentioned by Kothari (2004) are;

i. It is cheap to be conducted if the sample is large and widely spread.
ii. There is no bias of the data as compared to interview.

iii. The data obtained are originally the respondents' own words.
iv. Respondents are given a plenty of time to reply to the questions given.

The questionnaire was divided into four sections, section A, B, C and D. In section A respondents were supposed to give their personal data, section B covered matters concerning the implementation of quality assurance, section C covered factors hindering the implementation of quality assurance and section D covered the ways of enhancing the implementation of quality assurance.

3.8.2 Secondary Data

The Secondary data for this research were collected through published books, journals, papers and articles which is another source where varieties of current materials will be obtained, providing information on quality assurance implemented in the construction of buildings projects. These data were used for the purpose of conducting and composing an intensive literature review.

3.9 Parameters for quality assurance implementation

In this study the parameters for quality assurance implementation includes: -

i. Preparation of quality assurance plan
ii. The use of quality assurance technique and
iii. Other requirements needed in co-operation with the technique used

3.9.1 Preparation of quality assurance plan

One of the most useful requirement in quality assurance is the preparation of quality assurance plan before the commencement of construction activities. Findings in this study aims to explore the production and usage of the quality assurance plans employed in the construction of multi-storey residential apartments. According to Miller (2019), building construction quality assurance plan consist of definition of project team members and their responsibilities, project communication, description of works, daily reporting and documentation, testing and sampling procedures and environmental monitoring.

3.9.2 The use of quality assurance technique

The study aims at investigating on which technique is being used at the construction site in implementing the quality assurance. The techniques include; project quality audits (the

use of checklist), check sheet, flowchart and inspection. It will also explore how the supervisors are familiar with the technique used in implementing quality assurance.

3.9.3 Other requirements needed in co-operation with the technique

Also the study looked on the usage of the other requirements needed in co-operation with the technique used. The requirements include, frequency of site visit, frequency of site meetings, and tendency of material approvals and conduction of peer reviews.

3.10 Data analysis method

After data collection method, the data obtained has to be processed and analyzed in order to accomplish the purpose of the research (Kothari, 2004). The analysis of data in this research was done using SPSS version 25.

3.11 Validity of research instrument

Validity shows and explains the relationship of the data collected and the studied part in the research (Ghauri and Gronhaug, 2005). Validity identifies if the research matters are correctly measured (Golafshan, 2003). According to Boudreau et al (2004), content validity evaluates a new research instrument and ensures that it includes all the item needed and remove the unwanted items in the particular research instrument.

In this study, before sending questionnaire to the intended sample, literature review and several consultations were done with the research supervisor to ensure the validity of the research instrument which will enable to obtain the information required in order to achieve the research objectives.

In addition, to ensure the validity of the research instrument, the questionnaire comprises of four sections, which reflect the specific objectives of the study. Combining together all sections A-D, will enable to evaluate the implementation of quality assurance in construction of private building projects in Tanzania, which is the main objective of the study.

Section A includes the personal data questions which will help to know about the knowledge and experience of the respondent towards the construction of building works. Section B provides questions concerning the implementation of quality assurance in

construction of private building projects in Tanzania, this helps to know as to what extent the quality assurance is being implemented. Section C and D shows which are the challenges towards implementation of quality assurance and what are the ways of enhancing the implementation of quality assurance in construction of private building projects in Tanzania, respectively.

3.12 Reliability of Research Instrument

According to Joppe (2000) and Toke et al (2012), a liable research instrument is the one which can produce same result under similar methodology, meaning that similar results obtained in a research instrument used if the process is repeated again will make the research instrument to be determined as a reliable research instrument. Wilson (2010) added that the test is needed to be valid so that it can be reliable.

According to Hinton et al (2004), a good guide to the appropriate cut-off points for reliability test using Cronbach alpha are;

i. 0.90 and above shows excellent reliability
ii. 0.70 to 0.90 shows high reliability
iii. 0.50 to 0.70 shows moderate reliability
iv. 0.50 and below shows low reliability

In this study, the Cronbach alpha test was conducted to check the reliability of the research instrument using SPSS version 25.00. The results obtained are as shown here under: -

Table 3.1 Reliability Test of Research Instrument

Description	Cronbach's Alpha	Number of items	Remarks
Requirements to consider for the best implementation of QA	0.55	11	Moderate reliability
Factor hindering the implementation of QA	0.77	17	High reliability
Ways of enhancing implementation of QA	0.67	9	Moderate reliability

Source: Survey data, 2021

3.13 Chapter Summary

Chapter three of the study describes the research design, research approach, population of the study, sampling design and sample size, parameters used for measuring the implementation of quality assurance, data collection and analysis method used and also the validity and reliability of the research instrument.

CHAPTER FOUR
DATA ANALYSIS AND PRESENTATION OF FINDINGS

4.1 Introduction

This chapter presents the analysis and discussion of the outcome of an evaluation of implementation of quality assurance in construction of private building projects in Tanzania carried out in Dar es Salaam. Data collected from the questionnaire were critically examined and then analysis of the findings was done. This chapter describes the quality assurance implemented, the factors hindering the implementation and ways of enhancing the implementation of quality assurance in the construction of multi-storey residential apartment which are privately owned projects in Dar es Salaam, Tanzania.

4.2 Data analysis

The analysis of data means detailed investigation of items obtained by the usage of the research instrument, the processing and examination of data obtained will enable the research to obtain intended findings of the research which can help to achieve the research objectives (Kothari, 2004). The analysis of this research was based on 44 responded questionnaires among 67 distributed. The raw data was analyzed using Statistical package for social sciences (SPSS) version 25.00 so as to obtain a comprehensive and accurate analysis.

4.3 Findings

Total number of questionnaire distributed was 67 questionnaires but only 44 questionnaires were responded. The questions in the questionnaire contain multiple choice questions, short answer questions and a Likert scale. Each likert scale in the questionnaire contains 5 points, in the first likert scale, 1= “very low”, 2= “low”, 3= “moderate”, 4= “high” and 5= “very high”. In the remaining two forms of Likert, 1= “strongly disagree”, 2= “disagree”, 3= “neutral”, 4= “agree” and 5= “strongly agree”. In the likert scale and by using the SPSS version 25.00, responses were computed to produce mean scores for the measures. The mean score helps to compare and rank the items provided in the likert scale according to the response from the respondents. Evaluation level for the mean score was based according to the Table 4.1 below adopted from Mwenga (2020).

Table 4.1: Evaluation level

No.	Mean	Level of Importance
1.	<3	Low
2.	3-4	Moderate
3.	>4	High

Source: Mwenga, 2020

4.3.1 Response rate

The number of questionnaire distributed was 67, while 44 were responded. This means the response from the questionnaire distributed is 65.67% of the whole total number of sample. The respondents were supposed to fill in the project title and location, their designation for instance if the respondent is an architect, engineer or a quantity surveyor and date. It was an important aspect to know the designation of the respondent, so that it helps to know if the project in question is being supervised by the technical personnel who have knowledge in construction or not. 18 out of 44 respondents are architects by profession, 17 out of 44 respondents are engineers and 9 out of 44 respondents are quantity surveyors. This implies all the respondents have knowledge of construction of buildings. The result of respondent designation is summarized in the Table 4.2 below.

Table 4.2: Status of response

Respondents	Frequency	Percent	Cumulative percent
Architect	18	40.9	40.9
Engineer	17	38.6	79.5
Quantity Surveyor	9	20.5	100
Total	44	100	

Source: Survey data 2021

4.4 Personal Data

4.4.1 Qualification of the respondent

It was necessary to identify the qualification or education background of the respondent so that to determine the validity of the information provided by the respondents in the questionnaire. Therefore, the respondents were supposed to indicate their education background in the questionnaire. The results in the Table 4.3 show that, most of the respondents have attained university or college and they do not have advance level certificate only. Since 29 out of 44 respondents have bachelor degree, 8 out of 44 have

Master's degree, 7 out of 44 have Diploma certificate and none of the respondent has only advance level certificate.

The findings reveal that most of the private clients who are building the residential apartments are employing technical personnel who have knowledge in the construction works to supervise their works, and none of the clients employ personnel who do not have knowledge in the construction works.

Table 4.3: Qualification or Education background

Qualification	Frequency	Percent
Diploma certificate	7	15.9
Bachelor degree	29	65.9
Master's degree	8	18.2
Total	44	100

Source: Survey data 2021

4.4.2 Working experience

It was necessary to identify the experience of the respondent because an experienced personnel would work effectively and more accurately than the personnel who have less experience in implementing the quality assurance in construction works. Therefore, the researcher wanted to know the experience status of the respondents.

Table 4.4: Working experience of the respondent

Years of experience	Frequency	Percent
Less than 5	24	54.5
5-10	16	36.4
Above 10	4	9.1
Total	44	100

Source: Survey data 2021

From the Table 4.4 above, the results show that 24 out of 44 respondents have experience of less than 5 years in the construction activities, 16 out of 44 have experience of 5-10 years, 4 out of 44 have experience of more than 10 years and none of the respondent have experience of less than one year.

The findings reveal that, majority of the respondents who are the supervisors of the construction of the residential apartments have experience of less than 5 years. This

indicate that many of the private client do not give much attention towards employing well experienced technical personnel to supervise their work.

4.4.3 Registration status of respondents from regulatory bodies

The respondents were asked if they have been registered by the regulatory bodies and if they have been registered in which level. To be registered by the regulatory body as a professional or consultant, a technical personnel should have first been registered as a graduate indicating that he/she has a bachelor degree and in addition the personnel should have an experience of construction works, this can help in assuring the quality of the work. In the other hand to be registered as a graduate only will indicate that the technical personnel do not have much experience in construction works.

From the Table 4.5, the result of the study shows that 12 out of 44 respondents are not registered by the regulatory body, 15 out of 44 have been registered as a graduate, 13 out of 50 have been registered as professionals and 4 out of 44 have been registered as consultants. The findings reveal that many of the personnel employed to supervise the construction works have been registered as graduate only or have not been registered at all.

Table 4.5: Registration status

Registration Status	Frequency	Percent
Graduate	15	34.1
Not registered	12	27.3
Professional	13	29.5
Consultant	4	9.1
Total	44	100

Source: Survey Data 2021

4.5 Implementation of quality assurance

4.5.1 Familiarization of quality assurance

The researcher wanted to know if the technical personnel supervising the construction of multi-storey residential apartments are familiar with the implementation of quality assurance concerned in the construction works. The result from the Figure 4.1 shows that 30 out of 44 respondents are familiar with the construction quality assurance and 14 out of 44 are not familiar. The findings reveal that although many of the technical supervisor employed by private clients in supervising the construction of multi-storey residential

apartments are familiar with implementation of quality assurance but there are some of them are not.

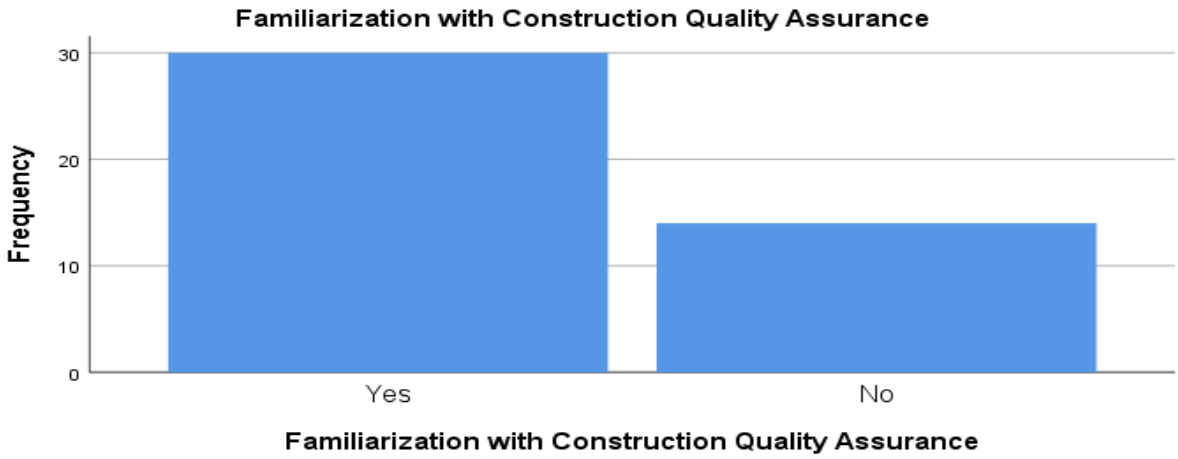

Figure 4.1: Familiarization with QA

Source: Survey data 2021

4.5.2 Frequency of site visit by site Supervisor

The researcher wanted to know how often the supervisors are visiting the site. Supervisors referred here include those professional, Architect, Engineer and Quantity Surveyor, having the role of supervising the work and making sure that the works are constructed according to standard and specification set, engaged by the Employer. Visiting the site in short regular interval of time will enable the supervisor to monitor closely compliance to specifications or quality requirements, thus helping to avoid any mistake or error in achieving quality of construction. It can be seen from Table 4.6 that 6 out of 44 supervisors are visiting the site every day, 12 out of 44 are visiting the site once a week, 20 out of 44 are visiting the site after every two weeks and 6 out 44 are visiting the site once in a month. Also the results from the respondents indicate that none of the supervisors are not visiting the site at all.

The findings reveal that many of the supervisors are not frequently visiting the site. Majority take two weeks before visiting site since the last visit and there are even some of the supervisors visiting the site once in a month, few of them are visiting the site every day. As it is well known that in an active construction site, construction activities are daily progressing, which means close supervision is needed.

Table 4.6: Frequency of site visit by site supervisor

Duration	Frequency	Percentage
Every day	6	13.6
Once a week	12	27.3
After every two weeks	20	45.5
Once in a month	6	13.6
Total	44	100

Source: Survey data 2021

4.5.3 Frequency of site meetings in studied projects

From the Table 4.7 the results show that, 3 out of 44 respondents are conducting site meetings after every two weeks, 7 out of 44 are conducting site meeting once in a month, 4 out of 44 after every three months and 30 out of 44 are not conducting site meetings at all. The findings reveal that 68.2% of the supervisors are not closely monitoring the project progress as a site meeting is one of the tools that enable monitoring of a project to be done. This implies that, in many of the construction site, stakeholders are not discussing construction issues. Furthermore, some the respondents who do not conduct site meeting at all added that, they do not see the importance of site meetings in those particular projects.

Conducting site meetings enables the supervisor to identify if there is any problem in the construction process and works. Hence, providing an opportunity to be addressed early before they become complex. According to Oke et al (2016), regular site meetings ensures conformance to original design and reduce rework during construction. Denim (2007) argues that site meetings helps in managing time in construction works and also it is an essential part which help in quality performance during construction works.

Table 4.7: Site meetings frequency

Frequency of site meetings	Frequency	Percent
After every two weeks	3	6.8
Once in a month	7	15.9
After every three months	4	9.1
Not at all	30	68.2
Total	44	100

Source: Survey data 2021

4.5.4 Tendency of material approval

The aim was to know when materials are being approved to be used during the construction of the project. This will help to know if materials and samples are being approved at a required time and as required in which if they are being approved as required then quality problems which are as a result of material will be avoided.

Table 4.8: Tendency of material approval

Tendency of material approval	Frequency	Percent
Immediately when they are delivered	19	43.2
Before they are used	10	22.7
Before being delivered at the site	3	6.8
Before bulk ordering	12	27.3
Total	44	100

Source: Survey data 2021

From the Table 4.8 above 19 out of 44 respondents are approving material immediately when they are delivered, 10 out of 44 are approving material before they are used, 3 out of 44 are approving material before being delivered and 12 out of 44 are approving material before bulk ordering. The results of the survey data show that most of the respondents are approving material when the materials are already at site, contrary to the construction procedures that materials should be approved before being delivered at site so that accurate material and non-defective material are to be used during the construction. There is a greater chance of using a defective material during the construction if the materials are approved after being delivered at site.

In addition, as most of private building projects, materials are purchased by the client himself. Hence if delivered materials are rejected and needs to be replaced, it means that the client will incur additional cost for replacement and also this may result to some activities being delayed.

4.5.5 Approval of completed construction stage

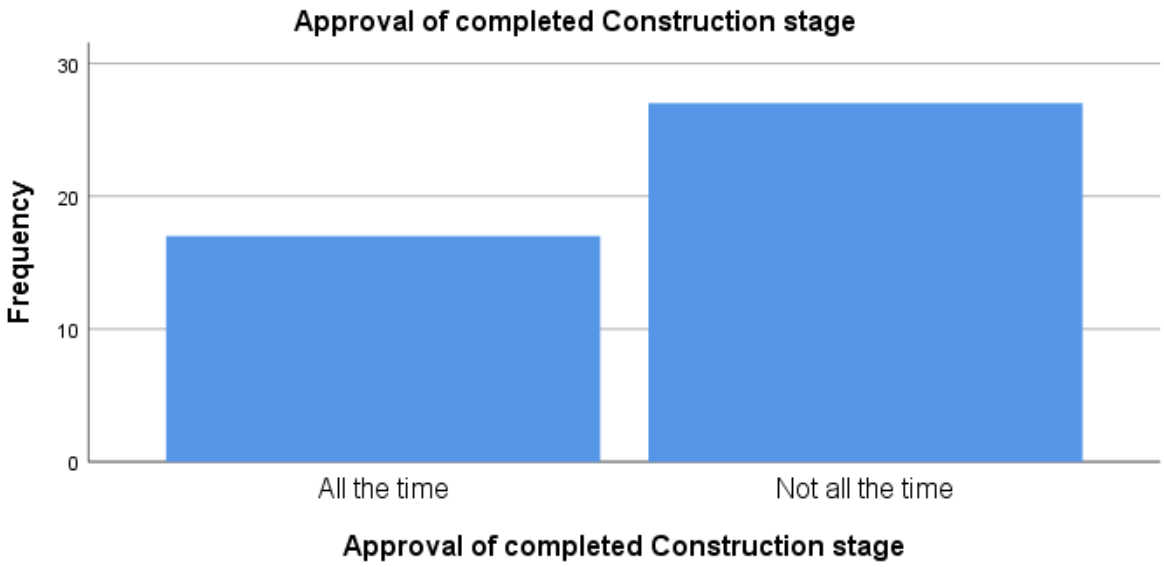

Figure 4.2: Approval of completed construction stage
Source : Survey data 2021

It was of great importance to identify that the construction stages are being approved during the construction process or not. The respondents were asked if they are approving the construction stage all the time or not all the time. The Figure 4.2 show that 27 out of 44 respondents which makes 61.4% of the respondents are not approving completed construction stages all the time and only 17 out of 44 respondent (38.6%) are approving completed construction stages all the time.

The findings show that in many construction site concerned with the research, completed construction stages are not approved at all time. There are some stages which after being completed are not approved by the supervisor. Other respondents commented that, they are not approving all the completed stages because at the site there are labourers who are well skilled in which conducting mistakes is very minor.

In addition, when respondents were asked as to which stages are being approved and which are not being approved they responded that, setting out of the works, the whole of substructure, fixing of reinforcements before pouring concrete, formwork fixing and concrete in slabs, beams and columns are items that are being approved without skipping. While, they further commented that they do not see any necessity of approving items like walling, plumbing installation, laying of tiles, plastering, painting, electrical installations,

doors windows and fixtures and fittings, because the skilled labourers have knowledge and experience to perform well the tasks and that there is minor risk of having a mistake.

Moreover, when the supervisors are asked about the statutory approvals, they commented that the municipal engineers are approving the structure elements of the works and the forms are submitted to clients.

4.5.6 Communication chain with regard to cost implication instruction

Mode of communication or communication chain used in passing instruction or information from the supervisor to the laborers is very important aspect in the construction works. The instruction or the information has to be delivered directly to the intended person. Table 4.9 shows that 32 out of 44 supervisors when issuing instructions which have cost implications inform the client first before implementing that instruction at site. And 12 out of 44 respondents issue instructions direct to the labourers.

The findings reveal that although many of the supervisors are getting client's consent before implementing any instruction which have cost implication but there are some are not. In addition, other respondents commented that, they give instructions which does not have cost implications directly to the labors without passing it to client.

Table 4.9: Communication chain used

Communication chain with regard to cost implication instruction	Frequency	Percent
From project supervisor to client	32	72.7
From project supervisor to skilled laborers	12	27.3
Total	44	100

Source: Survey data 2021

4.5.7 Availability of quality assurance plan

The aim was to know if the supervisor plans the quality assurance before commencement of the work and there is the quality assurance plan which guides the quality assurance process. Figure 4.3 below shows that, 32 out of 44 (72.7%) respondents do not have the quality assurance plan and only 12 out of 44 (27.3%) respondents have the quality assurance plan.

The background of the study shows that for the better implementation of quality assurance the QA should be planned before the commencement of the construction

activities. The findings reveal that majority of the respondents do not have the quality assurance plan, which means that they did not plan a proper QA process.

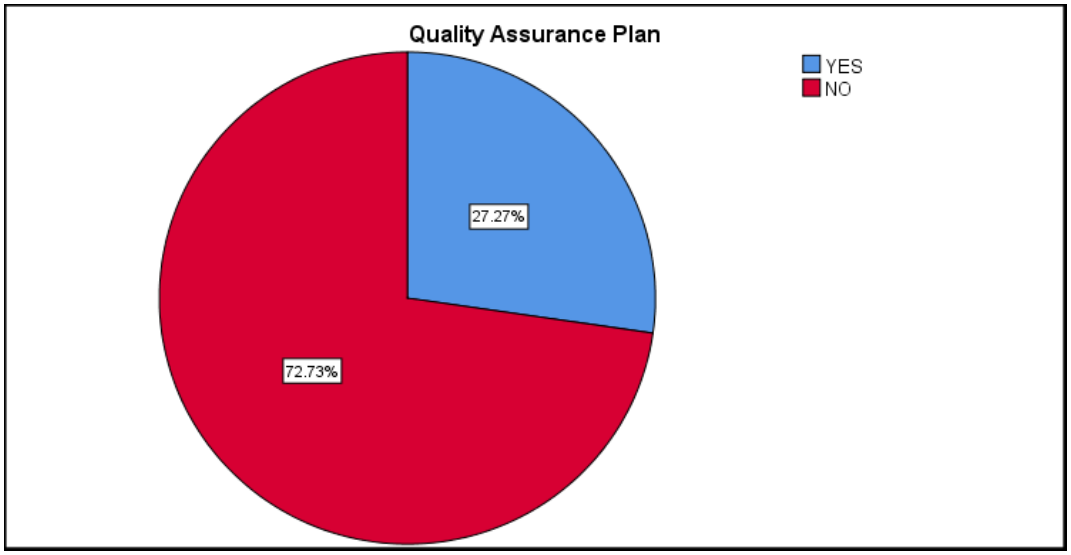

Figure 4.3: Quality Assurance plan
Source: Survey data 2021

4.5.8 Having quality assurance assistant at site

The aim was to identify if the supervisor is having a quality assurance assistant at site, in which in case the supervisor is not around the assistant would help in assuring quality and making sure that planned and required quality is achieved. The data and the findings shows that 9 out of 44 respondents answered YES while 35 out of 44 respondent answered NO. Not having quality assistant at site requires a supervisor to visit the site more frequently so as to be able to assure quality for each construction stage.

Table 4.10: Having quality assurance assistant at site

Answers	Frequency	Percent
YES	9	20.5
NO	35	79.5
Total	44	100

Source: Survey data 2021

4.5.9 Conduction of Peer Reviews by Site Supervisor

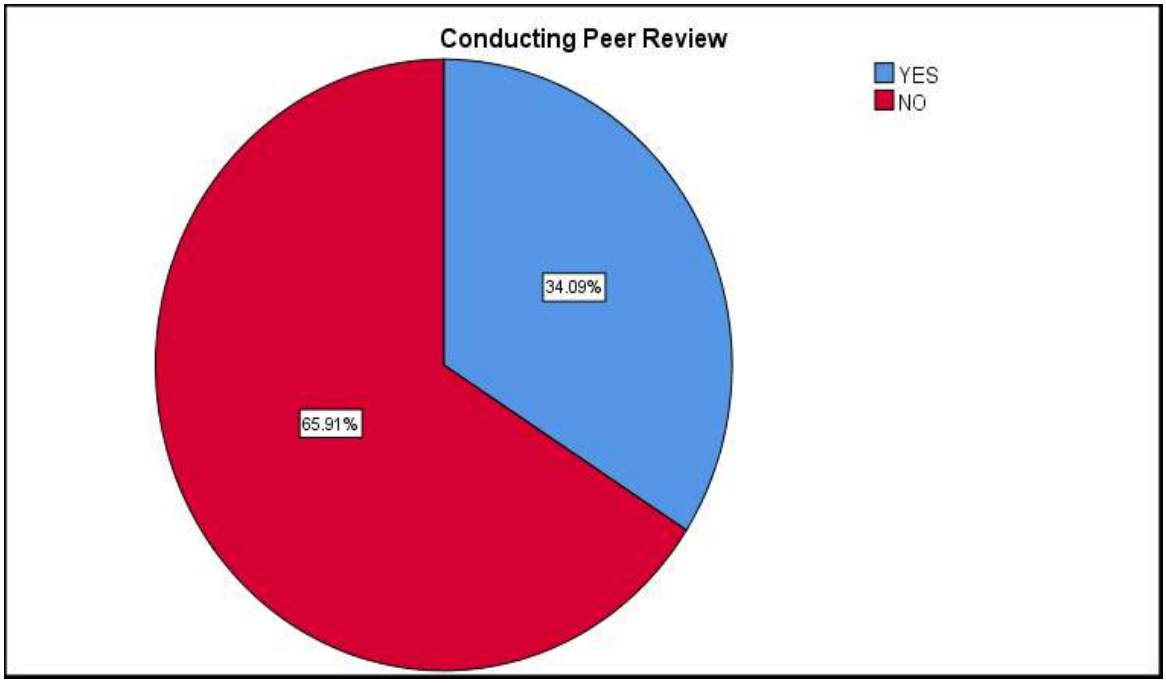

Figure 4.4: Conduction of Peer Reviews by Site Supervisor
Source: Survey data 2021

The respondents were asked if they are conducting project peer review at the site during the construction process. Figure 4.4 above shows that 15 out of 44 respondents answered YES while 29 out of 44 respondents answered NO. Peer review is conducted to ensure that activities are technically adequate, competently performed, properly documented and satisfy established quality requirements (Kerry & Robert, 2000).

The findings reveal that 65.91% of the respondents do not conduct project peer review while 34.09% of the respondents conduct project peer review, this implies that many of the supervisors performing their works cannot be able to identify potential difficulties in the project, cannot adequately assure that the construction activities are technically adequate or can satisfy established quality requirements and thus will not be able to mitigate or avoid problems later in the project. According to Gustafson (1990), project peer reviews helps in recognizing problem during construction works which later helps in avoiding such problem.

4.5.10 Technique used in implementing quality assurance

Table 4.11: Technique used in implementing quality assurance

Method	Frequency	Percent
Check sheet	2	4.5
Project quality audits (the use of checklist)	3	6.8
Flowchart	0	0
Inspection	39	88.6
None	0	0
Total	44	100

Source: Survey Data 2021

The aim was to know if the methods used in implementing quality assurance are well recognized by the supervisors and which method they are using in implementing quality assurance. Table 4.11shows that 39 out of 44 respondents use inspection method, 3 out of 44 use project quality audits, 2 out of 44 use check sheet, none use flowchart and no one has respondent to none option.

The results show that, most of the supervisors are using inspection method in implementing the quality assurance at the site which are 88.6%, 6.8% use project quality audits (the use of checklist) and 4.5% use the check sheet. Siddiqui (2014) has mentioned that, the site supervisors are advised to use and follow the checklist during their daily routine supervision to ensure strict adherence for quality, since the checklist contains detailed of what is to be checked.

The findings show that many of the supervisors are not familiar with some techniques of assuring quality. In addition, the supervisors commented that, these inspections are randomly done and are participated by themselves together with the skilled labourers at site.

4.5.11 Respondent view on the most important requirement to consider for the best implementation of QA

Respondents were provided a list of requirements that are considered to be important for the best implementation of quality assurance. They have been asked to tick appropriately on the item that they considered most important and rank according to scale provided, the scale shows that;

(1) = Strongly disagree, (2) = Disagree, (3) = Neutral, (4) = Agree and (5) = Strongly agree

The mean score and the standard deviation have been used in ranking the response from the respondents. Two requirements may have the same mean but different standard deviation, meaning the requirement having smaller standard deviation was ranked first then the other having high standard deviation, thus the requirements have been ranked accordingly.

Table 4.12: Requirements to consider for the best implementation of QA

Requirement	Occurrence					Mean	Std. Deviation	P-value	Rank	Level
	VH	H	M	L	VL					
Periodic quality audits	35	6	2	1	0	4.7	0.668	0.000	1	High
Testing of the constructed structures	27	14	3	0	0	4.55	0.627	0.000	2	High
Material/sample approval before being used	23	16	4	1	0	4.39	0.754	0.000	3	High
Accurate construction steps and procedures	10	27	4	3	0	4.00	0.778	0.000	4	High
Proper implementation of quality assurance plan	15	14	12	3	0	3.93	0.950	0.000	5	Moderate
Quality training and education for skilled and unskilled labourers at site	6	24	10	3	1	3.70	0.878	0.000	6	Moderate
Availability of skilled labourers at site	4	20	17	2	1	3.55	0.820	0.000	7	Moderate
Response towards quality issues/problems	5	15	17	7	0	3.41	0.897	0.004	8	Moderate
Mode of communication used	3	7	28	5	1	3.14	0.759	0.262	9	Moderate
Identifying project stakeholder's responsibilities	1	13	15	13	2	2.95	0.939	0.750	10	Low
Availability of material at a required time at site	3	7	18	14	2	2.89	0.97	0.441	11	Low

Source: Survey data 2021

Key: VH = Very High, H = High, M = Moderate, L = Low, VL = Very Low

The results from Table 4.12 shows that, periodic quality audits, testing of the constructed structures, material/sample approval before being used and accurate construction steps and procedures are the major requirements to consider for the best implementation of

quality assurance. The mean score for these requirements are 4.7, 4.55, 4.39 and 4.00 respectively and a standard deviation of 0.668, 0.627, 0.754 and 0.778 respectively.

Other requirements to consider for the best implementation of quality assurance are, proper implementation of quality assurance plan, quality training and education for skilled and unskilled laborers at site, availability of skilled laborers at site, response towards quality issues/problems and mode of communication used. The mean score for these requirements are 3.93, 3.70, 3.55, 3.41 and 3.14 respectively and the standard deviation are 0.995, 0.878, 0.820, 0.897, and 0.759 respectively.

From the ranking of the item provides as the results from the responses, the findings reveal that, in order to achieve the best implementation of quality assurance in construction of multi-storey residential building in Tanzania, there should be periodic quality audits for the construction works, testing of the constructed structures, material and samples should be approved before being used, and the supervisor should always make sure that the labourers are making use of accurate construction steps and procedures.

In addition to the above and as from the literature, according to Salvi & Kerkar (2020) argued that the quality assurance can be achieved by a well-directed and focused quality auditing and exact compliance to the construction specifications and standards which can be achieved by properly organized laboratory testing of completed structures and material approval.

The P value is determined as the probability of obtaining same result or extreme result than what was observed assuming that there is no effect or difference. It helps to measure how likely that the observed difference between group has been obtained by chance. The value of probability P can range between 0 and 0.05 if the significant level of 95% has been taken. These range of values of P shows that difference was not obtained by chance (Dahiru, 2008).

Table 4.12 below shows that, the P-value of most of the results obtained are less than 0.05, meaning that there is low probability that the result obtained from the sample

occurred by chance. The low value of P is good, since they indicate that the data did not occur by chance. Hence the results obtained are statistically significant.

4.5.12 Action taken to ensure desired project quality is met when a problem happens at site

Respondents were asked as what do they do to ensure project quality remain the same as required and planned before when a problem happen at site. Among the 44 respondents of questionnaire, only 22 respondents answered the question. The response towards this question is a bit lower compared to other questions responded in the questionnaire.

The results show that 17 out of 22 who have answered the question (77.27%), have mentioned that when quality problem happen at site re work is the only step to take. Meaning demolishing the substandard part of the building, cleaning up the demolished parts/components and building it up again as required, as the way of rectifying the problem and eventually obtaining quality construction. In addition, when a quality problem occurred at site, extra cost of re-work will be incurred by the client.

Other respondents who have answered the question which are 5 out of 22 (22.73%) have mentioned that, when a quality problem happen at site they conduct immediately project quality review to identify the cause of the problem, after that they rectify the problem. After the problem is solved they emphasize the labourers on the importance of quality in each stage of the construction work.

4.6 Challenges towards implementation of Quality Assurance

Table 4.13: Challenges towards the implementation of QA

Challenges	Occurrence					Mean	Std. Deviation	P-value	Rank	Level
	SA	A	N	D	SD					
Client interfering project supervisor's order	36	6	1	0	1	4.73	0.727	0.000	1	High
Low emphasis on quality training and education	22	17	4	0	1	4.34	0.834	0.000	2	High
Focus on short-term cost saving by client	18	22	3	1	0	4.30	0.701	0.000	3	High
Low payment of technical supervisor by client	18	15	5	5	1	4.00	1.10	0.004	4	High

Poor understanding, lack of commitment and resistance to quality programs by workers at site	10	24	9	1	0	3.98	0.731	0.000	5	Moderate
Absence of quality assurance plan	14	19	7	2	2	3.93	1.043	0.009	6	Moderate
Availability of few skilled labourers at site	7	25	7	5	0	3.77	0.859	0.041	7	Moderate
Insufficient attention to achieve quality by labourers at site	6	25	9	4	0	3.75	0.811	0.047	8	Moderate
Time consuming task	8	13	13	8	2	3.39	1.125	0.506	9	Moderate
Lack of communication between parties	3	13	23	3	2	3.27	0.872	0.091	10	Moderate
Supervisor not defining the role and responsibilities of each personnel at site	4	9	24	6	1	3.20	0.878	0.031	11	Moderate
Changing of material supplier	3	16	14	8	3	3.18	1.04	0.049	12	Moderate
A lot of paper work is needed which causes difficulties in documentation	3	15	14	10	2	3.16	1.01	0.030	13	Moderate
Lack of client awareness about the importance of quality	2	18	7	17	0	3.11	0.993	0.013	14	Moderate
Being tired as a result of very tight schedule	2	6	17	15	4	2.70	0.978	0.000	15	Low
Availability of poor quality material at the market	2	8	8	19	7	2.52	1.11	0.007	16	Low
Nature of construction activities	2	2	18	15	7	2.48	0.976	0.001	17	Low

Source: Survey data 2021

Key: SA = Strongly Agree, A= Agree, N = Neutral, D = Dis-agree, SD = Strongly Dis-agree

A list of several factors hindering the implementation of quality assurance has been provided in the questionnaire. Respondents were asked to put a tick on a space provided to indicate the most major challenge to the most minor challenge and rank the challenges according to the scale provided, the scale provided shows that;

(1) = Strongly disagree, (2) = Disagree, (3) = Neutral, (4) = Agree and (5) = Strongly agree

The mean score and the standard deviation have been used in ranking the response from the respondents. Two challenges may have the same mean but different standard

deviation, meaning the challenge having smaller standard deviation was ranked first then the other having high standard deviation, thus the challenges have been ranked accordingly.

Referring Table 4.13 above, the results show that, client interfering projects supervisor's order, low emphasis on quality training and education to drive quality improvement process, focus on short-term cost saving by client and low payment of technical supervisor by client are the most common challenges towards the implementation of quality assurance, in which the challenges have score the high level of ranking mean. The results show that these challenges score a mean of 4.73, 4.34, 4.30, 4.00 respectively and a standard deviation of 0.727, 0.834, 0.701 and 1.10 respectively.

Other challenges towards the implementation of quality assurance in construction of private building projects in Tanzania particularly the multi-storey residential apartments, which have scored the moderate level of ranking mean are poor understanding, lack of commitment and resistance to quality programs by workers at site, absence of quality assurance plan, availability of few skilled labourers at site, insufficient attention to achieve quality by labourers at site, time consuming task, lack of communication between parties, supervisor not defining the role and responsibilities of each personnel at site, changing of material suppliers several times at site, a lot of paper work is needed which causes difficulties in documentation and lack of client's awareness about the importance of quality in projects. These challenges have score mean of 3.98, 3.93, 3.77, 3.75, 3.39, 3.27, 3.20, 3.18, 3.16 3.11 respectively and a standard deviation of 0.731, 1.043, 0.859, 0.811, 1.125, 0.872, 0.878, 1.04, 1.01, 0.993 respectively.

According to the results there are other challenges which score low level of ranking mean which are, being tired as a result of very tight schedule, availability of poor quality material at the market and nature of construction activities. These factors score a mean of 2.70, 2.52, 2.48 respectively and a standard deviation of 0.978, 1.11, 0.976 respectively.

As it can be seen from the Table 4.13 above that, the answers which scores the highest mean have got low standard deviation value. This means that most of the respondents choose the answers, and that is the reason of the high mean value to the answers. As the

mean value decreases the value of standard deviation increase. Thus the ranking of the result.

The findings shown from Table 4.13 above reveal that, the challenges having scored the high level of ranking mean are the most common challenges towards the implementation of quality assurance in construction of multi-storey residential apartments in Tanzania. Other challenges which score the moderate level of ranking the mean, shows that they somehow affect the implementation of quality assurance but the factors which scores low level of ranking the mean shows that the respondents do not consider them as being the challenges towards the implementation of quality assurance. In addition, respondents commented that clients not only are interfering their orders at site, but they also give orders to laborers and being implemented without consulting the supervisors. Also there are other respondents mention that the clients are interfering professionalism decision and employ/engage unskilled family members to construct the building which causes problems at site.

Furthermore, the respondents commented that apart from having low payment, there is also a delay of payment in which the payment interval is too long in such a way that they have to put much attention in other sites of different type of construction and client where there is no delay of payment.

According to Dahiru (2008), being a probability, P can take any value between 0 and 0.05 if the significant level of 95% has been taken. The values close to 0 indicate that the observed difference is unlikely to be due to chance. The Table 4.13 above shows that, the P-value of most of the results obtained are less than 0.05, meaning that there is low probability that the result obtained from the sample occurred by chance. Hence the result obtained are statistically significant.

4.7 Proposals for enhancing the implementation of QA

A list of proposed ways of enhancing the implementation of QA was provided in the questionnaire for the respondents to tick on the space provided showing the appropriate ranking according to the scale. The scale provided shows that;

(1)= Strongly disagree, (2) = Disagree, (3) = Neutral, (4) = Agree and (5) = Strongly agree

The mean score and the standard deviation have been used in ranking the response from the respondents.

Table 4.14: Proposal for enhancing the implementation of Quality Assurance as stated by Respondents

Proposals	Occurrence					Mean	Std. Deviation	P-value	Rank	Level
	SA	A	N	SD	D					
Assessment of completed construction works and quality audits should be done daily and as required to avoid serious quality problems	35	9	0	0	0	4.8	0.408	0.000	1	High
Quality assurance plan should be prepared before commencement of construction works	27	14	3	0	0	4.55	0.627	0.000	2	High
Quality of completed construction works should be taken seriously at site	25	17	1	1	0	4.5	0.665	0.000	3	High
The construction process should comply with the quality specifications and standards set during the design stage	21	21	2	0	0	4.43	0.587	0.000	4	High
Workers at site should be given regular training and education towards quality	16	24	3	1	0	4.25	0.686	0.000	5	High
Emphasis should be on the quality of material to be used	18	19	7	0	0	4.25	0.719	0.000	6	High
There should be quality assurance assistant at the site to assist the supervisor in case he is not around	13	15	15	1	0	3.91	0.858	0.003	7	Moderate
Quality problem should be solved immediately after they have been identified	9	16	18	1	0	3.75	0.811	0.047	8	Moderate
Responsibilities and accountabilities of each personnel involved in the projects should be well known	7	21	14	1	1	3.73	0.845	0.082	9	Moderate

Source: Survey data, 2021

Key: SA = Strongly Agree, A= Agree, N = Neutral, D = Dis-agree, SD = Strongly Dis-agree

The results in Table 4.13 shows that assessment of construction completed works and quality audits to be done daily and as required to avoid serious quality problems is the top most ranked proposal of enhancing the implementation of quality assurance in the list provided, since it has a mean of 4.8 and a standard deviation of 0.408.

Other proposals of enhancing the implementation of quality assurance which scores high level of ranking mean are quality assurance plan should be prepared before commencement of construction works, quality of completed construction works should be taken seriously at site, the construction process should comply with the quality specifications and standards set during the design stage, workers at site should be given regular training and education towards quality and emphasis should be on the quality of material to be used. These proposals score a mean of 4.55, 4.5, 4.43, 4.25 and 4.25 respectively and a standard deviation of 0.627, 0.665, 0.587, 0.686 and 0.719 respectively.

There are other proposals in which according to the results from the respondents their mean score is ranked as moderate. These are, there should be a quality assurance assistance at site to assist the supervisor in case he is not around, quality problems should be solved immediately after they have been identified and responsibilities and accountabilities of each personnel involved in the projects should be well known. These proposals have a mean of 3.91, 3.75 and 3.73 respectively and a standard deviation of 0.858, 0.811, 0.845 respectively.

The findings show that although the proposals have scored different means from the highest to the lowest but all the proposals suggested have been agreed by the respondents, and the ranking of the answers are due to high mean score and low standard deviation. In order to well implement the quality assurance at site, assessment of construction results and quality audits should be done daily, quality assurance should be planned before commencement of the construction activities. Quality audit in construction needs to be continuous, ongoing, and performed in a timely manner (Rumane, 2018). According to Miller (2019) the purpose of quality assurance plan in construction is to detail the testing methods and quality assurance procedures required, thus it is an essential component for the success of quality assurance.

In addition, other respondents commented that by conducting regular project quality audits a supervisor can well identify quality problems if any and achieve quality objective. Others have also commented that all personnel involved in the construction activities at site should be regularly remembered on the goal of achieving the quality of the completed construction works, thus the quality of completed construction should be taken seriously at site in order to achieve quality and as well as improving/uplifting the implementation of quality assurance.

According to Dahiru (2008), being a probability, P can take any value between 0 and 0.05 if the significant level of 95% has been taken. The values close to 0 indicate that the observed difference is unlikely to be due to chance. The data from Table 4.14 below shows that, the P- value of almost all the result presented is less than 0.05, this indicate that there is a small probability that the result has occurred by chance. Hence the results are statistically significant.

4.8 Chapter Summary

Chapter four of the study presents the data analysis, discussion and presentation of findings. The discussion and findings of raw data obtained covers all the main and specific objectives.

CHAPTER FIVE
CONCLUSION AND RECOMENDATIONS

5.1 Introduction

This chapter presents the conclusion and recommendations of an evaluation of implementation of quality assurance in construction of private building projects in Tanzania, it also presents areas for further studies. The conclusion and recommendations are drawn basing on the findings discussed in chapter four of this study which reflect the main objective of the study.

5.2 Conclusion

5.2.1 Implementation of quality assurance in construction of private building project in Tanzania

This study has focused on the implementation of quality assurance in construction of multi-storey residential apartment building in Dar es Salaam. The study has examined the implementation of quality assurance, which by definition is the planned and systematic activities implemented that can be demonstrated to provide confidence a product or service will fulfill requirements for quality. The parameters used for measuring the QA were, the preparation of quality assurance plan, the use of quality assurance techniques specifically the use of project quality audits (the use of checklist), check sheet, inspection and flowchart; together with other requirements needed in co-operation with the technique used. The following are the conclusions.

Although many of the clients who are building multi-storey residential apartment are employing site supervisors who have knowledge in construction works and the project supervisors are familiar with and have knowledge of the quality assurance in construction site, but the implementation of quality assurance is done without fully considering other requirements needed in co-operation of the technique used. This eventually causes repetition of defaulted work at site, as the rework process and procedure is the action taken by many supervisors when a problem happens at site so as to ensure the desired project quality is met.

There is no full consideration of the requirements needed in co-operation with the technique used in implementing quality assurance at site due to the fact that, many of the supervisors do not have a quality assurance plan at the site which can guide them in

achieving construction quality assurance. Also many of the supervisors are not conducting site meetings at site, they are not frequently visiting site so that they can be able to identify problem promptly and materials are approved when have been already purchased and delivered at site, in which there is a possibility of using defective material, increasing construction cost by rework process.

In addition to the above, many of the supervisors are not familiar with some of the techniques used in assuring quality apart from inspection, they do not have a quality assurance assistant at site who can conduct the quality assurance activities in case the supervisor has not managed to visit the site. Also many of the supervisors are not frequently conducting project quality review.

5.2.2 Challenges towards implementation of Quality Assurance

Challenges towards the implementation of quality assurance during the construction of multi-storey residential apartments as established in this study include;

i. Client interfering project supervisor's order, this is the common challenge in many sites causing the project supervisors not implementing the quality assurance as required at site. Although it is mandatory that a supervisor should get client's consent in any changes which is to be done at site but Clients has the tendency of interfering, neglecting and asking the labourers not to follow supervisors' decision at site.
ii. Low emphasis on quality training and education. This is another challenge which hinder the quality assurance at site. If workers are not given education and training towards the quality of construction works, it will be difficult for the supervisor to assure quality, even if he gives instructions to the labourers at site on quality issues, they will not be able to perform in a good way if they could not get education and they did that mistake in a first place.
iii. Focus on short-term cost saving by client. Clients' major focus of concern is always to construct a building using cheap materials. Cheap materials are considered to be of low quality, it is considered difficult to assure quality by constructing a building using cheap materials. Also clients do not want to increase construction cost at site by any means, but if default happen and for a better quality construction works demolitions and rectifications is inevitable. Thus using

cheap material will lead to poor quality construction and increasing construction cost as well.

iv. Low payment of technical supervisor by client, this is another challenge towards the implementation of quality assurance. Low payment and delay of payment to the supervisor will make the supervisor to be demoralized hence may not to put much attention in assuring quality at site.

v. Poor understanding, lack of commitment and resistance to quality programs by workers at site. There is a tendency of private clients to employ family members as laborers at site, hence poor understanding, lack of commitment and resistance to quality programs at site and eventually it is very difficult to the supervisors to assure quality at site.

vi. Absence of quality assurance plan at site will make the quality assurance process to be partial since it was not planned before. Also not having a quality assurance plan will give a chance to skip items in construction when assuring quality.

vii. Availability of few skilled labourers at site will make difficulties in assuring quality by supervisor at site, because even if there is a rectification of quality problem but unskilled labourers will not be able to rectify.

viii. Insufficient attention to achieve quality by labourers at site making it difficult to achieve good quality as the laborers are not giving much attention in instructions given by the supervisor, thus hindering quality assurance.

5.2.3 Ways of enhancing the implementation of Quality Assurance

The following are the ways of enhancing the implementation of quality assurance in construction of multi-storey residential apartments in Tanzania.

i. Assessment of construction completed works and quality audits should be done daily and as required to avoid serious quality problems. For the proper implementation of quality assurance, quality audits should be done daily so as to identify any existing construction problem and making sure that the construction works are complying to the specification and requirements set prior to the execution of work.

ii. Quality assurance plan should be prepared before commencement of construction works so as to be able to know and identify step and procedures

to be taken together with all item to be assured without skipping any item in assuring quality at site.

iii. Quality of completed construction works should be taken seriously at site. If workers and laborers are allowed to be given an education on the quality of works needed to be achieved at site, will help to build in a goal of achieving good quality in construction and eventually will ease and smoothen the assurance of quality by the supervisor at site.

iv. The construction process should comply with standards and specifications set during the design stage. By complying with the standards and specification will make the construction works to be of good quality and thus smoothen the quality assurance process at site by the supervisor.

v. Workers at site should be given regular training and education towards quality at site, by conducting workshops and giving education on quality construction, the labourers at site will be able to achieve good quality after the rectification/re-work when a quality problem has occurred. Thus ease the assurance of quality at site.

vi. Emphasis should be on the quality of material to be used. Good quality material will enable having good quality construction. The quality of material can be identified by testing and material/sample approval, for the purpose of achieving good quality in construction, materials are supposed to be tested and sample to be approved. Thus smoothen the implementation of quality assurance.

vii. There should be quality assurance assistant at site to assist the supervisor in case he is not at site, the assistance will be able to perform the quality audits, giving education to the labourers at site and also approving material to be used. Hence the assistance will help in assuring quality at site.

5.3 Recommendations

5.3.1 Recommendation to clients

In order to have a supervisor who can implement quality assurance at site, clients have to employ technical personnel who have knowledge in supervision of construction works and who have been registered by the respective bodies. Although having knowledge in construction will enable the technical personnel to implement quality assurance, but being

registered with the respective bodies will guarantee that the supervisor has experience in assuring quality and implementing the quality assurance at large.

Also, clients should consider more important that the supervisors are committing themselves in assuring quality work, this will not only make the supervisor to conduct the implement quality assurance at site but also will help the client to have a quality building and not to incur un-necessary extra cost in rework and even in renovating the building after being used.

Moreover, to enhance the whole process of implementing quality assurance, client should not hire family members who do not have knowledge in construction as labourers at their site, but instead should hire skilled labourers at site. In addition, clients by the help of the supervisor should consider and allow a session of giving education the labourers at site which can help them in following up the instruction given by the supervisor when implementing quality assurance at site, and also they should put much consideration in purchasing good quality material to be used in construction work.

5.3.2 Recommendation to project supervisors

For proper and adequate implementation of quality assurance at site, project supervisors should first prepare quality assurance plan before the execution of construction work which can help to identify steps and procedures to be followed during the implementation of quality assurance. Also the project supervisors should conduct project quality audits and quality peer reviews which are essential procedures to be followed as far as quality assurance is concerned.

Moreover, for the project supervisors to be able to prevent problems, take immediate action to rectify the problems so as to assure quality and reducing extra cost due to rework and making sure construction works are complying with the standard and specification set, they should daily visit an active site and should conduct site meeting at least once a month. Assuring quality and minimizing extra cost at site can also be achieved by having a quality assurance assistant at site.

Furthermore, for the adequate implementation of quality assurance project supervisor should make sure that, sample of material are approved before being used, testing of

completed construction and material are done and certificate of testing is obtained. In addition, each completed construction stage is approved.

5.3.3 Responsibilities for both clients and supervisor before and during the execution of construction works

In a nutshell, both client and the supervisor should follow the below procedures as according to their respective positions for the best implementation of Quality Assurance during the construction works. The procedures are categorized into two stages, the summary of the procedures in each stage are as shown below.

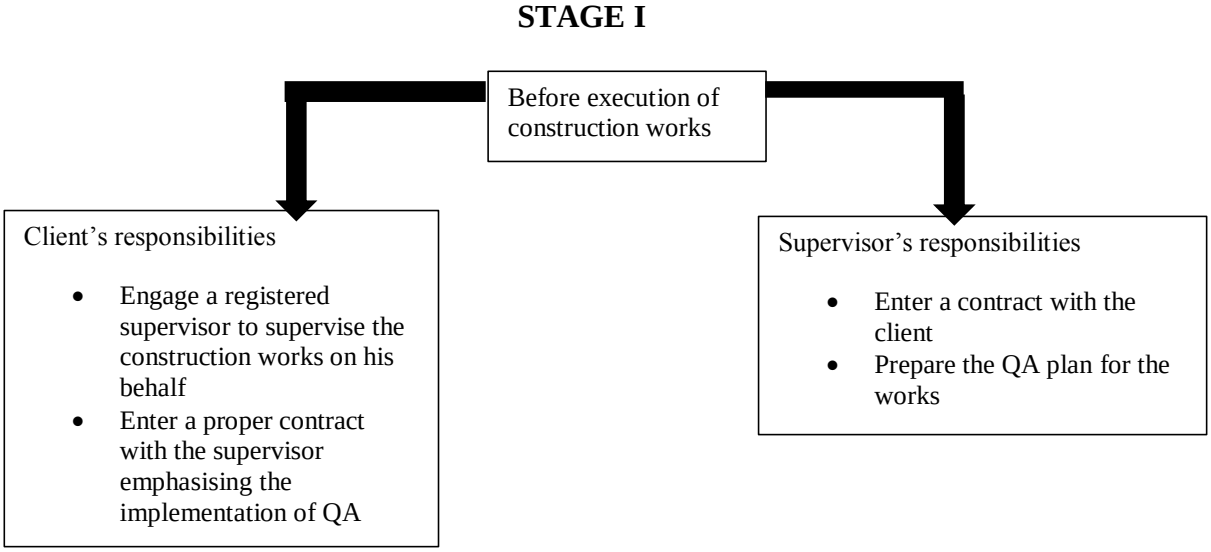

Figure 5.1: QA responsibilities for clients and supervisor before commencement of construction works

Source: Own construction (2021)

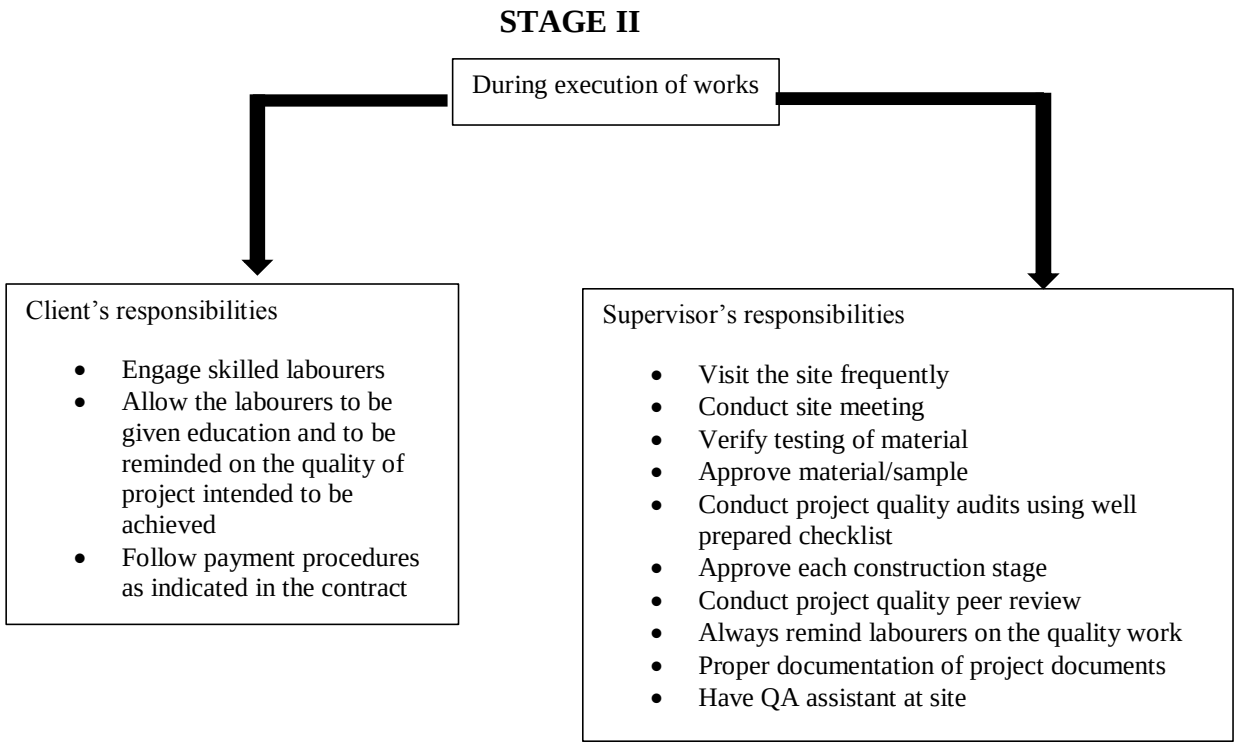

Figure 5.2: QA responsibilities for clients and supervisors during the execution of construction works.

Source: Own construction (2021)

5.4 Areas of further research

With respect to the study, the following are suggestions of areas of future research;

i. An evaluation of application of quality programs in construction public building projects in Tanzania.
ii. Assessment of the role and responsibilities of stakeholders involved in construction of private building projects in Tanzania.

5.5 Chapter summary

Chapter five presents the conclusion and recommendations of the study. Conclusion was done to all specific objectives and the recommendations are for the clients and project supervisors separately.

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APPENDICES

APPENDIX I

QUESTIONNAIRE SURVEY

RESEARCH TITLE: AN EVALUATION OF APPLICATION OF QUALITY ASSURANCE IN CONSTRUCTION OF PRIVATE BULDING PROJECTS IN TANZANIA

Reference is made to the above captioned subject. I am a student at Ardhi University Dar es Salaam, studying masters of Science in Construction Economics and Management. Currently I am conducting a research on the topic mentioned above which is part of the fulfillment of the requirement of masters of Science in Construction economics and management at Ardhi University.

For me to succeed in my task, I am kindly requesting to cooperate with the research by answering to the questions that I have prepared and given to you. The information obtained will only be used for academic purpose only without any disclosure.

Your co-operation is highly appreciated.

Thanking you in advance

.....

AHMED, Karima. A

SECTION A: PERSONAL DATA

1. Qualification
    a) Advanced level certificate ( )
    b) Diploma certificate ( )
    c) Bachelor degree ( )
    d) Master's degree ( )
    e) Others ……..
2. How long you have been working in the construction of buildings?
    a) Less than one year ( )
    b) 1-5 years ( )
    c) 5-10 years ( )
    d) Above 10 years ( )
3. Which level of registration are you registered relevant regulatory body?
    a) Graduate ( )
    b) Professional ( )
    c) Consultant ( )
    d) Not Registered ( )

SECTION B: IMPLEMENTATION OF QUALITY ASSURANCE IN CONSTRUCTION OF PRIVATE BUILDING PROJECTS IN TANZANIA

Please answer by putting a tick in a space provided

4. Are you familiar with construction quality assurance?
    a) YES ( )
    b) NO ( )
5. How often are you visiting the site?
    a) Every day ( )
    b) Once a week ( )
    c) After every two weeks ( )
    d) Once in a month ( )
    e) Not at All ( )

6. How often are you conducting regular site meeting at the site?
    a) After every two weeks ( )
    b) Once in a month ( )
    c) After every three month ( )
    d) Not at All ( )
7. When exactly are you approving material to be used?
    a) Immediately when they are delivered ( )
    b) Before they are used ( )
    c) Before being delivered ( )
    d) Before bulk ordering ( )
    e) Not at All ( )
8. Do you approve completed construction stage before the next stage being entered?
    a) All the time ( )
    b) Not all the time ( )
9. Which chain of communication are you using with regard to cost implication instruction?
    a) From Project Supervisor to client ( )
    b) From Project Supervisor to skilled labourers ( )
10. Do you have quality assurance plan?
    a) YES ( )
    b) NO ( )
11. Do you have quality assurance assistant at the site?
    a) YES ( )
    b) NO ( )
12. Do you conduct peer review during the construction process with skilled labourers?
    a) YES ( )
    b) NO ( )
13. Which method/technique do you use in implementing quality assurance?
    a) Check sheet ( )
    b) Project quality audits (the use of checklist) ( )
    c) Flowchart ( )
    d) Inspection ( )
    e) None ( )

14. Which of the following is the most important requirement to consider for the best implementation of quality assurance?

    (1) Very low (2) Low (3) Moderate (4) High (5) Very high

SN	REQUIREMENTS	1	2	3	4	5
A	Material/sample approval before being used					
B	Testing of the constructed structure, eg cube test					
C	Availability of skilled labour at site					
D	Quality training and education for skilled and unskilled labours at site					
E	Mode of communication used					
F	Response towards quality issues/problems					
G	Accurate construction steps and procedures					
H	Identifying project's stakeholders responsibilities					
I	Availability of material at a required time at site					
J	Periodic quality audits					
K	Proper implementation of quality assurance plan					

15. What are other requirement for quality assurance implementation that need to be considered apart from the mentioned above

    .....

    .....

16. What do you do to ensure project quality remain the same as required and planned before when a problem happen at site?

    .....

    .....

    .....

SECTION C: CHALLENGES TOWARDS IMPLEMENTATION OF QUALITY ASSURANCE IN CONSTRUCTION OF PRIVATE BUILDING PROJECTS IN TANZANIA

17. This section deals with challenges towards implementation of quality assurance in construction of private building projects in Tanzania. Please rank 1-5in the space provided according to your opinion and experience.

SN	Challenges	1	2	3	4	5
A	Client not defining the role and responsibilities of each personnel at site					
B	A lot of paperwork is needed which causes difficulties in documentation					
C	Time consuming task					
D	Low payment of Technical supervisor by client					
E	Availability of few skilled labours at site					
F	Client interfering the Projects Supervisor's orders					
G	Low emphasis on quality training and education to drive quality improvement process					
H	Focus on short term cost saving by client					
I	Poor quality material available at the market					
J	Changing of material suppliers several times at site					
K	Lack of communication between project parties					
L	In sufficient attention to achieve quality by labours at site					
M	Poor understanding, lack of commitment and resistance to quality programs by workers at site					
N	Lack of client's awareness about the importance of quality in projects					
O	Being tired as a result of very tight schedule					
P	Nature of construction activities					
Q	Absence of advance quality planning					

18. Other challenges towards implementation of quality assurance in construction of private building projects in Tanzania apart from the mentioned above that has been experienced at the site

    .....

    .....

SECTION D: WAYS OF ENHANCING THE IMPLEMENTATION OF QUALITY ASSURANCE IN CONSTRUCTION OF PRIVATE BUILDING PROJECTS IN TANZANIA

19. This section provides the proposed ways of enhancing the implementation of quality assurance in construction of private building projects in Tanzania.

Please rank 1-5 at the space provided according to your experience and opinion.

(1) Strongly disagree (2) Disagree (3) Neutral (4)Agree (5) Strongly agree

SN	Proposals	1	2	3	4	5
A	Quality assurance plan should be prepared before commencement of construction works					
B	Responsibilities and accountabilities of each personnel involved in the projects should be well known					
C	Workers at site should be given regular training and education towards quality					
D	The construction process should comply with the quality specifications and standards set during the design stage					
E	Emphasis should be on the quality of material to be used					
F	Quality of completed construction works should be taken seriously at site					
G	Assessment of completed construction works and quality audits should be done daily and as required to avoid serious quality problems					
H	Quality problems should be solved immediately after they have been identified					
I	There should be quality assurance assistant at the site to assist the supervisor in case he is not around					

20. Briefly explain if there are any proposed ways of enhancing the implementation of quality assurance at the site

.....

.....

THANK YOU FOR YOUR RESPONSE

APPENDIX II

INTRODUCTION LETTER

ARDHI UNIVERSITY

Telephone: +255 738 357 310,
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Ref.No. ARU/A.2013/

30th April, 2021

TO WHOM IT MAY CONCERN

Dear Sir/ Madam,

RE: INTRODUCTION LETTER FOR POSTGRADUATE STUDENT

Refer to the subject above.

The Student above is pursuing Masters of Science in Construction Economics and Management (MSc. CEM) in our University. As a Student she is required to do dissertation work as part of the requirements for the award of the Masters of Science in Construction Economics and Management (MSc. CEM). For the accomplishment of this exercise, students are required to carry out literature review, extensive search for field data and subsequently analyse the same for conclusive scientific results.

We are therefore requesting you to assist the bearer of this letter **Ms. Karima Ameir Ahmed, with Reg. No. HD/T.1376/2019**, who will need information from your organisation. The title of his Dissertation is ***"An Evaluation of Application of Quality Assurance in Construction of Private Building Projects in Tanzania."***

Thank you for your cooperation and contribution.

Yours Sincerely,

Dr. Shubira Kalugila
For: Deputy Vice Chancellor
Academic Affairs

ARDHI UNIVERSITY
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DAR-ES-SALAAM