QUALITY MANAGEMENT PRACTICES IN BUILDING CONSTRUCTION COMPANIES IN ETHIOPIA IN THE CITY OF ADDIS ABABA

A Thesis Submitted to the Graduate Program of the Department of Management and the College of Business and Economics, of Addis Ababa University

In partial fulfillment of the requirements for the Degree

Master of Science in Management Specialized in

Quality Management and Organizational Excellence

BY:

Yohannes Kefyalew (GSE/8027/10)

ADDIS ABABA UNIVERSITY,

COLLEGE OF BUSINESS AND ECONOMICS

Addis Ababa

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Declaration

I, the undersigned, hereby declare that this thesis entitled "**Quality Management Practices in building construction companies in Ethiopia in the city of Addis Ababa**" is my original work and that all sources of materials used for this study have been identified and acknowledged as complete references. This research study has not been previously submitted in full or partial fulfillment for a degree in this or any other recognized educational institution. This research study is being submitted in partial fulfillment of the requirement for Master of Science in Management, Specialized in Quality Management and Organizational Excellence.

Yohannes Kefyalew	_____	_____
Author	Date	Signature
Tilahun Teklu (PhD)	_____	_____
Advisor	Date	Signature

STATEMENT OF CERTIFICATE

This is to certify that Yohannes Kefyalew carried out this research on the topic entitled, **Quality Management Practices in building construction companies in Ethiopia in the city of Addis Ababa**". This work is original in nature and is suitable for submission for the award of the Master of Science in Management, Specialized in Quality Management and Organizational Excellence.

Internal Examiner	**Signature**	**Date**
External Examiner	**Signature**	**Date**
Advisor	**Signature**	**Date**

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List of Abbreviation

PMBOK	Project Management Body of Knowledge
TQM	Total Quality Management
CSF	Critical Success Factor
MSF	Major Success Factor
IDA	International Development Association
IBRD	International Bank for Reconstruction and Development
QMP	Quality Management Principles
QMS	Quality Management System
BC	Building Contractors
GC	General Contractors
CLRM	Classic Linear Regression Model
COQ	Cost of Quality

Abstract

The purpose of this research is to study the quality management practices of building construction companies in Addis Ababa. Furthermore, the research tries to show that quality management system is not regarded as a critical success factor among the building construction companies. 40 building construction companies in the capacity of Grades 1 to Grade 4 have been considered for this study. Other grades have not been considered due to time and cost limitations. A quantitative approach was used in this research. Questionnaire was developed based on the 7 quality management principles as indicated by ISO 9001:2015 to study the quality management systems of the respective companies. A descriptive analysis indicates a decline in quality awareness and implementation as the level of the contractor decreases from Grade 1 to Grade 4. Unlike a high perception on quality management system and long term firm profitability the overall mean score is 2.95 with a standard deviation of 0.565 on a 5 point Likert scale. A correlation analysis reveals that there is a strong and positive relationship between the 7 quality management principles and quality improvement tools. A regression analysis found that customer focus, leadership and engagement of people have significant contribution to improving quality in building constructions. The study concludes that the quality management system is not regarded by contractors as a critical success factor. Lower grade companies need to meet customer requirements and measure customer satisfaction. Management needs to establish vision and empower employees and evaluate performances. Open discussions must be encouraged and company resources need to be deployed effectively. Furthermore, trainings must be given and companies need to measure improvements consistently while decisions must be made based on reliable data and analysis.

Key Words: Quality Management, Building Construction, Ethiopia

CHAPTER ONE - INTRODUCTION

1.1 Background of the Study

In today' changing environment, quality is the key to an organization's success and survival. Many construction organizations have to adopt quality as a reliable management tool. (Jayarthana & Senaratne, 2017). Construction projects are always expected to create a balance between cost, time and quality. It is possible to have high quality and low cost, but at the expense of time, and conversely to have high quality and a fast project, but at a cost. High quality is not always the primary objective for the client; however, it is extremely important to a successful project. (Mallawaarachchi & Senaratne, 2015)

Quality management is one of the critical and determinant factors in delivering goals of construction projects. Major success factors (MSFs) in construction industry are inputs to project management practice which can lead directly or indirectly to project success. (Belay, Tekeste &Ambo, 2017) Ethiopia is one of the developing countries which cannot achieve its construction project goals due to lack of adherence to different major success factors. (Belay, Tekeste & Ambo, 2017). According to Belay, Tekeste and Ambo (2017) from 68 identified major management success factors; decision making effectiveness, project delivery system, contractor's cash flow and leadership skills of project manager are the most significant success factors. These significant factors can be traced back to the poor quality management system in place. Alzahrani and Emsley (2013) identified safety and quality as one of the critical success factors in a construction project.

Ayalew, Dakhli and Lafhaj (2016) noted that the main reasons in project failure in developing countries are: lack of advanced planning, a holistic approach, lack of comprehensive engineering and inconsistency in monitoring and follow-up and above all, absence of a methodological approach. Quality elements must be given prior importance in the construction industries. The quality elements are team work, training, supplier's involvement, cost of quality, customer service, management commitment and leadership, statistical methods. The quality of codes and standards, drawings and specifications and constructability analysis plays a vital role in the quality of the construction works. (Rajiv & Harinath, 2018)

Managing quality in construction requires assigning the right people on projects. Leadership skill is one aspect of delivering a successful project. A leader without the proper understanding

of project management tools and techniques cannot direct projects to hit success targets. Demirkesen and Ozorhon (2017) argue that integration of processes and people within a construction project are of paramount importance in the performance of construction projects.

The TQM success depends mainly on the management practices. For the success of any construction industry the commitment of management to the work and leadership plays a vital role in the success of the construction. (Rajiv & Harinath, 2018). The ISO 9000 quality management system is the most widely practicing or almost only system practicing in construction organizations. (Jayarthana & Senaratne, 2017).

This research aims at studying quality management practices by construction companies in Addis Ababa. Within quality management efforts, modern organizations pay more attention to improving the quality planning process. However, construction contractors in developing countries still lag in their practice of effective quality planning. (Senaratne & Jayarathna, 2012).

In order to dominate the highly congested building construction sector, contactors need to improve their quality management system. This paper identifies the level of quality awareness among building contractors and analyzes the relationship between existing quality management practices with the 7 quality management principles.

1.2 Statement of the Problem

Construction is one of the major driving factors of the current Ethiopian economy. During the past decade robust public and private expenditure on infrastructure and other construction works has served as a catalyst for Ethiopia's rapid economic development. ("The Construction Industry in Ethiopia 2018", 2018). However, as indicated by Garomsa, Agon and Assefa (2019), the current management practice in the Ethiopian building construction projects is more conventional and the industry is still facing delays, cost overruns and poor quality.

Based on the Ethiopian Quality Award (EQA) self-assessment model, quality management practice in Ethiopian manufacturing and service industries was found to be poor. (Beshah & Kitaw, 2014). A study by Beshah (2011) identified that quality management was the cause for many Ethiopian industries for their weak performances and low competitiveness in the global market. One of the industries in this research was the building construction sector.

Miressa (2017) noted that," from the perspective of construction projects, quality management should mean maintaining the quality of construction works at the required standard so as to obtain customers' satisfaction that would bring long term competitiveness and business survival for the companies (Abdul-Rahman, 2011)". Ayalew, Dakhli and Lafhaj (2016) noted from a study in the UK that the quality management practice in Ethiopia is even far behind from those poor performing developing countries in Africa.

This brings our attention to the level of quality management practices in our current building constructions. Building construction companies in Addis Ababa do not regard quality management practices as a critical success factor. The important critical success factors will have direct impact on a construction project. All industries nowadays are dynamic and the construction industry is not excluded. In fact, construction projects involve in one of the most vibrant and complex environment (Ramlee et.al, 2016).

Asefa (2018) noted that, "Dinku (2016), a professor at Addis Ababa University states that the collapses of a five-story building in Addis Ababa were not new in Ethiopia. There were similar collapses that occurred in Ethiopia like a three-story building in Gonder; three –story building in Hawassa; and a four-story building in Wolayta in the past couple of years. And he suggested the most important elements for high quality in the construction industry are active participation of all stakeholders like client, contractor, consultant, financiers and so on".

Although the building construction industry is booming in the country certain quality aspects are not being practiced to satisfaction. The number of construction companies has been increasing tremendously in the last decade. However, in order to generate more profits construction companies most often do not adhere to the specifications and drawings. This in turn will lead to rework and incur drastic effects on safety and health issues.

Construction companies often lose the idea that maintaining quality in construction is not only profitable in the long run but is also a vital step to minimizing unnecessary costs to be incurred in projects. Hence two major problems can be stated as follows:

1. Is quality management regarded as a critical success factor by building construction companies in Addis Ababa?
2. Is quality awareness and implementation level in building construction poor?

1.3 Research Questions

The main research questions this study sets out to ask are the following:

1. How do quality management practices compare among different grades of building contractors in Addis Ababa?
2. Are there any factors challenging the quality management system in building construction?
3. How will attaining or striving to attain International Quality Certification influence the performance of building constructions?

1.4 Objective of the Research

In line with the problem stated and the research questions described above, the following are the objectives of the study.

General Objectives

The main objective of this research is to examine quality management practices in building construction companies in Addis Ababa.

Specific Objectives

The aim of this study is to add to existing research on construction and quality by comparing construction practices among different local companies.

The reseach also targets to identify the relationship between attaining international quality certifications and performance among construction companies in regard to quality management.

1.5 Significance of the Study

Directing a construction project towards quality with optimal cost and scheduled time of completion is a greater concern today. This is due to the fact that quality is required to meet project requirements of the owners, constructors and other parties involved with a greater satisfaction. Moreover, poor quality could lead to unnecessary cost to the organization where it could create costs due to failure, appraisal and prevention. (Mallawaarachchi & Senaratne,

2015). Hussain et.al (2018) argue that time, cost and quality have been accepted as key factors of project success. Among these three generally accepted constraints, the quality dimension is studied as the least explicit feature of project success.

This research is of great significance to the growing building construction sector in Addis Ababa. First, it will raise the quality awareness and implementation in construction. Second, it will allow building contractors to focus on key quality management principles that will in turn help them improve their quality management system.

In research and academic perspective the research will give a different insight on the quality management systems of the top building contractors graded for 1 -4. Furthermore, a comparative study will help to associate the current quality management system with different levels in construction.

The research can also be used as a ground for further studies. Similar research can be conducted by simply changing the scheme of this research from building to other construction modes as road, irrigation, bridge etc. Furthermore, the paper can also be used to compare construction practices among different cities in Ethiopia, as this study is based on building construction companies in Addis Ababa.

1.6 Scope of the Study

The research focuses on building construction companies from grades 1-4 situated in the city of Addis Ababa. Other construction companies outside of Addis have not been considered. General contractors are also not part of the scope of the study due to capability differences with their building contractor counterparts.

CHAPTER TWO – LITERATURE REVIEW

This chapter discusses different literature published by scholars in the area of construction management and quality management practices in construction. It puts into perspective different findings and conclusions of various articles. Recent articles and publications have been considered to reflect the central idea of this paper.

2.1 Theoretical Literature Review

2.1.1 Quality and Quality Management

Brief Overview of Quality Management

Quality has been described by many authors broadly over the years. However, the definitions for quality can be summarized as a process by which products and services meet or exceed customer expectations. Quality management is the act of overseeing different activities and tasks within an organization to ensure that products and services offered, as well as the means used to achieve them, are consistent. ("What is Quality Management", n.d.).

Related ISO quality Management Standards are based on the following QMPs: Customer Focus, Leadership, Engagement of People, Process Approach, Improvement, Evidence-Based decision making, Continuous Improvement and Relationship Management. (Henssen, 2015)

What is Quality

Over the years, there has been much said regarding quality in that the term has become a broad concept. The definition for quality is manifested in different ways as conformance to requirements (Crosby's definition) where the lack of not meeting "zero defects" in production will be the cost of non-conformance. Another definition relating to quality is Six Sigma (Jack Welch of General Electric) that views quality as a product/ service in which 99.99966% of total production is free from defects.

J.M Juran, who is one of the gurus of quality states that quality is a process or a product that is fit for purpose. If the purpose of an aircraft is to be fast, efficient, comfortable and safe — then that's the definition of a quality aircraft. (Mar, 2013)

"Quality" means freedom from deficiencies—freedom from errors that require doing work over again (rework) or that result in field failures, customer dissatisfaction, customer claims, and so

on. In this sense, the meaning of quality is oriented to costs, and higher quality usually "costs less." (Juran & Godfrey, 1999).

In addition to the general definitions of quality, Hussain et al. noted that "In the construction industry, quality is defined as the effective and successful accomplishment of contracted project goals between clients and the service providers or main contractors. (Fan, 1995)"

Quality Management

Quality Management is nothing more than managing the processes in a system to bring out the best outcome. Armand Feigenbaum is one of the gurus of quality and is renowned for his great contributions as Total Quality Management and the Hidden Plant.

Total quality management (TQM) is the integration of all functions and processes within an organization in order to achieve continuous improvement of the quality of goods and services.

The goal is customer satisfaction. (Ross, 1999).According to Juran Quality Management revolves around three principles (the Quality trilogy): Quality Planning, Quality Control and Quality improvement. The figure below shows The Juran Trilogy diagram.

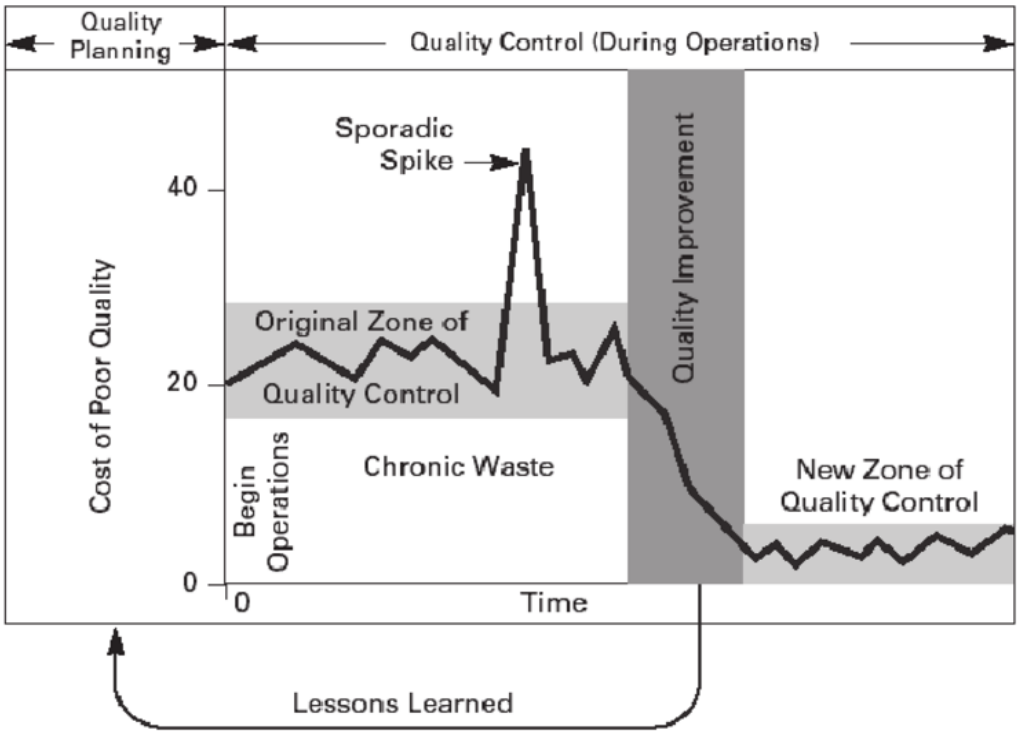


Figure 2.1: Juran Quality Trilogy Diagram, Source: (Juran & Godfrey, 1999)

2.1.2 Project and Project Management

Project

A project can be defined in many ways. Many scholars have their own definitions of what a project is.

A project is an activity to create something unique. (Pranchi, n.d). Project Management Institute - A Guide to the Project Management Body of Knowledge (PMBOK) defines project as an activity with a beginning and an end oriented towards achieving a certain goal. A project is an activity to meet the creation of a unique product or service and thus activities that are undertaken to accomplish routine activities cannot be considered projects.

Project is a unique process consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective confirming to specific requirements including constraints of time, cost and resources. (ISO 10006:2003 – Quality Management Systems – Guideline for Quality Management in Projects). J.M Juran, one of the gurus of Quality, defined project as a problem scheduled for a solution.

Although there are broad definitions for Project, it can be said that most definitions state that project is temporary in that it has a beginning and an end; a project utilizes various resources as time, people and cost; and a project can be regarded as a task that involves certain degrees of planning and executing towards obtaining a predetermined goal.

Project Management

Having the understanding of what the core concepts of a project are, a project management can then be viewed as the set of tools and techniques to carry out the project to its determined goal.

Radujkovic and Sjekaica (2017) noted that “Project management is planning, organization, monitoring and control of all aspects of project, with motivation of all included to achieve project goals on safe manner, within agreed schedule, budget and performance criteria. (IPM Association, 2006)” It can be seen from the definition of project management, that it is focused on project performance, regarding short-term dimensions of project success – adherence to criteria of time, cost and quality. (Radujkovic & Sjekaica, 2017).

Project Management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements. (“What is Project Management”, n.d.). Project

management is the application of processes, methods, skills, knowledge and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters. Project management has final deliverables that are constrained to a finite timescale and budget. (“What is Project Management”, n.d) A key factor that distinguishes project management from just 'management' is that it has this final deliverable and a finite timespan, unlike management which is an ongoing process. Because of this a project professional needs a wide range of skills; often technical skills, and certainly people management skills and good business awareness.

The processes of Project Management fall into 5 stages, namely, initiating, Planning, Executing, Monitoring Controlling and Close-out. (“What is Project Management”, n.d.).

Successful project management can be defined as achieving a continuous stream of project objectives within time, within cost, at the desired performance/technology level while utilizing the assigned resources effectively and efficiently. (Kerzner, 2017)

When considerations about project management success are made, it is possible to find and use many different approaches. One of the most traditional ones is the iron triangle approach. It affirms that three main aspects that must be managed together characterize projects: scope, cost and time. (Machado & Martens, 2015). However, Al-Zayyat, Al-khaldi, Tadros and Al-Edwan (2010) argue that knowledge management also has a significance impact on Project management. They also highlight that TQM, six sigma and ISO 9000 have recently contributed directly or indirectly to improve project initiation, planning, execution and control.

2.1.3 Quality in Developing Countries

Based on World Bank (2015) economies are divided into IDA, IBRD and Blended Countries. International Development Association (IDA) countries are those with low per capita income that lack the financial ability to borrow from the International Bank for Reconstruction and Development (IBRD). Blend countries are eligible for IDA loans but are also eligible for IBRD loans because they are financially creditworthy.

For the 2020 fiscal year, World Bank defines low-income economies as those with a GNI per capita, calculated using the World Bank Atlas method, of $1,025 or less in 2018. IDA countries include Ethiopia, Eritrea and Afghanistan who are classified as a Low-Income Economies ($1,025 or less) according to World Bank. (World Bank, 2015)

2.1.4 Construction Management in Ethiopia

The construction industry is one of the major bloodlines for the Ethiopian economy. During the past decade robust public and private expenditure on infrastructure and other construction works has served as a catalyst for Ethiopia's rapid economic development. The country has consistently invested more than 30% of GDP into Gross Fixed Capital Formation (GFCF) expenditure since 2010 and as a result, Ethiopia has emerged as one of the fastest-growing economies in the world. The market value of the construction sector is currently estimated at more than US$7bn. According to the 2017 edition of African Economic Outlook, construction activities in Ethiopia accounted for 15.9% of GDP at current prices during the 2015/16 fiscal year. (Veitch, 2018)

Globally, the construction industry hugely influences the economy, the environment and the society. In 10 trillion USD revenue and added value of 3.6 trillion, the sector is account for about six percent of the world GDP, according to World Economic Forum's 2016 report. (Derso, 2018)

In order to effectively utilize massive resources that are being invested annually in this industry the construction management is of at most interest. The construction industry in Ethiopia faces numerous challenges. A study by Gadisa and Zhou (2019) on project performance in Ethiopia revealed that weak management leadership skills as one of the critical factors affecting government financed infrastructures project performance.

In agreement with this, Ayalew, Dakhli and Lafhaj (2016) based their research on a study at the London School of Economics that found that the management practice in Ethiopia is even far behind from those poor performing developing countries in Africa. Their research also found that the level of construction project management practice in terms of adapting general project management procedures, project management functions, tools & techniques to be unsatisfactory.

Previous research shows that the construction management in Ethiopia is an area that requires improvement.

2.1.5 Quality Management in Construction

Construction industry plays an important role in the development of any country. The development of construction industry depends on the quality of construction projects. Quality is one of the critical factors in the success of construction projects. Improvement in the quality of construction projects is linked with quality management in the project life cycle. Although quality management at every stage of project life cycle is important but the quality management at the execution (construction) stage contributes significantly on final quality outcome of construction projects. (Ashokkumar, 2014).

2.1.6 Importance of Quality for Ethiopian Construction Projects

The construction industry is one of the main sources of economic growth and development all over the world. Thus, the success of these projects is very important. Construction projects are engaged with three main factors of time, cost, and quality. Among these three factors, quality is considered as one of the most significant competitive factors. An important factor in maintaining and controlling quality and reinforcement of buildings is continuous supervision. (Shahraki, Saghatforoush & Ravasan, 2018).

For developing countries like Ethiopia construction plays a key role in supporting the livelihood of many in the industry. Construction in modern Ethiopia is the major blood line of the economic development in the country as construction practices have been attracting many foreign investors. Shahraki et al. (2018) also pointed that “the construction industry is considered as the wealth of any country. Due to the strong relation of this industry with other industries, any change in it affects other industries (Negara, 2011).” Higher product quality is required for a company to become more competitive, both locally and in international trade. Improved quality at the enterprise level lowers its cost of operations and increases its productivity. The benefits that accrue from improved quality at individual firm level also augment ational competitiveness. Hence, many world class firms and nations use quality as a powerful competitive tool. (Kitaw and Bete, 2003)

Currently, the country forms the heart of Africa’s economic evolution due to high demands in the construction sub-sectors. The wave of construction in Addis Ababa has spilled into other Ethiopian cities, causing investors to take serious measures in expanding their business in the country. (“Construction in Ethiopia and opportunities in the Ethiopian Building Industry”,n.d.)

Ethiopia's economy experienced strong, broad-based growth averaging 10.3% a year from 2006/07 to 2016/17, compared to a regional average of 5.4%. Ethiopia's real gross domestic product (GDP) growth decelerated to 7.7% in 2017/18. Industry, mainly construction, and services accounted for most of the growth. Agriculture and manufacturing made lower contribution to growth in 207/18 compared to the previous year. Private consumption and public investment explain demand-side growth, the latter assuming an increasingly important role. (World Bank, 2019). The construction industry is the second largest industry in creating employment opportunities for over 1.8 million people. (Derso, 2018).

This shows that construction practices play a vital role in the economic growth of the nation. Quality in the delivery of construction projects should be stressed highly and critical success factors for sustainable delivery of projects should be sought after.

2.2 Empirical Literature

2.2.1 Quality Awareness and Implementation

Quality awareness is the way to promote quality activities by emphasizing quality at all stages of the business, which can help solving complex problems and denote excellence. Quality has become a key concern to organizations, not only because of growing importance of the quality system, but also because of the multitude challenges. Quality awareness is one of the major issues in all industries working hard to cope with the quality challenges irrespective of their working nature. (Hussain, Abba & Merviel, 2006)

Industries in Ethiopia are deficient in vigor and stagnant: hence less exposed to a highly competitive market and don't adopt the latest quality control techniques in order to gain knowledge about systems to improve quality and operational performance. (Berhe & Gidey, 2016). In a study conducted by Berhe and Gidey (2016) that included 44 companies in various industry sectors most of quality departments do not fully recognize quality control tools. 62% of their respondents have indicated that they did not get any trainings concerning quality control tools. This is mainly due to lack of awareness and motivation of top managements.

Aderaw (2019) noted that, "TQM implementation in Tigray state indicated that there is positive association between TQM variables and organizational performance, among which Top

Management Commitment has the strongest positive relation with performance of the surveyed firms. (Gebremedhin & Raju, 2016)".

In a study conducted by Marasini and Quinnell (2010) on 11 different construction projects in the UK, 23% of respondents used ISO 9000 as a quality management system, 23% used a checklist template and 26% used common approaches. However, although various quality management techniques are recognized by site managers it was found that there was a lack of uniformity in the application of tools and techniques. This has indicated that managers required more trainings on the concepts of quality management.

Mack (2017) suggest that improving quality awareness within an organization starts with the management. In addition, he states that the company needs to create standards after which the company's quality objectives are explained to the employees. ISO implementation is believed to serve as a basis for quality improvement. "An ISO implementation can also serve as basis for TQM implementation. Where there is an ISO system, about 75% of the steps are in place for TQM. (Van de wiel et.al, 2000)" (Demissie, Zhu, Kitaw & Matebu, 2016).

From the various literature, the following items have been identified to study the quality awareness and implementation in the companies.

1. Availability of Quality planning, control and assurance methodology in the company
2. On-site quality tracking
3. Familiarity and application of quality management tools and techniques
4. Trainings and inductions regarding quality management
5. Aim towards acquiring international quality certifications

2.2.2 Factors Affecting Construction Project Quality

Project quality is greatly affected by poor management practices in each stages of the project. Quality of construction projects is linked with proper quality management in all the phases of project life cycle. (Ashokkumar, 2014). A research by Ayalew, Dakhli & Lafhaj (2016) found that the level of Ethiopian construction project management practice in terms of adapting general project management procedures, project management functions, tools & techniques were unsatisfactory. In addition, the level of practices in terms of safety, risk and time management was found to be very low. Projects also showed schedule delays and planned cost overruns. Furthermore, other variables as risk, quality, resources utilization and safety deviates

by up to 40% from predetermined requirements at the beginning of the projects. Agreeing with this, Shahraki, et al. (2018) argue that unfortunately, due to the significance of construction industry, the poor performance of supervisor engineers leads to poor quality of urban constructions. On the other hand, Aigbavboa, Oke and Tyali (2016) argue that lack of adherence to ethical practices that help ensure transparency and accountability within the construction industry is a major impediment towards being a consistent and an effective growth to the economy.

London survey aimed at improving methods of quality control for building works found that "design" and "poor workmanship in the construction process" combined to form more than 90% of the total failure events. (Ashokkumar, 2014). Similarly, a study by Ali and Wen (2011) found that lack of experience and unsuitable construction equipment contribute highly to poor construction workmanship. Further, they elucidate that trainings and proper design can better enhance workmanship in construction.

Ayalew et.al (2016) noted that “construction projects are somewhat difficult to manage and meet these requirements due to the nature of the industry; such as complex and unique nature, mobile workforce, ingrained culture, working conditions, and project-based setup, diverse sub-contractors and suppliers.(P. U. Okoye, C. Ngwu, and S. Ugochukwu, 2015)”. Yahya, Abba, Mohamed and Yassin (2019) also stated in their research that fluctuation of materials price, lack of conformance to specification, poor monitoring and feedback, poor contract management and supply of defective material were the most significant factors contributing to poor construction project performance. In addition, according to a study by Enshassi, Mohamed and Abushaban (2010) the most important factors affecting project performance are: delays because of borders/roads closure leading to materials shortage; unavailability of resources; low level of project leadership skills; escalation of material prices; unavailability of highly experienced and qualified personnel; and poor quality of available equipment and raw materials.

In their quantitative analysis, Davis, Ledbetter and Burati (1989) indicated that most of the important quality costs can be identified for tracking and analysis. Research has shown that construction materials and equipment may constitute more than 70% of the total cost for a typical construction project. (Patel & Vyas, 2011). From their study, Patel and Vyas (2011) have shown that material management includes, among others, Materials handling and waste management.

From comprehensive literature review on factors of poor quality in construction, the following items have been adopted for this study.

1. Skilled and qualified people not assigned on jobs
2. Lack of trainings
3. Inappropriate equipment and defective materials
4. Absence of on-site quality tracking
5. Wasteful construction practices
6. Non-conformance to specifications and drawings
7. Unethical practices
8. Absence of quality planning, control and assurance methodology
9. Leadership commitment

2.2.3 Cost of Poor Quality

A study by Abdelsalam and Gad (2009) indicated that the cost of quality, CoQ in projects in Dubai represents 1.3% of the total project civil work cost and that the optimum CoQ value was estimated to be 1.34% of the total CoQ. Failure costs, on the other hand, were estimated to be .7% of the project cost.

The construction industry has been plagued with problems associated with lack of proper standards and lack of effective project management practice. The complex nature of the industry is what made the construction industry sensitive to poor projects performance. (Yahya, Abba, Mohamed & Yassin, 2019). An evaluating and reporting quality failures incidents is perceived as a useful indicator of project performance and provides opportunities for quality improvements and cost reduction. These failures can cause frequent delay in project, cost overruns and loss of confidence in contractors. (Samiaah, Al-Tmeemy & Hatem, 2015).

Researches have shown that the cost of poor quality is substantial, and often much larger than is shown in accounting reports. For most companies the quality-related cost range from 25 to 40 % of operating expenses (Juran and Godfrey, 1999).

Quality is one of the key critical success indicators within a firm. Irhamna and Nurchahyo (2018) argue that quality is a key element that cannot be ignored in the competition and is one of the critical issues for the success of the company, including in the construction industry. On the other hand, if the quality management policy is not implemented or limited participation

will both negatively affect the management of the project and competitiveness of the firms. This will also decrease the survival potential of construction firms within the industry.

Aigbavboa et al. (2016) state that unethical practices in the industry which include bribery and fraud, falsification of experience, illegal award of tenders and collusive tendering result in clients' dissatisfaction, poor workmanship, poor quality of infrastructural development and loss of public trust.

Titov, Nikulchev and Bubnov (2015) argue that cost of rework in construction projects represents a significant portion of construction project budgets in many companies. This is to mean that poor construction quality leads to rework, which in return leads to the unexpected or unplanned escalation in the project cost.

From the various research, the following items have been identified and used to study the cost of poor quality in the Addis Ababa construction context.

1. Cost of unplanned rework
2. Long-term firm competence
3. Exposed Health and safety issues
4. Poor staff morale
5. Administrative and support costs

2.2.4 Quality Improvement

Cost of poor quality (COPQ) in the construction industry is a serious problem that the industry is faced with, due to failure in preventing wastage and defects during construction work. The cost of poor quality remains hidden and eats up to 40% revenues of the construction enterprise. (Mashwama, Aigbovboa & Thwala, 2017)

The study conducted by Mashwama, Aigbovboa and Thwala (2017) indicated that the role of the managers in construction projects is still under looked and therefore, this can be a problem if it is not attained and revealed. Further, it concludes that are a lot of success factors such as the use of quality management system and the critical success factors can actually help eliminate poor quality in most construction projects.

After stating from their study on the potential benefits expected from the implementation of lean construction as greater productivity, improved sustainability/waste reduction, greater

customer satisfaction, and reduced project schedule and high quality construction, Ayalew, Dakhli and Lafhaj (2016) found that at least there is some level of awareness upon professionals about Lean Construction even though Lean Construction is not yet practiced in Ethiopian construction industry. Result on the barriers in practicing lean construction indicate that 74% is due to the lack of knowledge and skill. (Ayalew, Dakhli & Lafhaj, 2016)

In line with the factors for poor quality and the subsequent cost attached for failing to meet quality standards, the following items have been recognized as quality improvement techniques.

1. Continuous trainings on waste and quality management
2. Assigning qualified staff
3. Adopting quality documentations and records
4. Respecting code of working ethics
5. Conformance to standards and specifications

2.2.5 Quality Management Principles

There are different quality related criteria awards companies could use to implement for their quality management system. Building construction companies could adopt any of The ISO 9001 requirements, Malcolm Baldridge Criteria, The Ethiopian Quality Award, The Eurpean Quality Criteria or the Australian Quality Criteria to improve their quality management system.

Many researchers have conducted studies using the ISO 9001 criteria in order to assess the quality management system of various industries. Gap analysis was conducted by Demissie et.al (2016) to assess and determine improvement areas for Ethiopian garment enterprises. Similarly, Ochieng, Muturi and Njihia (2015) found that ISO 9001 certification influenced return on net assets of the organizations in East African countries thereby influencing their performance.

Furthermore, from a survey based research on construction project performance from 336 respondents there was a significant difference at the 5% confidence level that ISO 9000 certified companies have enhanced levels of performance in their project environments compared to those in non-certified companies. (Din, Abd-Hamid & Bryde, 2011).

Taking this into account, quality management principles as per ISO 9001:2015 were adopted to study the quality management system of the building construction companies.

ISO has a range of standards for quality management systems that are based on ISO 9001 and adapted to specific sectors and industries. ISO 9001:2015 sets out the criteria for a quality management system and is the only standard in the family that can be certified to. Using ISO 9001:2015 helps ensure that customers get consistent, good quality products and services, which in turn brings many business benefits. (ISO 9000 Family – Quality Management, n.d.)

The ISO 9000:2015 and ISO 9001:2015 standards are based on seven quality management principles. Customer Focus, Leadership, Engagement of People, Process Approach, Improvement, Evidence-based decision making and Relationship Management have been used as per the ISO 9001:2015 standards to study the quality management practices of the respective construction companies.

2.3 Conceptual Framework

In light of the above empirical review of literature, the following conceptual framework has been adopted for the study.

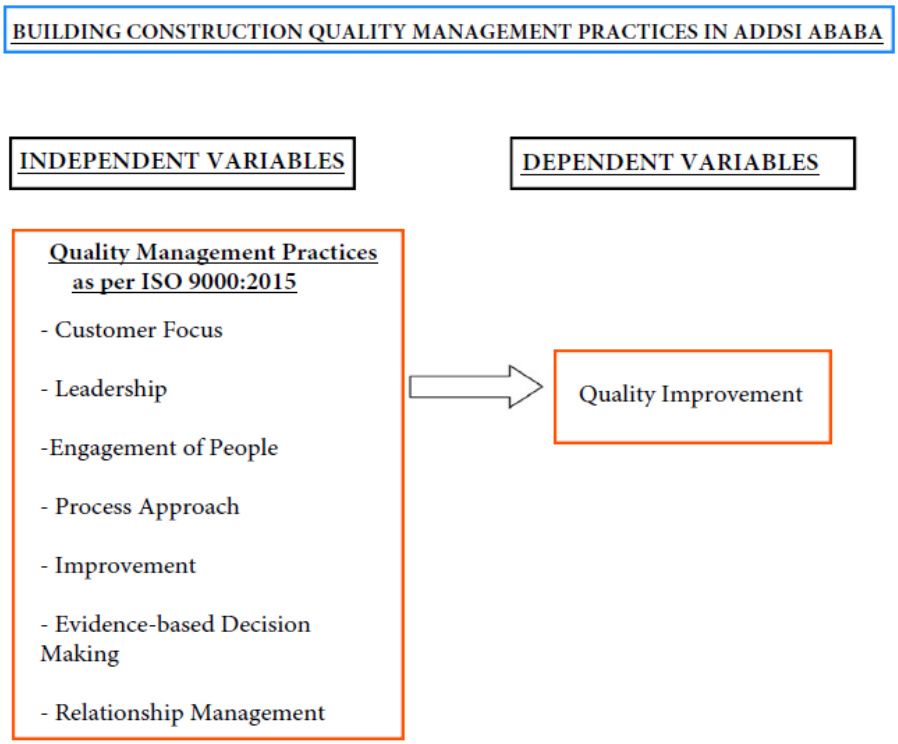


Figure 2.2 Conceptual Framework

2.4 Research Hypothesis

As indicated above in the literature review, quality management principles are assumed to improve the level of quality performance. Accordingly, the research has made an initial assumption that maintaining or implementing the quality management principles as per ISO 9001:2015 standards will improve the quality performance among building contractors.
Validated items have been used to measure the quality management principles on a 5 point Likert scale (5= very strongly agree, 1= very strongly disagree).

The following hypothesis was then proposed and tested:

Proposition:
Quality management system as per ISO 9001:2015 is positively associated with improving quality performances.

Hypothesis H1:
Quality management principles are positively associated with continuous trainings

Hypothesis H2:
Quality management principles are positively associated with on-site documentations and records

Hypothesis H3:
Quality management principles are positively associated with company mindset towards international certifications

Hypothesis H4:
Quality management principles are positively associated with respect to code of working ethics

Hypothesis H5:
Quality management principles are positively associated with conformance to standards and drawings

CHAPTER THREE – RESEARCH DESIGN AND METHODOLOGY

This section will present the various mechanisms that were used to conduct the research. Moreover, the population, sampling techniques, samples, data collection and how data was analyzed will be discussed.

3.1 Description of the study area

This research was conducted on 40 building construction companies that have projects located in Addis Ababa targeting to study the various quality management practices in the considered construction companies. For the ease of data interpretation and generalizability, this research only focused on building construction projects.

3.2 Unit of analysis

The main focus of this research was to attain knowledge on the quality management practices of the Ethiopian construction. For this reason, the unit of analysis are different construction companies from grades 1-4. Employees within these selected construction companies were asked to provide information of their respected companies regarding the quality planning, controlling and assuring strategies, hence the technical staff were the units of observation.

3.3 Research Approach and Strategy

The purpose of this study is to examine the relationship between the quality management principles and quality improvement levels. Furthermore, a comparison between the grade of the contractor with the quality implementation and awareness level was also studied. Cross-sectional field survey using questionnaires was used. Constructs were measured at a particular time. Data was collected at one particular time. Since the study tries to explain the relationship between variables quantitative and explanatory methods have been adopted.

3.4 Target Population, Sampling Size and Sampling techniques

BC contractors registered for the budget year of 2016/2017 in the list of construction proxy (2015) were considered as the sampling frame. According to this list the number of eligible

construction companies for BC 1 were found to be 59. Similarly, the number of contractors for BC 2, BC, 3 and BC 4 were 35, 47 and 92 respectively.

When deciding on the sample size for each construction company, a number of considerations have been made.

The first method considered for selection of the sample size was using the Cochran's adjusted formula for a small population. A margin of error, confidence level and sample proportion were set at 5%, 95% and 5% respectively. Accordingly, calculated sample sizes were 52, 33, 42 and 75 for BC 1, BC 2, BC 3 and BC 4 companies respectively.

The second method was to use sample size of previous study. Sample sizes could not be used from relative previous study as there have not been found any research conducted in this area that compares performances among various building contractors in Addis Ababa.

A third method considered was to use published tables. Using the sample size determination table developed by Krejcie and Morgan (Sample size determination Using Krejcie and Morgan Table, 2012) for a known population size and predetermined confidence level and margin of error. For the previously stated population size and using a confidence level of 95% and margin of error 5% the required sample size would be 52, 30, 41 and 76 for BC 1, BC 2, BC 3 and BC 4 companies. In other words, 52 contractors of the 59 companies would have to be sampled from BC 1 contractors.

Table 3.1: Sample size determination Using Krejcie and Morgan Table, 2012

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

In reality, this would be a challenging sample size to cover given the length of the study period and attached financial and other resource limitations. For this reason the researcher was forced to base the study on 10 construction companies from each grade of contractor working on a total of 40 building construction companies and gathered 169 valid responses (46, 39, 40 and 44 responses from grades 1-4 respectively). Responses were gathered from the companies depending on the availability of the professional staff assigned. For example, one company may have 5 Engineers stationed on site while another company may have 3.

Having decided on the size of the sample, a probabilistic approach was used to select the samples from the sampling frame as discussed above. A systematic sampling method was used to select the contractor for each grade of construction. After a list of contractors was prepared and numbered an interval was developed by dividing the total number of the contractors by the sample size. For example, the interval for BC 1 contractors was determined to be 59/10 which equals close to 6. This means that the 6^{th} contractor on the list was selected to be the sample. This system was used for all the remaining grades of the contractors.

After selecting the contractors with the technique mentioned above, a questionnaire was distributed to technical staff members of that company. The researcher faced certain unwilling companies that refused to take part in this study. It was decided to substitute these companies by omitting them from the list and using the same systematic technique.

3.5 Research Design

This paper is a quantitative research. The research aims to compare the quality management practices of construction companies among various grades of the sector. Furthermore, it was required to determine that quality management principles are not regarded as a critical success factor among contractors.

Causes of poor quality were tried to be identified. In addition, cost of poor quality and ways of improving quality in construction were also part of the research. In other words, the paper identified factors that have effects on the quality in construction.

For the reason stated above, the method that best suited the paper was an explanatory research. This paper, being an explanatory study, will be a base for further research to be conducted and extend the level of knowledge that this paper will provide in the end.

The research adopted a cross-sectional study, as data collection and analysis was conducted at one time only. Data collection and analysis has taken 8 weeks. Please see the Research Timeline provided in the annex.

The main tool for collecting data was a self-administered questionnaire. The questions in the survey were prepared based to answer the researcher's main research questions. In addition, the questionnaire was developed by considering previous studies all around the world regarding quality management in the construction sector. Previous studies from the UK, India, Iran,

Nigeria, and Ghana have been used as a background tool to study causes and cost of poor quality and how to address quality issues in construction. This suits well in using previous literature and adopting techniques to the context of the construction trend in Addis Ababa.

3.6 Method of analysis

The study has adopted both descriptive and inferential methods of analysis. Relationship between the grade of the contractor and quality awareness and implementation level have been analyzed using descriptive statistic tools of mean and standard deviation. Factors of poor quality, as identified from various literature have also been analyzed using a similar descriptive statistic tool.

Correlation analysis has been used to identify the relationship between the dependent and independent variables: Quality management principles and quality improvement. Furthermore, a linear regression analysis has been conducted to examine the relationship between quality management principles and quality improvement.

3.7 Measurement of Variables

As discussed in chapter 2, all constructs under quality awareness and implementation, factors challenging the quality management system and cost for poor quality have been sourced from various literature. Experiences in the construction sectors from different countries have been studied and adopted for the purpose of this research.

Furthermore, dependent variables (quality improvement) have similarly been identified from various literature while independents variables (quality management principles); Customer Focus, Leadership, Engagement of People, Process Approach, Improvement, Evidence-Based Decision Making and Relationship Management have been used as per the specifications of ISO 9001:2015.

Table 3.2: List of Measurements

Variable Type	Variables	Measurements	Source
Independent Variables	Customer Focus	Part III Section B – Questions 1-4	American Society for Quality, 7 quality management principles https://asq.org/quality-resources/iso-9000
	Leadership	Part III Section B – Questions 5-9	American Society for Quality, 7 quality management principles https://asq.org/quality-resources/iso-9000
	Engagement of People	Part III Section B – Questions 10-13	American Society for Quality, 7 quality management principles https://asq.org/quality-resources/iso-9000
	Process Approach	Part III Section B – Questions 14-16	American Society for Quality, 7 quality management principles https://asq.org/quality-resources/iso-9000
	Improvement	Part III Section B – Questions 17-19	American Society for Quality, 7 quality management principles https://asq.org/quality-resources/iso-9000

	Evidence-based Decision Making	Part III Section B – Questions 20-22	American Society for Quality, 7 quality management principles https://asq.org/quality-resources/iso-9000
	Relationship Management	Part III Section B – Questions 23-25	American Society for Quality, 7 quality management principles https://asq.org/quality-resources/iso-9000
Dependent Variable	Quality Improvement	Part III Section E – Questions 1-6	(Mashwama, Aigbovboa & Thwala, 2017), (Ayalew, Dakhli & Lafhaj, 2016)

3.8 Source of Data

To help attain the research objectives and answer the research questions relevant data was collected mainly using primary sources. In other words, data was gathered through questionnaires.

This study is not an unprecedented research. Related studies have been conducted to investigate causes of poor quality in construction in other areas of the world. For this reason, the researcher used secondary sources of data to include studies conducted so far in relation to quality and the Ethiopian construction and based on these previously conducted research the researcher has extended existing knowledge by offering some insight on the degree of variation in quality management practices with varying grade of contractors.

3.9 Data Collection Methods

Primary data was collected using:

Questionnaires: self-administered questionnaires were distributed to the sample in the target population. Questions were developed in the questionnaire to answer the research questions and meet the objective of the research.

3.10 Procedures of Data Collection

Having established the samples as discussed earlier a questionnaire was developed and distributed to the selected construction companies. For those companies who were willing to fill out the questionnaire without any assurance from the researcher, the survey was immediately distributed to the staff (Project Managers down to Site Engineers, and in some cases Engineers at the Head Offices).

There were some projects, however, that required a go ahead from the Main Office before filling out the survey. In such cases, the researcher made a visit to the General Managers (or the owners) and had to explain that the data would strictly be used for research purposes only. In addition a collaboration letter issued from the university was also provided to the approval of the surveys.

3.11 Reliability and Validity

Reliability of the Research

The questionnaire was structured to ask similar questions in different sections. This test-re test method of assuring the reliability of the questionnaire was an indication whether the answers given were coherent. Questionnaires were grouped to check for consistency in responses. IBM SPSS version 26 software was used for analyzing the data. Before feeding the collected data into SPSS a visual check of all the responses was made. This allowed the researcher to extract usable data from all the returned questionnaires. The first visual check was to assess the eligibility of the respondents for the research. For example, respondents who were outside the scope of the research were deemed unusable. The next visual check was to examine the accuracy in responses. Respondents ticking on different answers with similar measures in different sections of the questionnaire were also deemed unusable.

Internal consistency of responses to all similar items was checked using the Cronbach's coefficient alpha. Cronbach's alpha has been checked for different sections of items during analysis. The Cronbach's alpha score for an overall 54 items is outlined in the table below.

Table 3.3: List of Variables

Independent Variables (Quality management principle constructs)	**Dependent Variables (Quality improvement constructs)**
Customer Focus	Continuous trainings with respect to waste management
Leadership	Continuous trainings with respect to quality management
Engagement of People	On-site quality documentation
Process Approach	Company mindset towards international quality certifications
Improvement	Respecting work ethics
Evidence-based decision making	Conformance to specifications and drawings
Relationship Management	

Table 3.4: Reliability Statistics for Internal Consistency

Reliability Statistics		
Constructs	**Cronbach's Alpha**	**N of Items**
Customer Focus	0.801	4
Leadership	0.798	5
Engagement of People	0.705	4
Process Approach	0.833	3
Improvement	0.819	3
Evidence-based decision making	0.789	3
Relationship Management	0.807	3
Overall Cronbach's Alpha (Independent Variable)	0.828	7
Overall Cronbach's Alpha, quality improvement (Dependent Variables)	0.807	6

Source: Survey Output, 2019

Validity of the Research

A number of questions have been included to ascertain that all research questions were exhausted and the objectives of the research adequately addressed. The research questionnaires were made sure to study the quality management practices of each contractor by basing on the staff members of the respective companies. A pilot survey was gathered from 10 responses and modifications were made according to comments given.

The researcher made use of the 7 Quality Management Principles for ISO 9001 requirements as Customer Focus, Leadership, Engagement of People, Process Approach, Improvement,

Evidence-based decision making and Relationship Management to study the quality management practices of the companies.

Other items as factors for poor quality, cost of poor quality and quality improvement were also incorporated in the questionnaire so that the data to be gathered is in alignment with the study. The items in the questionnaire were based on experiences from several studies in the UK, India, Nigeria, Ghana and Iran. It was intended to adopt a similar study here in Addis Ababa by including new additions in the research as how many of the companies are striving to acquire an International quality certification, and comparing practices among four different building construction companies in the way they manage and practice quality in construction.

Furthermore, the researcher set out with his expectations of the outcomes of the result of the study. Validity in the research questions were checked whether responses signal obvious theoretical views as poor quality in construction leading to loss in the trust of the contractor.

3.12 Ethical Issues

The purpose of the research was thoroughly explained to the sample companies. All data collection process was carried out after consent with the project managers or general managers of the companies. Collaboration letter issued by the University was also provided to show the legitimacy of the study.

Data collected was not used for other purposes than for the success of this research attaining the research questions and objectives. The names of the construction companies and the members who provided relevant data was concealed and not disclosed in this paper.

CHAPTER FOUR – DATA PRESENTATION, ANALYSIS AND INTERPRETATION

Introduction

This chapter of the paper presents and discusses the results of the data gathered and analyzed. The first subsection gives an overview of the demographics of the respondents who took part in this research. The table below summarizes the methods used to analyze and interpret the collected data.

Table 4.1 Data Analysis Methods

Construct Description	Method of analysis
General information of respondents	Descriptive Statistics of frequencies
Quality awareness and Implementation	Descriptive Statistics of mean and standard deviation
Factors for poor quality	Descriptive Statistics of mean and standard deviation
Cost of poor quality	Descriptive Statistics of mean and standard deviation
Quality management principles	Correlated with quality improvement
Quality improvement	Linear Regression analysis

4.1 Response Rate

This paper was conducted on 40 building construction companies in Addis Ababa. Two hundred questionnaires were given out to possible respondents in the sector. Of the two hundred handed out questionnaires one hundred and eighty were filled and returned. From the rough visual check, one hundred and sixty nine were deemed usable by the researcher.

4.2 General Information of Respondents and Surveyed Companies

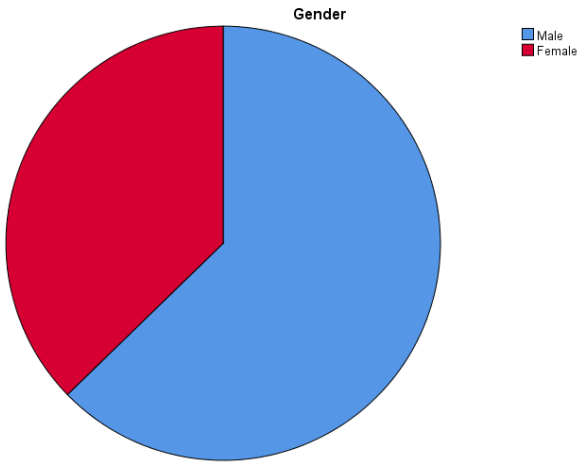
The first section of the distributed questionnaire assesses the gender composition, educational qualifications, roles and the corresponding grades of the contracting firms the respondents

belong to. The sub-chapters hereunder outline the various demographic, educational status, years of working experience, qualification of respondents and the variation of responses along the grade of construction companies.

Table 4.2: Summary of General Information

A. Gender Composition	
Valid	***Frequency***
Male	106
Female	63
Total	169
B. Educational Background	
Valid	***Frequency***
Master's degree	29
Bachelor's degree	124
Diploma	16
Total	169
C. Roles	
Valid	***Frequency***
Project manager	20
Construction Engineer	55
Contract Admin/ Site/ Office Engineer	75
Other	19
Total	169
D. Corresponding Grades of Respondents	
Valid	***Frequency***
Grade 1	46
Grade 2	39
D. Corresponding Grades of Respondents (continued)	
Valid	***Frequency***
Grade 3	40
Grade 4	44
Total	169

4.2.1 Gender Composition



Source: Survey Output (2019)

Figure 4.1 Gender Composition of Respondents

From the table, it can be seen that 62.7% of the participants were Male while the remaining 37.3% were female. Paraphrasing, of the 169 valid responses fed into the SPSS software, 106 were male while 63 were female.

The gender composition shows that the sample population on building construction companies in Addis Ababa is slightly dominated by male respondents.

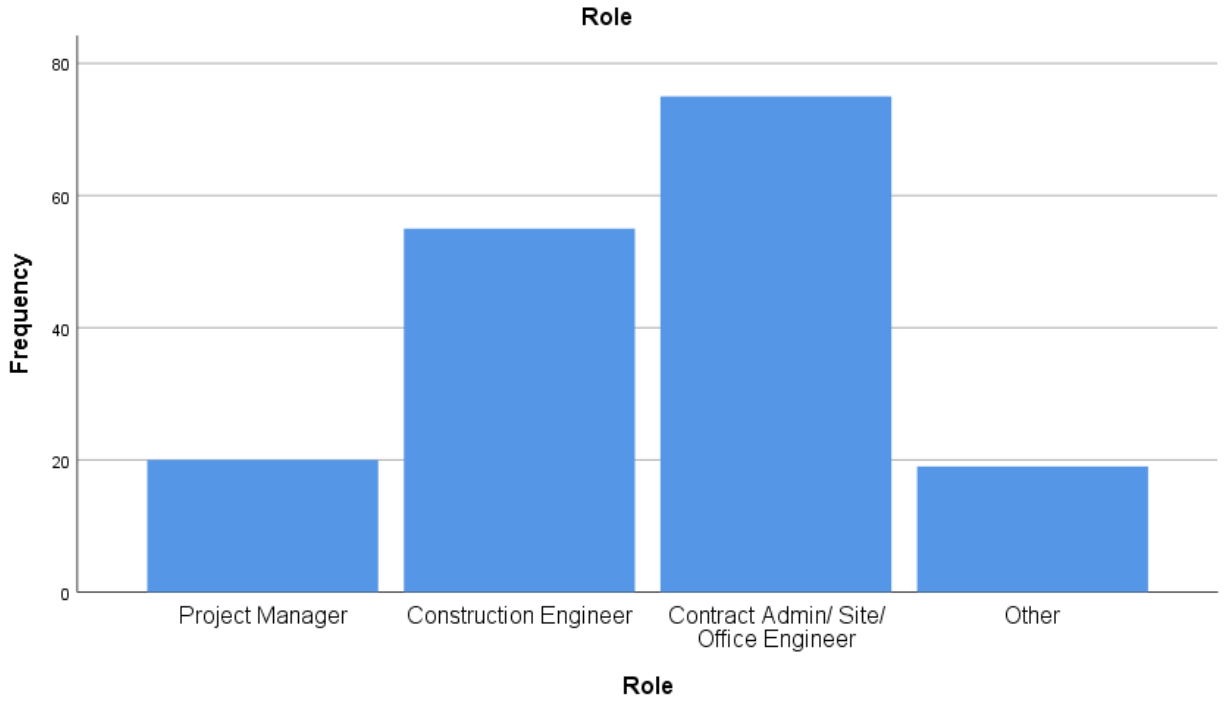
4.2.2 Educational Background

From the summary table above it can be seen that most of the respondents are with a Bachelor's degree qualification. From the total sample 73.4% of the respondents have a Bachelor's degree. Similarly, twenty-nine of the total respondents (17.2%) hold a Master's degree while the remaining sixteen respondents have a college diploma.

4.2.3 Role of Respondents in the Building Construction Sector

The bar chart below summarizes the roles of the respondents. The positions held by the respondents were grouped into 4, namely, Project Management, Construction Engineer, Contract/Site/ Office Engineer and Other. Accordingly, 75 of the respondents were found to be in the Contract Admin/ Site/ Office Engineering position (44.4%), 55 were Construction Engineers (32.5%), 20 were Project Managers (11.8%) and the remaining 19 were occupied

other sectors (11.2). From the open ended section of the roles in the survey it was possible to see that these19 respondents were quantity surveyors.



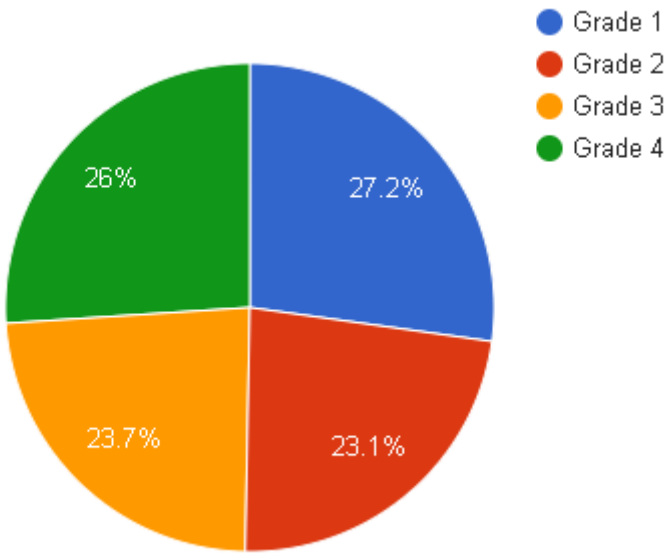
Source: Survey Output (2019)

Figure 4.2 Role of Respondents

In addition, years of working experience was grouped into 4: 5 years or less, 5-10 years, 10-15 years and over 15 years. Analysis showed that of the total 169 respondents 82 had 5 years or less working experience (48.5%). Similarly, 48 respondents had working experience between 5-10 years (48%) while 20 worked between 10-15 years (11.8%) and 19 had over 15 years of working experience (11.2%).

4.2.4 Corresponding Grades of the Respondents

As indicated in previous sections, data from 40 building construction companies was used to conduct this research. Data was collected from the technical staff of these companies. Accordingly, 46 responses were gathered from employees working in a Grade 1 building contractor (27.2%). Similarly, 39 respondents were from a Grade 2 building contractor (23.1%), 40 from a Grade 3 building contractor (23.7%) and 44 from a Grade 4 building contractor. (26%).



Source: Survey Output (2019)

Figure 4.3 Corresponding Grades of Respondents

4.3 Descriptive Statistics of Study Variables

4.3.1 Quality Awareness and Implementation

The second section of the survey asked questions relating to quality awareness and implementation of the construction companies. For ease of comparison, the data gathered from each grade of contractors was separately fed into SPSS.

Questions 1 through 10 of the second section in the questionnaire asked if quality planning, control and assurance methodology was used as a guiding document in the constructing firms. Subsequently, respondents were asked if this document was used on site and whether quality performances were tracked.

Respondents were then asked if they were familiar with quality management tools and techniques and if these were used in their companies. Other questions asked were if trainings or inductions were given by the companies relating to quality management and if the companies had or were striving to attain International Quality Certifications. The analysis of responses is elucidated below.

A. Grade1 Building Contractors

From a total of forty-six responses gathered, a significant forty respondents (87%) stated that quality planning, control and assurance documentation was present in their companies, three (6.5%) stated that this documentation was not present in their organization while three(6.5%) were not sure if there was any kind of documentation related to quality planning, control and assurance.

While forty respondents stated that the firms had quality documentation, thirty-nine of them (84.8%) identified to having implemented this documentation on-site. A point to note here is that only one respondent (2.2%) stated that although quality documentation is present it was not implemented on-site.

Thirty-three responses (71.7%) were counted in relation to quality tracking by the contractor while ten (21.7%) responded that there is no quality records tracked by their firms.

Forty-one respondents (89.1%) were familiar with quality management tools and techniques. However, only thirty-eight of these respondents (82.6%) clarified that quality management tools and techniques were implemented by their companies. Interestingly, one respondent (2.2%) stated that these tools and techniques were not implemented by the firm.

Nineteen respondents (41.3%) stated that their companies provide with trainings and inductions while 23 (50%) specified that no trainings or inductions were given by their firms. 4 (8.7%) respondents were unsure of any trainings or inductions provided by the contractors they represent.

Four respondents (8.7%) ascertained that their companies had or was striving to attain International quality certifications where 33 responses (71.7%) were found that no such qualifications were being sought by their firms.

From the descriptive analysis of frequencies it can be said that there is a high tendency of presence of quality planning, control and assurance methodology in grade 1 contractors. Looking at the frequency of implementation tells us that quality documents are also well implemented on-site. Grade 1 contractors have a high record on tracking quality and at the same time quality management tools and techniques are also well applied. Although grade 1 companies provide trainings and quality related inductions to employees to a certain degree, descriptive analysis results have shown that this value is below average.

Table 4.3 Quality Awareness and Implementation of Grade 1 Contractors

Questions	Valid	Frequency	Percent	Valid Percent	Cumulative Percent
Presence of quality planning, control and assurance methodology	Not Sure	3	6.5	6.5	6.5
	Yes	40	87.0	87.0	93.5
	No	3	6.5	6.5	100.0
	Total	**46**	**100.0**	**100.0**	
Implementation of quality documents on site	Not Sure	6	13.0	13.0	13.0
	Yes	39	84.8	84.8	97.8
	No	1	2.2	2.2	100.0
	Total	**46**	**100.0**	**100.0**	
Quality tracking by the company	Not Sure	3	6.5	6.5	6.5
	Yes	33	71.7	71.7	78.3
	No	10	21.7	21.7	100.0
	Total	**46**	**100.0**	**100.0**	
Familiarity with quality management tools and techniques	Yes	41	89.1	89.1	89.1
	No	5	10.9	10.9	100.0
	Total	**46**	**100.0**	**100.0**	
Application of tools and techniques by the company	Not Sure	7	15.2	15.2	15.2
	Yes	38	82.6	82.6	97.8
	No	1	2.2	2.2	100.0
	Total	**46**	**100.0**	**100.0**	
Does the company	Not Sure	4	8.7	8.7	8.7
	Yes	19	41.3	41.3	50.0

provide with inductions or quality related trainings	No	23	50.0	50.0	100.0
	Total	**46**	**100.0**	**100.0**	
Does the company have or is striving to attain international quality certifications	Not Sure	9	19.6	19.6	19.6
	Yes	4	8.7	8.7	28.3
	No	33	71.7	71.7	100.0
	Total	**46**	**100.0**	**100.0**	

Source: Survey Output (2019)

B. Grade 2 Building Contractors

From a total of 39 responses gathered, 32 respondents (82.1%) stated that quality planning, control and assurance documentation was present in their companies, 3 (7.7%) stated that this documentation was not present in their organization while 4 (10.3%) were not sure if there was any kind of documentation related to quality planning, control and assurance.
While 32 respondents stated that the firms had quality documentation, only 28 of them (71.8%) identified to having implemented this documentation on-site. In other words, 4 respondents (10.3%) stated that although quality documentation is present it was not implemented on-site. 22 responses (56.4%) were counted in relation to quality tracking by the contractor while 13 (21.7%) responded that there is no quality records tracked by their firms.

Twenty-six respondents (66.7%) were familiar with quality management tools and techniques. However, only 25 of these respondents (64.1%) clarified that quality management tools and techniques were implemented by their companies. Interestingly, 1 respondent (2.6%) stated that these tools and techniques were not implemented by the firm.

Eleven respondents (28.2%) stated that their companies provide with trainings and inductions while 21 (53.8%) specified that no trainings or inductions were given by their firms. 7 (17.9%) respondents were unsure of any trainings or inductions provided by the contractors they represent.

One respondent (2.6%) ascertained that the company had or was striving to attain International quality certifications where 32 responses (82.1%) were found that no such qualifications were being sought by their firms.

From the analysis of the table below it was observed that quality planning, control and assurance methodology is also highly present among the grade 2 contractors and this methodology is also well implemented on site. Degree of quality tracking and application of quality management tools and techniques is satisfactory. However, trainings and quality related inductions do not seem to be sufficiently provided in grade 2 construction companies.

Table 4.4 Quality Awareness and Implementation of Grade 2 Contractors

Questions	Valid	Frequency	Percent	Valid Percent	Cumulative Percent
Presence of quality planning, control and assurance methodology	Not Sure	4	10.3	10.3	10.3
	Yes	32	82.1	82.1	92.3
	No	3	7.7	7.7	100.0
	Total	**39**	**100.0**	**100.0**	
Implementation of quality documents on site	Not Sure	7	17.9	17.9	17.9
	Yes	28	71.8	71.8	89.7
	No	4	10.3	10.3	100.0
	Total	**39**	**100.0**	**100.0**	
Quality tracking by the company	Not Sure	4	10.3	10.3	10.3
	Yes	22	56.4	56.4	66.7
	No	13	33.3	33.3	100.0
	Total	**39**	**100.0**	**100.0**	
Familiarity with quality management tools and techniques	Yes	26	66.7	66.7	66.7
	No	13	33.3	33.3	100.0
	Total	**39**	**100.0**	**100.0**	

Application of tools and techniques by the company	Not Sure	13	33.3	33.3	33.3
	Yes	25	64.1	64.1	97.4
	No	1	2.6	2.6	100.0
	Total	**39**	**100.0**	**100.0**	
Does the company provide with inductions or quality related trainings	Not Sure	7	17.9	17.9	17.9
	Yes	11	28.2	28.2	46.2
	No	21	53.8	53.8	100.0
	Total	**39**	**100.0**	**100.0**	
Does the company have or is striving to attain international quality certifications	Not Sure	6	15.4	15.4	15.4
	Yes	1	2.6	2.6	17.9
	No	32	82.1	82.1	100.0
	Total	**39**	**100.0**	**100.0**	

Source: Survey Output (2019)

C. Grade 3 Building Contractors

From a total of 40 responses gathered, 27 respondents (67.5%) stated that quality planning, control and assurance documentation was present in their companies, 7 (17.5%) stated that this documentation was not present in their organization while 6 (15%) were not sure if there was any kind of documentation related to quality planning, control and assurance.

While 27 respondents stated that the firms had quality documentation, only 20 of them (50%) identified to having implemented this documentation on-site. In other words, 7 respondents (17.5%) stated that although quality documentation is present it was not implemented on-site.

Thirteen responses (32.5%) were counted in relation to quality tracking by the contractor while 21 (52.5%) responded that there is no quality records tracked by their firms. 33 respondents (82.5%) were familiar with quality management tools and techniques. However, only 19 of these respondents (47.5%) clarified that quality management tools and techniques were implemented by their companies. Interestingly, 14 respondent (35%) stated that these tools and techniques were not implemented by the firm.

One respondent (2.5%) stated that the company provides with trainings and inductions while 32 (80%) specified that no trainings or inductions were given by their firms. 7 (17.5%)

respondents were unsure of any trainings or inductions provided by the contractors they represent.

Thirty-two respondents (80%) ascertained that their companies neither had nor was striving to attain International quality certifications where 8 respondents (20%) were unsure that such qualifications were being sought by their firms.

Analysis of descriptive statistics showed that quality planning, control and assurance methodology is also present among grade 3 contractors. Implementation of these methodologies is satisfactory, however, quality tracking and application of quality management tools and techniques scored below average. Most grade 3 building contractors do not also provide employees with trainings or quality related inductions.

Table 4.5 Quality Awareness and Implementation of Grade 3 Contractors

Questions	Valid	Frequency	Percent	Valid Percent	Cumulative Percent
Presence of quality planning, control and assurance methodology	Not Sure	6	15.0	15.0	15.0
	Yes	27	67.5	67.5	82.5
	No	7	17.5	17.5	100.0
	Total	**40**	**100.0**	**100.0**	
Implementation of quality documents on site	Not Sure	13	32.5	32.5	32.5
	Yes	20	50.0	50.0	82.5
	No	7	17.5	17.5	100.0
	Total	**40**	**100.0**	**100.0**	
Quality tracking by the company	Not Sure	6	15.0	15.0	15.0
	Yes	13	32.5	32.5	47.5
	No	21	52.5	52.5	100.0
	Total	**40**	**100.0**	**100.0**	
Familiarity with quality	Yes	33	82.5	82.5	82.5
	No	7	17.5	17.5	100.0

management tools and techniques	**Total**	**40**	**100.0**	**100.0**	
Application of tools and techniques by the company	Not Sure	7	17.5	17.5	17.5
	Yes	19	47.5	47.5	65.0
	No	14	35.0	35.0	100.0
	Total	**40**	**100.0**	**100.0**	
Does the company provide with inductions or quality related trainings	Not Sure	7	17.5	17.5	17.5
	Yes	1	2.5	2.5	20.0
	No	32	80.0	80.0	100.0
	Total	**40**	**100.0**	**100.0**	
Does the company have or is striving to attain international quality certifications	Not Sure	8	20.0	20.0	20.0
	Yes	-	-	-	-
	No	32	80.0	80.0	100.0
	Total	**40**	**100.0**	**100.0**	**40**

Source: Survey Output (2019)

D. Grade 4 Building Contractors

From a total of 44 responses gathered, 10 respondents (22.7%) stated that quality planning, control and assurance documentation was present in their companies, 22 (50%) stated that this documentation was not present in their organization while 12 (27.3%) were not sure if there was any kind of documentation related to quality planning, control and assurance.

While 10 respondents stated that the firms had quality documentation, only 4 of them (9.1%) identified to having implemented this documentation on-site. In other words, 6 respondents (13.6%) stated that although quality documentation is present it was not implemented on-site.

Six responses (13.6%) were counted in relation to quality tracking by the contractor while 30 (68.2%) responded that there is no quality records tracked by their firms.

Thirty-eight respondents (86.4%) were familiar with quality management tools and techniques. However, only 6 of these respondents (13.6%) clarified that quality management tools and techniques were implemented by their companies. An alarming 34 respondents (77.3%) stated that these tools and techniques were not implemented by the firm.

Thirty-two (72.7%) specified that no trainings or inductions were given by their firms while 12 (27.3%) respondents were unsure of any trainings or inductions provided by the contractors they represent.

Twenty-nine respondents (65.9%) ascertained that their companies neither had nor was striving to attain International quality certifications where 15 respondents (34.1%) were unsure that such qualifications were being sought by their firms.

From the descriptive analysis of frequencies it was observed that quality planning, control and assurance methodology is not present in most grade 4 building contractors. Similarly, quality documents are not well implemented on site. In addition, quality tracking and application of quality management tools and techniques is poor in grade 4 construction companies. No grade 4 contractor in the sample was found to provide with quality related trainings and inductions.

Table 4.6 Quality Awareness and Implementation of Grade 4 Contractors

Questions	Valid	Frequency	Percent	Valid Percent	Cumulative Percent
Presence of quality planning, control and assurance methodology	Not Sure	12	27.3	27.3	27.3
	Yes	10	22.7	22.7	50.0
	No	22	50.0	50.0	100.0
	Total	**44**	**100.0**	**100.0**	
Implementation of quality documents on site	Not Sure	34	77.3	77.3	77.3
	Yes	4	9.1	9.1	86.4
	No	6	13.6	13.6	100.0
	Total	**44**	**100.0**	**100.0**	
Quality tracking by the company	Not Sure	8	18.2	18.2	18.2
	Yes	6	13.6	13.6	31.8
	No	30	68.2	68.2	100.0
	Total	**44**	**100.0**	**100.0**	
Familiarity with quality	Yes	38	86.4	86.4	86.4
	No	6	13.6	13.6	100.0

management tools and techniques	**Total**	**44**	**100.0**	**100.0**	
Application of tools and techniques by the company	Not Sure	6	13.6	13.6	13.6
	Yes	4	9.1	9.1	22.7
	No	34	77.3	77.3	100.0
	Total	**44**	**100.0**	**100.0**	
Does the company provide with inductions or quality related trainings	Not Sure	12	27.3	27.3	27.3
	Yes	-	-	-	-
	No	32	72.7	72.7	100.0
	Total	**44**	**100.0**	**100.0**	
Does the company have or is striving to attain international quality certifications	Not Sure	15	34.1	34.1	34.1
	Yes	-	-	-	-
	No	29	65.9	65.9	100.0
	Total	**44**	**100.0**	**100.0**	

Source: Survey Output (2019)

From the above descriptive analysis it was able to conclude that the quality planning, control and assurance methodology is more present in the higher graded contractors. As the grade of the contractor decreases so does the presence of this quality planning, control and assurance methodology.

Quality control, assurance and tracking is also implemented on site more on the top graded contractors as compared to the third and fourth grade contractors.

Trainings and induction regarding quality awareness and implementation is more fostered in Grade 1 contractors as compared to the other grade contractors.

Attaining or striving to attain international quality certifications was found to be the least focused area in all Grade of contractors. From the gathered data it was possible to see that only 3 companies of the 40 were ISO 9001 certified, 2 Grade 1 contractors and 1 Grade 2 contractor.

Alternatively, rating items were developed to further study the Quality awareness and implementation among the contractors. Section A of part III in the questionnaire asked

questions relating to the existing quality management practices. In addition to the previous section of the analysis regarding quality awareness respondents were asked if quality management system was present in their organization, and in relation to quality implementation they were asked if the organization uses quality checklists, If the quality manual was regularly updated, if construction materials confirm to specifications and drawings and if subcontractors were evaluated thoroughly and whether qualified experts were assigned on the required positions.

The following descriptive analysis presents the responses from the various grades of the contractors.

A. Grade 1 Contractors

Responses from grade 1 contractors show that construction materials confirm to specifications and standards with a mean and standard deviation of 3.85 and 0.868 respectively. All quality awareness and implementation results are above the mean cut off point of 2.5. The item that was found to show the least mean is quality manual being updated regularly. This mean score was found to be 2.61with a standard deviation of 0.856.

Analysis of grade 1 contractors has indicated that most quality awareness and implementation mean points are well above average.

Table 4.7 Scale Rating of Quality Awareness and Implementation, Grade 1 Contractors

Category	N	Minimum	Maximum	Mean	Standard Deviation
Quality Management System is present in the Organization	46	1	5	3.61	0.774
The Organization uses quality checklists	46	1	5	3.24	0.848
Quality Manual is updated regularly	46	1	4	2.61	0.856
Construction materials confirm to specifications and drawings	46	1	5	3.85	0.868

Subcontractors are thoroughly evaluated	46	1	5	3.52	0.836
Qualified experts are assigned on the required positions provide with inductions or quality related trainings	46	3	5	3.74	0.575

Source: Survey Output (2019)

B. Grade 2 Contractors

A similar scale rating was used for all graded contractors. Accordingly, responses from grade 2 contractors indicated the higher score for quality management system being present in the organization with a mean of 3.46 and standard deviation of 0.682. This showed that quality awareness is more pronounced that it is implemented in the Grade 2 construction companies.

Although all quality awareness and implementation are above the cut-off mean point, here again it was seen that quality manual being updated regularly had the least score. This mean score was found to be 2.62 with a standard deviation of 0.59.

Table 4.8 Scale Rating of Quality Awareness and Implementation, Grade 2 Contractors

Category	N	Minimum	Maximum	Mean	Standard Deviation
Quality Management System is present in the Organization	39	2	5	3.46	0.682
The Organization uses quality checklists	39	2	5	2.95	0.724
Quality Manual is updated regularly	39	2	4	2.62	0.590
Construction materials confirm to specifications and drawings	39	2	5	3.44	0.680

Subcontractors are thoroughly evaluated	39	2	5	3.10	0.852
Qualified experts are assigned on the required positions provide with inductions or quality related trainings	39	3	4	3.31	0.468

Source: Survey Output (2019)

C. Grade 3 Contractors

A descriptive statistics analysis for Grade 3 contractors found a higher score of 3.3 mean and 0.608 standard deviation for the construct construction materials confirm to specifications and standards. Quality Manual being updated regularly has scored a mean of 2.1 with standard deviation of 0.545 which is below the mean cut-off point.

The scores for quality awareness and implementation highlight a mean around the average point for the Grade 3 contractors.

Table 4.9 Scale Rating of Quality Awareness and Implementation, Grade 3 Contractors

Category	N	Minimum	Maximum	Mean	Standard Deviation
Quality Management System is present in the Organization	40	2	4	2.93	0.526
The Organization uses quality checklists	40	2	4	2.85	0.580
Quality Manual is updated regularly	40	1	3	2.10	0.545
Construction materials confirm to specifications and drawings	40	3	5	3.30	0.608
Subcontractors are thoroughly evaluated	40	2	4	3.15	0.483

Qualified experts are assigned on the required positions provide with inductions or quality related trainings	40	2	3	2.85	0.362

Source: Survey Output (2019)

D. Grade 4 Contractors

As can be seen from the table below all quality awareness and implementation constructs are either below or around the average. Scores for Quality management system being present in the organization has a mean and standard deviation of 2.23 and 1.008 respectively. Judging from the cut-off point it can be said that Grade 4 construction companies are not sufficiently aware of quality practices.

Table 4.10 Scale Rating of Quality Awareness and Implementation, Grade 4 Contractors

Category	N	Minimum	Maximum	Mean	Standard Deviation
Quality Management System is present in the Organization	44	1	4	2.23	1.008
The Organization uses quality checklists	44	1	4	1.95	0.888
Quality Manual is updated regularly	44	1	4	1.82	0.995
Construction materials confirm to specifications and drawings	44	1	4	2.95	0.888
Subcontractors are thoroughly evaluated	44	2	4	2.91	0.421
Qualified experts are assigned on the required positions provide with	44	1	4	2.36	0.650

inductions or quality related trainings					

Source: Survey Output (2019)

A take away point here is that although quality awareness and implementation seems to be poor in Grade 4 companies' analysis for construction materials confirming to specs and standards scored a mean point of 2.95 with a standard deviation of 0.888.

Comparing the overall scores on quality awareness and implementation based on part III section A of the questionnaire indicated the following.

1. The level of quality awareness and implementation decreases with the level of the contractor.
2. The least score of construct for all Grades of contractors was quality manual being updated regularly.
3. Construction materials confirming to specifications and standards generated a better score on all grades of contractors. This showed that all graded contractors stick to drawings and design specifications during construction.

Table 4.11 Scale Rating of Quality Awareness and Implementation overall scores

Category	Grade of Contractor	N	Mean	Standard Deviation
Quality Awareness and Implementation	**Grade 1**	46	3.43	0.51
	Grade 2	39	3.145	0.46
	Grade 3	40	2.863	0.699
	Grade 4	44	2.372	0.59
	Overall score	169	2.953	0.565

Source: Survey Output (2019)

A perception analysis was conducted using 4 items as indicated in Part II Section B, questions 11 through 14. The perception questions were if the respondents viewed quality management

system as a critical success factor for a firm, if maintaining quality would lead to long term profitability, if there was any regulation that required attainment of international quality certification before construction operation and if the current building construction sector needed a raise in awareness. The following table summarizes the responses from the gathered questionnaire.

From the table below it can clearly be seen that there is a high perception as to whether quality management is one of the key critical success indicators for a firm (96.4%). Respondents also perceived that maintaining quality would lead to long term profitability. (97.6%).

Table 4.12 Perceptions on Quality Management

Questions	Valid	Frequency	Percent	Valid Percent	Cumulative Percent
Quality Management is one of the key critical success indicators for a firm	Yes	163	96.4	96.4	96.4
	No	4	2.4	2.4	98.8
	Not sure	2	1.2	1.2	100.0
	Total	**169**	**100.0**	**100.0**	
Maintaining Quality leads to the company's long term profitability	Yes	165	97.6	97.6	97.6
	No	4	2.4	2.4	100.0
	Total	**169**	**100.0**	**100.0**	
There is a regulation that requires International Quality certifications to be attained by the contractor before operation	No	134	79.3	79.3	89.9
	Not sure	17	10.1	10.1	100.0
	Total	**169**	**100.0**	**100.0**	
The quality management system in building construction companies needs a raise in awareness	Yes	160	94.7	94.7	94.7
	No	6	3.6	3.6	98.2
	Not sure	3	1.8	1.8	100.0
	Total	**169**	**100.0**	**100.0**	

Source: Survey Output (2019)

4.3.2 Cost of Poor Quality

Part III section D of the questionnaire discusses the cost of not meeting a building construction project's quality requirements. Accordingly, rework, long term firm competence, health and safety issues, poor staff morale, tie up of workforce and assets and administrative costs have been highlighted to signal the cost of poor quality.

Table 4.13: Cost of poor quality

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Cost of unplanned rework	169	1	5	4.45	.715
Long term competence of the firm will be compromised	169	3	5	4.28	.619
Exposed health and safety issues due to non- conformance to specs and drawings	169	1	5	3.03	.860
Staff morale will be low	169	2	5	3.58	.842
Company's workforce and assets will be tied up	169	2	5	3.72	.725
Administrative and overhead costs will be higher	169	2	5	3.62	.866
Valid N (list wise)	169				

Source: Survey Output (2019)

As can be seen from the table above, all items had a score above the average cut-off point of 2.5. This indicates that all six items are results of failing to have a quality management system in place.

The greatest cost of poor quality was found to be cost of unplanned rework increasing the cost of the overall project with a mean and standard deviation of 4.45 and 0.715 respectively from a total of 169 responses. Similarly, long term firm competence and company's workforce and other assets being tied up also had a high cost attachment with means (and standard deviations) respectively of 4.28 (0.619) and 3.72 (0.725).

4.3.3 Factors for Poor Quality

Part III section 3 of the questionnaire was used to investigate possible factors that result in poor quality outcomes in construction. The constructs were determined after reviewing related literature. The table below summarizes the results of the descriptive analysis.

Table 4.14: Mean Value of Factors for Poor Quality

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Skilled people not assigned on jobs	169	2	5	4.39	.733
Lack of continuous trainings	169	2	5	4.08	.676
Use of inappropriate equipment and defective materials	169	2	5	4.09	.733
Absence of on-site quality tracking	169	2	5	4.37	.745
Increase in wasteful construction practices	169	1	5	3.92	.779
Non-conformance to specifications and drawings	169	1	5	3.70	1.027
Unethical practices	169	1	5	4.07	.821
Absence of quality planning, control and assurance methodology	169	1	5	4.24	.734
Leadership Commitment	169	1	5	3.63	.815
Valid N (list wise)	169				

Source: Survey Output (2019)

Analysis of summary of scores shows that the mean values range from 3.63 to 4.39 with minimum and maximum standard deviations ranges of 0.676 and 1.027 respectively for all variables. The mean value indicates the average response of respondents on a five point Likert scale while the respective standard deviation values indicate the variation of these values about the mean.

According to the analysis made, the greatest factor for poor quality was found to be not assigning skilled people on jobs with a mean and standard deviation values of 4.39 and 0.733 respectively, followed by absence of on-site quality tracking with mean value of 4.37 and standard deviation of 0.745.

A research conducted by Ali and Wan (2011) found that lack of experience and competency of labors with a mean value of 4.45 was the highest ranked variable that greatly contributed to poor workmanship.

4.4 Correlation Analysis

Part III section B of the questionnaire was developed to study the quality management practices of the construction companies. The questions were based on the 7 quality management principles defined by ISO 9001: 2015.

The International Organization of Standardization (ISO) was formed in Geneva, Switzerland, in 1946 to develop international, industrial and quality standards as a model for quality assurance standards in design, development, production, installation and service. (Aba & Badar, 2013). Aba and Badar (2013) noted that, "ISO 9000 is a series of quality management standards published by the ISO in 1987 after a process of consensus handled by ISO Technical Committee 176; these are confided, verifiable and easily adaptable (Wilson et al., 2003)". In their research, Aba and Badar (2013) stated that, "McAdam and McKeown (1999) mentioned that the main benefit of ISO 9000 is that it gives rise to an effective quality system that assists in the elimination of errors, which eventually saves money on rework and scrap". The ISO 9000:2015 and ISO 9001:2015 standards are based on seven quality management principles that senior management can apply to promote organizational improvement. These principles are Customer Focus, Leadership, Engagement of People, Process Approach, Improvement, Evidence-based decision making and Relationship Management. ("What is the ISO 9000 Standards Series", n.d.)

Questions 1- 4 of Part III Section B of the questionnaire was developed to measure the Customer Focus construct while questions 5-9 measured Leadership. Questions 10 – 13 measured Engagement of People where questions 14 - 16 were used to study the Process Approach. Questions 17 – 19 were used to study Improvement while questions 20 – 22 were used to measure Evidence-based Decision Making of the companies and questions 23 – 25 measured how Relationship Management is detailed.

Correlation analysis was conducted to explore the strength in the relationship between the 7 quality management principles and quality improvement methods. Correlation coefficients are used to assess the strength and direction of the linear relationships between pairs of variables. (Mukaka. MM, 2012)

There are two main types of correlation coefficients: Pearson's product moment correlation coefficient and Spearman's rank correlation coefficient. (Mukaka. MM, 2012). Pearson's r is a measure that assesses the association between two continuous (or metrics) variables. Spearman's ρ is a non-parametric measure that assesses the association using two sets of ranked scores of two variables. Similar to Pearson's r, the range of Spearman's ρ is also from -1 to 1, but Spearman's ρ doesn't require that the two variables be linearly related and does not assume that the variables are measured on interval or ration scales. (Choi, Peters and O. Mueller, 2010) A 5 point Likert scale was developed to determine the quality management practices of the construction firms making the collected data as an ordinal variable. The data was then transformed using SPSS to relate the existing quality management practices with the 7 quality management principles. To this end, Pearson's correlation coefficient ρ has been reported as follows to discuss the relationship of the 7 quality management principle variables with the actual quality management practice.

As can be observed from the table below all independent variable of the QMP's are positively and strongly related. This relationship for most variables is also significant at the 99% confidence level. This significant relationship is in support of the assumption that the quality management principles are related with one another.

Table 4.15 Correlation between Quality Management Principle Variables

		CF	L	EP	PA	I	EBDM	RM
CF	Pearson Correlation	1	.734**	.665**	.744**	.646**	.786**	.498**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
	N	169	169	169	169	169	169	169
L	Pearson Correlation	.734**	1	.788**	.679**	.630**	.598**	.549**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000
	N	169	169	169	169	169	169	169
EP	Pearson Correlation	.665**	.788**	1	.787**	.678**	.685**	.643**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000
	N	169	169	169	169	169	169	169
PA	Pearson Correlation	.744**	.679**	.787**	1	.735**	.730**	.602**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	169	169	169	169	169	169	169
I	Pearson Correlation	.646**	.630**	.678**	.735**	1	.771**	.534**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000

	N	169	169	169	169	169	169	169
EBDM	Pearson Correlation	.786**	.598**	.685**	.730**	.771**	1	.529**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
	N	169	169	169	169	169	169	169
RM	Pearson Correlation	.498**	.549**	.643**	.602**	.534**	.529**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	
	N	169	169	169	169	169	169	169

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

Key: CF- Customer Focus, L-Leadership, EP-Engagement of People, PA-Process Approach, I-Improvement, EBDM-Evidence based Decision Making, RM-Relationship Management

Source: Survey Output (2019)

The highest correlation was observed between leadership and engagement of people (r=0.788). This is an expected result as most manifestations of the construct under leadership is mostly related to employees. Although management directs the organization through visions and goals the end results will be delivered by the employees.

The second highest relationship was recorded between process approach and engagement of people (r=0.787). This also is an anticipated result managing process requires assigning qualified staff. Process oriented companies are required to deploy resources effectively and identify critical linkages between activities. This in turn will have to be executed by qualified employees within the organization.

Table 4.16 Correlation between Quality Improvement Variables

		CT&WM	CT&QM	OSD	MIC	RWE	CSD
CT&WM	Pearson Correlation	1	.791**	.599**	.726**	.493**	.606**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	169	169	169	169	169	169
CT&QM	Pearson Correlation	.791**	1	.571**	.729**	.532**	.616**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	169	169	169	169	169	169
OSD	Pearson Correlation	.599**	.571**	1	.549**	.483**	.598**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	169	169	169	169	169	169

MIC	Pearson Correlation	.726**	.729**	.549**	1	.591**	.605**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	169	169	169	169	169	169
RWE	Pearson Correlation	.493**	.532**	.483**	.591**	1	.638**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	169	169	169	169	169	169
CSD	Pearson Correlation	.606**	.616**	.598**	.605**	.638**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	169	169	169	169	169	169

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

Key: CT&WM- Continuous Trainings and Waste Management, CT&QM- Continuous Trainings and Quality Management, OSD- On-site documentations, MIC- Mindset towards International Certifications, RWE- Respecting working ethics, CSD- Conformance to standards and drawings

The table above summarizes the relationship between the quality improvement constructs. Most of the variables are strongly and positively related at $p<0.01$. Highest correlations were found between continuous trainings improving waste management and continuous trainings improving quality management ($r= 0.791$)

From the correlation analysis among the dependent variables it was also possible to see that there is a strong and positive relation between continuous trainings and companies' mindset towards attaining international certifications. ($r=0.729$).

Table 4.17 Correlation between Quality Management Principles and Quality Improvement Variables

		CF	L	EP	PA	I	EBDM	RM
CT&WM	Pearson Correlation	.421*	.324*	.678*	.348	.746**	.438*	.499*
	Sig. (2-tailed)	.045	.023	.012	.165	.000	.036	.028
	N	169	169	169	169	169	169	169
CT&QM	Pearson Correlation	.514*	.494**	.522*	.362*	.759**	.401*	.328*
	Sig. (2-tailed)	.039	.003	.019	.038	.000	.048	.011
	N	169	169	169	169	169	169	169
OSD	Pearson Correlation	.685	.528*	.654*	.622*	.698**	.789**	.495*

	Sig. (2-tailed)	.051	.040	.031	.025	.001	.000	.042
	N	169	169	169	169	169	169	169
MIC	Pearson Correlation	.651**	.663*	.382*	.735*	.697*	.441	.366*
	Sig. (2-tailed)	.000	.036	.024	.035	.044	.051	.037
	N	169	169	169	169	169	169	169
RWE	Pearson Correlation	.625**	.365*	.629**	.481	.583*	.548*	.463*
	Sig. (2-tailed)	.000	.021	.003	.054	.032	.036	.034
	N	169	169	169	169	169	169	169
CSD	Pearson Correlation	.426**	.511*	.652*	.666*	.431**	.384*	.525**
	Sig. (2-tailed)	.000	.025	.012	.015	.003	.017	.000
	N	169	169	169	169	169	169	169

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

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

The table above shows the relationship between the independent variables (quality management principles) with quality improvement variables. From the table it can be seen that most of the relationships are significant at the 95% confidence level ($p<0.05$). The correlations range between 0.324 and 0.789. It can be concluded that most quality management principle constructs are highly and positively related with quality improvement variables.

Highest correlation was observed between evidence based decision making and on-site documentation ($r=0.789$) followed by continuous trainings & improvement ($r=0.759$). This result shows a similar outcome from a study conducted on bottling companies by Beshah, Kitaw and Alemu (2013) which found that continuous trainings are highly related with the decrease of bottle breakage. The outcome of the correlation analysis shows a similarity with previous studies conducted by Sadikoglu and Olcay (2014) which indicated correlation coefficients between TQM practices and performance ranging from 0.23 to 0.66.

4.5 Regression Analysis

A regression analysis was conducted to determine the effect of implementing the quality management principles on improving the quality in building construction companies.

Before discussing the outputs of the regression tests for violation on the classic linear regression model assumptions was conducted as follows.

4.5.1 Testing for violations of statistical assumptions

Most statistical tests rely upon certain assumptions about the variables used in the analysis. When these assumptions are not met the results may not be trustworthy, resulting in a Type I or Type II error, or over- or under-estimation of significance or effect size(s). (Osborne and Waters, 2002)

The degree to which valid inferences may be drawn from the results of inferential statistics depends upon the sampling technique and the characteristics of population data. This dependency stems from the fact that statistical analyses assume that sample(s) and population(s) meet certain conditions. These conditions are called statistical assumptions. If violations of statistical assumptions are not appropriately addressed, results may be interpreted incorrectly. In particular, when statistical assumptions are violated, the probability of a test statistic may be inaccurate, distorting Type I or Type II error rates. (Nimon, 2012).

4.5.1.1 Normality and Linearity Test

According to Park (2015) one common assumption is that a random variable is normally distributed. In many statistical analyses, normality is often conveniently assumed without any empirical evidence or test. But normality is critical in many statistical methods. When this assumption is violated, interpretation and inference may not be reliable or valid.

Lack of symmetry (skewness) and pointiness (kurtosis) are two main ways in which a distribution can deviate from normal. The values for these parameters should be zero in a normal distribution. (Ghasemi and Zahedias, 2012)

Kim (2013) stated that for small samples ($n < 50$), if absolute z-scores for either skewness or kurtosis are larger than 1.96, which corresponds with an alpha level 0.05, then reject the null hypothesis and conclude the distribution of the sample is non-normal.

For medium-sized samples ($50 < n < 300$), reject the null hypothesis at absolute z-value over 3.29, which corresponds with an alpha level 0.05, and conclude the distribution of the sample is non-normal.

The following table summarizes the skewness and kurtosis results of the variables that were used in the regression models.

Table 4.18 Skewness and Kurtosis results for QMP

Variable-QMP	N	Skewness		Kurtosis	
		Statistic	Std. error	Statistic	Std. error
CF	169	0.341	0.187	-0.482	0.371
L	169	0.327	0.187	-0.539	0.371
EP	169	0.339	0.187	0.234	0.371
PA	169	0.256	0.187	-0.176	0.371
I	169	0.366	0.187	-0.382	0.371
EBDM	169	0.282	0.187	0.301	0.371
RM	169	0.286	0.187	0.002	0.371
CT&WM	169	-0.366	0.187	-0.530	0.371
CT&QM	169	-0.315	0.187	-0.226	0.371
OSD	169	-0.264	0.187	-0.204	0.371
MIC	169	-0.283	0.187	+0.645	0.371
RWE	169	-0.047	0.187	-0.727	0.371
CSD	169	+0.133	0.187	-0.546	0.371

Source: Survey Output (2019)

As can be observed from the tables the results skewness and kurtosis values in relation to standard errors is between the acceptable ranges of ±2.00. Furthermore the histogram and Normal P-P plots in the Appendix clearly indicate that the data for the variables are normally distributed.

4.5.1.2 Multicollinearity Test

The multicollinearity test was performed to determine if the independent variables were not highly correlated with one another. In order to detect this, pairwise and multiple variable collinearity tests of Tolerance and its inverse Variation Inflation Factor (VIF) were used. Accordingly, the table below presents these values of the two independent regression independent variables.

Table 4.19 Collinearity Statistics for Regression model

Coefficients [a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	Customer Focus	.242	4.138
	Leadership	.274	3.656
	Engagement of People	.228	4.392
	Process Approach	.254	3.939
	Improvement	.320	3.125
	Evidence Based Decision Making	.239	4.191
	Relationship Management	.554	1.805

a. Dependent Variable: Quality Improvement

Source: Survey Output (2019)

As can be seen from tables 4.19 the tolerance values for both models are above 0.1 and the inverse VIF values are below 10. This indicates that there is no severe multicollinearity among the independent variables, hence, the assumption of multicollinearity is not violated.

4.5.1.3 Independence of Observations

A final test that the residuals of observations are independent from one another was performed to verify the assumption of no autocorrelation in the CLRM. The Dublin-Watson (DW) test was used to check the independence of residuals from one another.

A regression analysis using the DW test statistic indicated the following values for the regression model.

Table 4.20 DW Statistic for Regression model

Model Summary [b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.540[a]	.292	.261	.49677	1.587

a. Predictors: (Constant), Relationship management, Customer focus, Improvement, Leadership, Process approach, Evidence based decision making, Engagement of people

b. Dependent Variable: Quality Improvement

Source: Survey Output (2019)

As can be seen from table 4.20 the DW test statistic values for the regression model is 1.587 with a null hypothesis of no evidence of autocorrelation if these values are between the upper and lower bounds of the critical D values. Using the DW distribution table with n=169 and k=10 at the 95% confidence interval for model 1 the boundary is (1.521, 1.772) and our DW value is within this range. Therefore, we fail to reject the null hypothesis that there is no autocorrelation between the independent first order residuals. In other words, the independence of observations assumption is satisfied.

4.5.2 Regression Results of QMP variables and Continuous trainings with respect to waste management

Table 4.21 Regression Results of QMP and Continuous trainings with respect to waste management

Model Summary [b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.622[a]	.387	.36	.63054

a. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

b. Dependent Variable: Continuous trainings improve waste management

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.663	7	2.666	6.706	.000[b]
	Residual	64.011	161	.398		
	Total	82.675	168			

a. Dependent Variable: Continuous trainings improve waste management

b. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.917	.298		13.126	.000
	CF	.604	.139	.612	4.335	.000
	L	.898	.144	.929	6.236	.000
	EP	.451	.169	.487	2.669	.009

	PA	-.221	.133	-.229	-1.662	.099
	I	.795	.106	.841	7.5	.000
	EBDM	-.250	.147	-.241	-1.701	.092
	RM	.033	.098	.031	.337	.737

a. Dependent Variable: Continuous trainings improve waste management

The multiple linear regression as indicated in Table 4.21 shows that the model is statically significant at $p<0.05$ level. The table also shows a positive relationship ($r=0.622$) between QMP and continuous trainings with respect to waste management. As can be seen from the adjusted r^2 value of 0.36, 36% of the variability in the dependent variable can be explained by the independent variables.

The ANOVA analysis shows that the model indicates a linear relationship between the variables which is significant at the 99% confidence interval.

From the regression result it can be seen that leadership ($\beta=0.898$), improvement ($\beta=0.795$) customer focus ($\beta=0.604$) are the predominant factors that would most likely have a significant effect on continuous trainings with regards to waste management in the building construction industry in Addis Ababa.

4.5.3 Regression Results of QMP variables and Continuous trainings with respect to quality management

The regression result in table 4.22 below shows that the model is statically significant at the 95% confidence interval. The correlation coefficient $r = 0.725$ indicates a positive relationship between the independent and dependent variables. The r^2 value of 0.526 indicates that 52.6% of the variability in continuous trainings with respect to quality management is explained by the 7 quality management principles. The adjusted r^2 value indicates the generalizability of this model in another population.

The significant F-test in the ANOVA table shows the joint significance of the independent variables in the linear regression model. Further analysis of coefficients indicated that leadership ($\beta= 0.802$), customer focus ($\beta=0.752$), customer focus ($\beta=0.718$), engagement of people ($\beta= 0.393$) and process approach ($\beta= 0.366$) are statically significant in explaining the relationship between the two variables.

Table 4.22 Regression Results of QMP and Continuous trainings with respect to quality management

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	.725[a]	.526	.50	.59456

a. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	19.014	7	2.716	7.684	.000[b]
	Residual	56.915	161	.354		
	Total	75.929	168			

a. Dependent Variable: Continuous trainings improve quality

b. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
2	(Constant)	4.343	.281		15.432	.000
	CF	.752	.131	.794	5.740	.000
	L	.802	.136	.773	5.897	.000
	EP	.393	.160	.452	2.456	.015
	PA	.366	.126	.395	2.905	.004
	I	.718	.100	.783	7.180	.000
	EBDM	-.019	.139	-.008	-.137	.483
	RM	-.058	.093	-.057	-.624	.533

a. Dependent Variable: Continuous trainings improve quality

4.5.4 Regression Results of QMP variables and On-site Quality Documentation

The multiple correlation coefficient value as shown in table 4.23 above (r=0.511) indicates a positive relationship between independent and dependent variables. The adjusted r2 value of 0.229 shows that the explanatory power of the model in which 23% of variability of the dependent variables can be explained by the independent variables.

Table 4.23 Regression Results of QMP and Adopting on-site quality documentation

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
3	.511[a]	.261	.229	.66381

a. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig.
3	Regression	25.056	7	3.579	8.123	.000[b]
	Residual	70.944	161	.441		
	Total	96.000	168			

a. Dependent Variable: Adopting quality documentation on-site

b. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
3	(Constant)	3.715	.314		11.831	.000
	CF	.648	.147	.698	4.408	.000
	L	.755	.151	.847	5.000	.000
	EP	.045	.178	.056	.254	.800
	PA	-.404	.140	-.387	-2.886	.605
	I	.158	.112	.169	1.415	.159
	EBDM	.804	.155	.894	5.187	.000
	RM	.467	.103	.472	4.523	.000

a. Dependent Variable: Adopting quality documentation on-site

The significant F-test in the ANOVA table confirms that the relationship between the variables was linear at a joint significance level $p<0.05$.

Coefficient analysis confirmed that evidence based decision making, leadership, customer focus and relationship management are statically significant at the 95% confidence interval.

4.5.5 Regression Results of QMP variables and Company mindset towards International Certifications

The regression results in the table below signal the model is statically significant at the 95% confidence interval. The multiple correlation coefficient $r = 0.821$ shows a positive relationship

between the variables where r^2 value of 0.674 indicates the independent variables together account for 67.4% of the variability in the company's mindset towards attaining international certifications. The ANOVA table shows that the model has a joint significance at the 99% confidence interval while customer focus, leadership and improvement are statistically significant at $p<0.05$ significance level. The regression result thus indicated that process approach, leadership, customer focus and improvement are the leading factors responsible for the variation on company's mindset towards attaining international certifications.

Table 4.24 Regression Results of QMP and Company mindset towards International Certifications

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
4	.821[a]	.674	.658	.80816

a. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig.
4	Regression	28.824	7	4.118	6.305	.000[b]
	Residual	105.153	161	.653		
	Total	133.976	168			

a. Dependent Variable: Company mindset towards international certifications

b. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
4	(Constant)	3.882	.382		10.162	.000
	CF	.598	.179	.627	3.341	.000
	L	.601	.184	.676	3.266	.001
	EP	.076	.217	.081	.348	.728
	PA	.955	.171	.968	5.585	.212
	I	.435	.136	.495	3.199	.002
	EBDM	-.285	.188	-.216	-1.513	.132
	RM	.091	.126	.098	.720	.472

a. Dependent Variable: Company mindset towards international certifications

4.5.6 Regression Results of QMP variables and Respecting Work Ethics

Table 4.25 Regression Results of QMP and Respecting Work Ethics

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
5	.795[a]	.632	.614	.59615

a. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig.
5	Regression	17.491	7	2.499	7.031	.000[b]
	Residual	57.219	161	.355		
	Total	74.710	168			

a. Dependent Variable: Respecting work ethics

b. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
5	(Constant)	3.291	.282		11.663	.000
	CF	.775	.132	.825	5.871	.000
	L	.352	.136	.367	2.590	.005
	EP	.822	.160	.891	5.138	.000
	PA	.511	.126	-.555	-4.058	.000
	I	.209	.100	.254	2.082	.039
	EBDM	-.065	.139	-.269	-.468	.095
	RM	.223	.093	.222	2.400	.018

a. Dependent Variable: Respecting work ethics

The multiple correlation coefficient value in table 4.25 (r=.795) shows a positive relationship among the two sets of variables. The adjusted r^2 value of 0.614 shows that 61.4% of the variability in the dependent variable can be explained by this model.

The ANOVA tables indicates that there is a joint significance in the model at the 99% confidence interval, whereas from the coefficients table it can be seen that engagement of

people, customer focus, leadership, improvement and relationship management are statistically significant at p<0.05 level.

4.5.7 Regression Results of QMP variables and Conformance to Specifications and Drawings

Table 4.26 Regression Results of QMP and Conformance to Specifications and Drawings

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.523[a]	.274	.242	.45757

a. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.694	7	1.813	8.661	.000[b]
	Residual	33.708	161	.209		
	Total	46.402	168			

a. Dependent Variable: Conformance to specifications and drawings

b. Predictors: (Constant), RM, CF, I, L, PA, EBDM, EP

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.618	.217		16.673	.000
	CF	.492	.101	.664	4.871	.000
	L	.331	.104	.407	3.172	.002
	EP	.717	.123	.735	5.825	.000
	PA	.729	.097	.8	7.512	.000
	I	.243	.077	.375	3.157	.002
	EBDM	-.02	.107	-.018	-.187	.101
	RM	.341	.071	.432	4.792	.000

a. Dependent Variable: Conformance to drawings and specifications

The multiple correlation coefficient value as shown in the table above (r= 0.523) indicates that there is a positive relationship between the independent and dependent variables. The r^2 value of 0.274 indicates the explanatory power of this model in which the independent variables together account for 27.4 % of the variance in conformance to drawings and specifications. The adjusted r^2 value of 0.242 indicates the generalizability of this model in another population.

The ANOVA table shows the joint significance of this model that confirms the model depicts a linear relationship between the independent and dependent variables.

Further analysis of coefficients showed that from the proposed 7 variables, process approach, engagement of people, customer focus, leadership and improvement are statically significant at the 95% significance interval.

4.6 Summary of Correlation and Regression Analysis

4.6.1 Results of Hypothesis H1:

Hypothesis H1 dictated that quality management principles are positively associated with continuous trainings. The correlation analysis showed that there is a positive relationship between continuous trainings and the quality management principles. Most of this relationship was significant at $p<0.05$ level. Improvement, customer focus and leadership were found to have the highest correlation with continuous trainings.

Similarly, the ANOVA table in the regression analysis indicated that there is a joint significance in the relationship. Coefficients analysis for continuous trainings with respect to waste and quality management showed that leadership ($\beta=0.898$), improvement ($\beta=0.795$) and customer focus ($\beta=0.604$) are the predominant factors that are statistically significant at the 95% confidence interval. This result has been found to be in alignment with a research conducted by Ali and Wen (2011) who stated that trainings and education to the labors, well manpower management and proper design have significant effect as a possible solution for poor construction workmanship.

4.6.2 Results of Hypothesis H2:

Hypothesis H2 proposed that quality management principles are positively associated with on-site documentations and records. From the correlation analysis it was possible to see that there is a positive relationship between the on-site documentation with all the quality management principles except for the customer focus construct. This relationship is also significant at the $p<0.05$ level.

While the ANOVA table shows that there is a joint significance in the model with which 22.9% of the variation in the dependent variable can be explained by the independent variables. The predominant factors in this model were found to be evidence based decision making ($\beta=0.804$), leadership (β 0.755) and customer focus ($\beta=0.648$). It can be concluded that 77% of the variation is thus explained by other factors not included in this study.

4.6.3 Results of Hypothesis H3:

Hypothesis H3 proposed that quality management principles are positively associated with company mindset towards international certifications. Correlation analysis has indicated that there is a positive relationship between the two sets of variables at the 95% confidence interval. The highest correlation was observed between process approach and company mindset towards attaining international certifications.

The ANVOA table supports that this model has a joint significance while the adjusted r^2 value of 0.658 indicated that 65.8% of the variability in the company mindset towards attaining international certifications can be explained by the quality management principles.

Among the variables process approach (β=0.955), leadership (β=0.601) and customer focus (β=0.598) are statistically significant at the 95% confidence interval. Thus, we fail to reject Hypothesis H3.

4.6.4 Results of Hypothesis H4:

Hypothesis H4 proposed that quality management principles are positively associated with respecting working ethics. Correlation analysis results showed that there is a positive relationship between the variables of QMP and respecting work ethics. The strongest relationships were observed between respecting work ethics and engagement of people (r=0.629) and respecting work ethics with customer focus (r=0.625). This relationship is significant at the $p<0.05$ level.

The adjusted r^2 value of 0.614 signals that the QMP variables together account for 61.4% of the variance in respecting work ethics. Coefficients analysis showed that engagement of people (β=0.832) and customer focus (β=0.775) are the predominant factors that impact respecting work ethics in the building construction industry in Addis Ababa. Therefore, we fail to reject H4.

4.6.5 Results of Hypothesis H5:

Hypothesis H5 postulated that quality management principles are positively associated with conformance to specifications and drawings. When investigating the relationship between conformance to standards and drawing with the QMP's the strongest relationship was found to be with the process approach and engagement of people constructs of the QMP's. This relationship was also found to be significant at the 95% confidence interval.

While 24.2% of the variance in conformance to standards and drawings can be explained by the QMP's the main factors affecting the dependent variable were found to be process approach

(β=0.729) and engagement of people (β=0.717). As this impact is found to be significant at the $p<0.05$ level we fail to reject H5.

Table 4.27: Summary of Hypothesis & Test Results

Hypothesis	Finding
H1: Quality management principles are positively associated with continuous trainings	Fail to reject
H2: Quality management principles are positively associated with on-site documentations and records	Fail to reject
H3: Quality management principles are positively associated with company mindset towards international certifications	Fail to reject
H4: Quality management principles are positively associated with respect to code of working ethics	Fail to reject
H5: Quality management principles are positively associated with conformance to standards and drawings	Fail to reject

CHAPTER 5 – SUMMARY OF MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of major findings

The study attempted to examine the construction practices in relation to quality management among 4 grades of building contractors in Addis Ababa. As per the data gathered though questionnaire survey and analyzed using SPSS software summary of the findings have been outlined as follows:

- Although there is a high perception that quality management system is one of the key critical success indicators for a firm (96.4%) and that maintaining quality leads to long term profitability (97.6%) the overall mean on the actual quality management and implementation is not that significant with a mean of 2.95 (cut-off mean value is 2.5) and standard deviation of 0.565.
- Level of quality awareness decreases as the Grade of the contractor decreases.
- On-site quality tracking and other quality management tools and techniques are more implemented in Grade 1 and Grade 2 building construction companies as compared to Grade 3 and Grade 4 contractors.
- Trainings and inductions related to quality management system are highly given in Grade 1 construction companies (41.3%) as compared to the 3 contractor grades.
- 2 contractors from Grade 1 and 1 contractor from Grade 2 building constructions were found to either have attained or were striving to attain international quality certifications.
- From a comprehensive review of literature quality improvement factors were identified to be continuous trainings with respect to waste and quality management, on-site quality documentation, company mindset towards attaining international quality certifications, respect of work ethics and conformance to standards and drawings were identified.
- Basing on the ISO 9001:2015 data the 7 quality management principles: customer focus, leadership, engagement of people, process approach, improvement, evidence based decision making and relationship management were considered as the control variables.

- A positive and strong relationship was observed among the 7 quality management principles. (Independent variables)
- Highest correlation was observed between leadership and engagement of people (r=0.788) and process approach with engagement of people (r=0.787)
- The 7 quality management principles are positively correlated with the quality improvement constructs.
- Highest correlation between the independent and dependent variables indicated a strong relationship between on-site documentation and improvement (r=0.789) and among continuous training and improvement (r= 0.759)
- The strong and positive relationship in the correlation analysis was found to reflect the same result in the regression analysis. Findings of the regression analysis have shown that customer focus, improvement and leadership are the most important factors that influence continuous trainings. Similarly, customer focus and evidence based decision making are the most predominant factors that account for the variation in on-site quality documentation in the building construction sector in Addis Ababa whereas leadership and process approach have a significant effect on company's mindset towards international certifications. From the regression analysis it was also possible to see that customer focus and engagement of people have a great impact on respecting code of working ethics while engagement of people and process approach have high influence on conformance to standards and specifications.
- Although all constructs have been shown to have an impact on the quality improvement, customer focus customer focus and leadership were found to have the greatest overall effect.
- Cost of unplanned rework and compromised long term competence of the contracting firm were found to be the greatest costs of poor quality at the expense of the contractor with means and standard deviations respectively of 4.45 (0.715) and 4.28 (0.619) as compared to the cut-off mean value of 2.5.

5.2 Conclusion

After a thorough analysis using different descriptive, correlation and regression tools the following are the conclusions of the research.

In relation to the problem initially stated by the research, the results showed that as opposed to the high perception that quality management is one of the key critical success indicators the overall quality implementation and awareness level in building constructions was not that significant. This result has been found to be consistent with the research question. Correlation analysis outputs also indicate a weak positive relationship between existing quality management practices and the 7 quality management principles with a coefficient of 0.431.

In relation to the main objectives of the research, level of quality awareness and implementation was found to decrease as the grade of the contractor decreases. Although there was a high score on the perception of maintaining quality and the long term profitability of the company, gap was observed in the existing quality management practices.

Scores on Leadership, Engagement of people and Relationship management were found to be significantly low as the grade of the contractor decreases. Whereas Customer Focus, Leadership and Engagement of people were found to be highly valued in the top graded contractors.

Main factors leading to poor quality in construction have been found to be Absence of on-site quality tracking and Unethical practices as bribery, fraud and falsification of qualifications while factors as continuous trainings and assigning qualified staff were found to significantly improve the level of quality.

Using a regression analysis and having quality management principles as control variables the research showed how these constructs as stated in ISO 9001:2015 can improve the quality in construction, hence showing that attaining or striving to attain international quality certification has a positive influence on the quality performance in the building construction sector in Addis Ababa.

5.3 Recommendations

Based on the findings and conclusions the following are the recommendations provided by the researcher so as to improve the level of quality management system in building constructions in Addis Ababa.

1. Building construction companies should prepare a quality planning, control and assurance manual so that it becomes easier to track and manage quality performances.

2. Gaps have been observed between perceptions on maintaining quality leading to the long term profitability of the firm and the existing quality management practices. Even though building contractors do not intend on attaining International Quality Certifications as the ISO 9001, they should consider implementing the 7 quality management principles because this was found to have a significant positive effect on the existing quality management practices.
3. Building construction companies should allocate resources for training its existing staff and giving inductions to new recruits in order to raise awareness on the importance of quality management system. In this regard, trainings and inductions will build a strong organizational culture in relation to improving the quality management system.
4. It was apparent that the level of quality awareness and implementation were found to decline with decrease in the grade of the contractor. Similarly, great costs related to poor quality management system were highly manifested in costs of rework that in turn increases the overall cost of the contractor and loss of long-term competence of the firm. To this end, lower graded construction companies should consider assigning qualified employees on the required positions as opposed to assigning relatives who may not have the desired skill set.

5.4 Limitation of the Study

While the findings of the current study shed light on the quality management practices among building contractors of Grades 1 to 4 the results have to be seen in light of some limitations. The first limitation is in the scope of the research. The research only considered building construction companies in Addis Ababa.

The building construction sector is a vast industry in Addis Ababa with an immense population size of 233 companies. The second limitation of this study was that the sample size considered 40 building construction companies and collected 169 valid responses due to various researcher related constraints as time limitations and financial capacity. However, this sample size was not found to have affected or biased the outcome of the research as the standard deviations as reported are not that significant. In contrast, increasing the sample size would most likely increase the confidence interval on the variable coefficients of the correlation and regression models.

In order to avoid conflicts that would arise from bias due to the similarity in professional background of the researcher, distance has been kept from influencing the data and result of the study. A strict and ethical procedure was followed so that the data that would be gathered was in alignment with the research questions and objectives.

Since the concept of quality management system is somewhat sensitive to the company in consideration there was a sense of limitation on the degree of willingness of responses. Seeking for approval to gather the required data has made it difficult to collect the questionnaires on time. Hectic work schedule and unavailability upon request of respondents was also another factor on the punctual collection of responses.

5.5 Future Research directions

The findings of the study make a valuable contribution in raising the awareness and further stressing on the importance of quality management system in building construction companies. In addition, it has extended existing knowledge by comparing the quality management systems among the 4 top grades of building contractors in Addis Ababa. Furthermore, it was suggested on how lower grade contractors can better firm competing advantages by aiming to implement quality management system.

Studies in the future can be done by extending the leads of this research and shifting its context. As the context of this research aimed at the building construction sector future studies could be conducted on different schemes of construction as road, bridge or water works construction. Another shift in context could be to change the location of the study and compare quality management practices of building constructions in Addis Ababa with other cities in Ethiopia.

The regression model on the factors for poor quality showed that 49.9% of the variation in poor quality were explained by the items identified as possible causes. As this research deploys a quantitative approach other related studies as the influence of information flow and communication on the quality management system may add to the explanatory power. The effect of quality management system on the betterment of Health and Safety issues in construction could also help improve the accident rates in the current construction practice in Ethiopia.

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Appendix I: Questionnaire

Addis Ababa University

College of Business and Economics

Department of Management

MSc. Thesis on Quality Management

Dear Respondents,

My name is Yohannes Kefyalew and I am a Master's student in Quality Management and Organizational Excellence at Addis Ababa University. This is a questionnaire survey I have developed to gather the necessary data for fulfillment of my Master's thesis in **Quality Management Practices in Building Construction Companies in Ethiopia.**

I would first like to thank you for sharing your time to take part in this questionnaire survey. Please be informed that this survey will STRICTLY be used for academic purposes ONLY to study the Quality Management Practices in various building construction companies in Addis Ababa, Ethiopia and therefore, your responses will be held confidential.

Furthermore, your genuine response will play a crucial role towards attaining a precise understanding on the construction practices in relation to quality. To this end I kindly ask you to truthfully provide the required information so that it is possible to advance the knowledge of and possibly improve quality management practices in Ethiopia.

Part I. General Profile

Please place a "✓" mark to all your responses in the box provided besides each statement.

1. Gender

☐ Male ☐ Female

2. Educational Background

☐ Master's degree or above ☐ College Diploma

☐ Bachelor's Degree ☐ High school Completed

☐ Other (Please specify _____)

3. Which of the following best describes your role in the building construction project?

☐ Project Manager ☐ Construction Engineer ☐ Contract Admin/Site/Office Engineer

☐ Other (Please specify _____)

4. How many years of working experience do you have?

☐ Less than 5 years ☐ 5-10 years ☐ 10-15 years ☐ Over 15 years

5. What is the grade of your construction company?

☐ Grade 1 ☐ Grade 2 ☐ Grade 3 ☐ Grade 4

☐ Other (Please specify _____)

Part II. Research Related Questions

Please tick on the box for a response you feel is appropriate for the following questions of the section.

A. Quality Awareness and Implementation

1. Does your company have quality planning, control and assurance methodology as a guiding document? Or are you aware of any quality management system that is developed by your organization?

☐ Yes ☐ No ☐ Not Sure

2. If yes, is this quality document implemented on site?

☐ Yes ☐ No ☐ Not Sure

3. Does your company track quality performances?

☐ Yes ☐ No ☐ Not Sure

4. If your response to question 3 is “YES”, how frequent is this?

_____

5. Are you familiar with quality management tools and techniques?

☐ Yes ☐ No

6. If your answer to question 5 is “YES”, do you use any of these quality management tools and techniques effectively in your company?

☐ Yes ☐ No ☐ Not Sure

7. Does the company provide the staff with inductions and trainings regarding quality management?

☐ Yes ☐ No ☐ Not Sure

8. If your answer to question 7 is "YES", please state how frequent this training is.

_____

9. Does the company have or is aiming to acquire any International Quality Certifications?

☐ Yes ☐ No ☐ Not Sure

10. If your answer to question 9 is "YES", please state which certification that is.

_____

B. Perceptions on Quality Management System	**Yes**	**No**	**Not Sure**
11. Quality Management is one of the key critical success indicators for a firm			
12. Maintaining quality leads to the company's long-term profitability			
13. There is a regulation that requires international quality certifications to be attained by the contractor before operation			
14. The quality management system in building construction companies needs a raise in awareness.			

Part III. Rating Scale Questions:

A. Existing Quality Management Practices

Please tick on the space you feel is appropriate for the following. Scale rating description: 5= Very Strongly Agree, 4= Strongly Agree, 3= Agree, 2= Strongly Disagree, 1= Very Strongly Disagree.

S No.	Existing Quality Management Practices	Rate				
		5	4	3	2	1
1.	Quality Management system is present in my organization					
2.	My company uses Quality Planning Checklists before actual works are executed					
3.	Quality Management planning and control is updated regularly					
4.	Materials that are used for constructions are tested for conformation to standards and specifications					
5.	Sub-contractors are thoroughly evaluated before work is awarded to them					
6.	Qualified experts are assigned on the required position					

B. Quality Management Principles

Please tick on the space you feel is appropriate for the following. Scale rating description: 5= Very Strongly Agree, 4= Strongly Agree, 3= Agree, 2= Strongly Disagree, 1= Very Strongly Disagree.

S No.	Quality Management Principles	Rate				
		5	4	3	2	1
Customer Focus						
1.	Understand the needs of existing and future customers					
2.	Align organizational objectives with customer needs and expectations					
3.	Meet customer requirements					
4.	Measure customer satisfaction					
Leadership						
5.	Management establishes a vision and direction for the organization					

6.	Management sets challenging goals					
7.	Management equips and empowers employees					
8.	Management recognizes employee contributions					
9.	Management establishes trust					
Engagement of People						
10.	Ensure that people's abilities are used and valued					
11.	Evaluate individual performance					
12.	Enable open discussion of problems and constraints					
13.	Make people accountable					
Process Approach						
14.	Deploy resources effectively					
15.	Identify linkages between activities					
16.	Measure the capability of activities					
Improvement						
17.	Empower people to make improvements					
18.	Measure improvement consistently					
19.	Improve organizational performance and capabilities					
Evidence-based Decision Making						
20.	Ensure the accessibility of accurate and reliable data					
21.	Balance data analysis with practical experience					
22.	Make decisions based on analysis					
Relationship Management						
23.	Identify and select suppliers to manage costs, optimize resources, and create value					
24.	Establish relationships considering both the short and long term					
25.	Recognize supplier successes					

C. Factors for poor construction quality

Please tick on the space you feel is appropriate for the following. Scale rating description: 5= Very Strongly Agree, 4= Strongly Agree, 3= Agree, 2= Strongly Disagree, 1= Very Strongly Disagree.

S No.	Factors for poor quality	Rate				
		5	4	3	2	1
1.	Skilled and qualified people not assigned on jobs					
2.	Lack of continuous trainings given to raise awareness of quality practices					
3.	Use of inappropriate equipment and defective materials					
4.	Absence of on-site quality tracking					
5.	Increase in wasteful construction practices					
6.	Non-conformance to specifications and drawings					
7.	Unethical practices as bribery, fraud and falsification of qualifications					
8.	Absence of quality planning, controlling and assurance methodology and documentation within the company					
9.	Leadership commitment					

D. Cost of poor quality

Please tick on the space you feel is appropriate for the following. Scale rating description: 5= Very Strongly Agree, 4= Strongly Agree, 3= Agree, 2= Strongly Disagree, 1= Very Strongly Disagree.

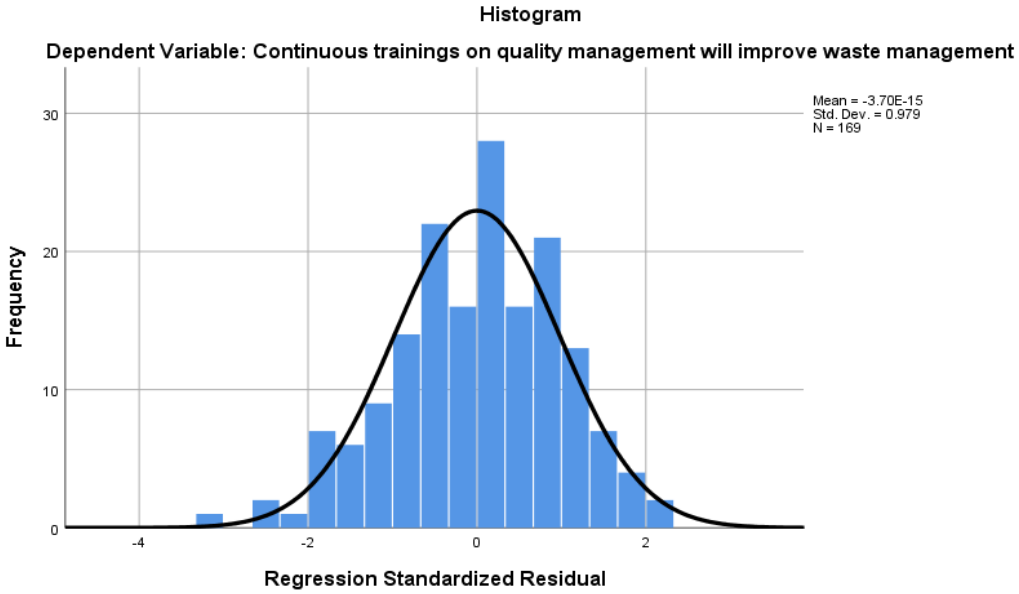
S No.	Cost of Poor quality	Rate				
		5	4	3	2	1
1.	Cost of unplanned rework increases the cost of the project					
2.	Long term Competence of the firm in the construction business will be compromised					
3.	Exposed Health and Safety issues due to nonconformance to specifications and drawings					
4.	Staff morale will be low					
5.	Company's workforce and other assets will be tied up					
6.	Administrative and support costs will be higher					

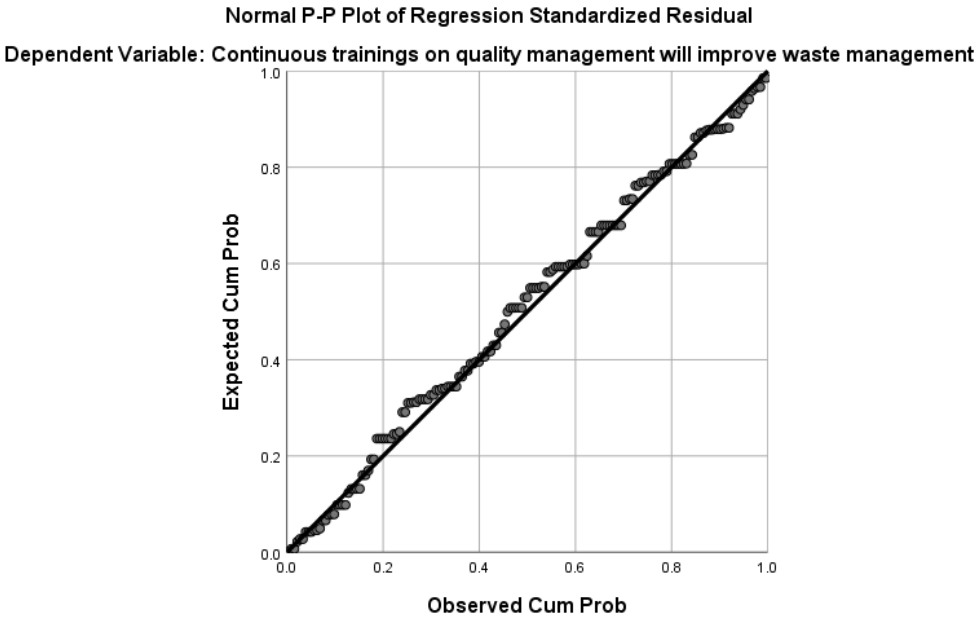
E. Quality Improvement

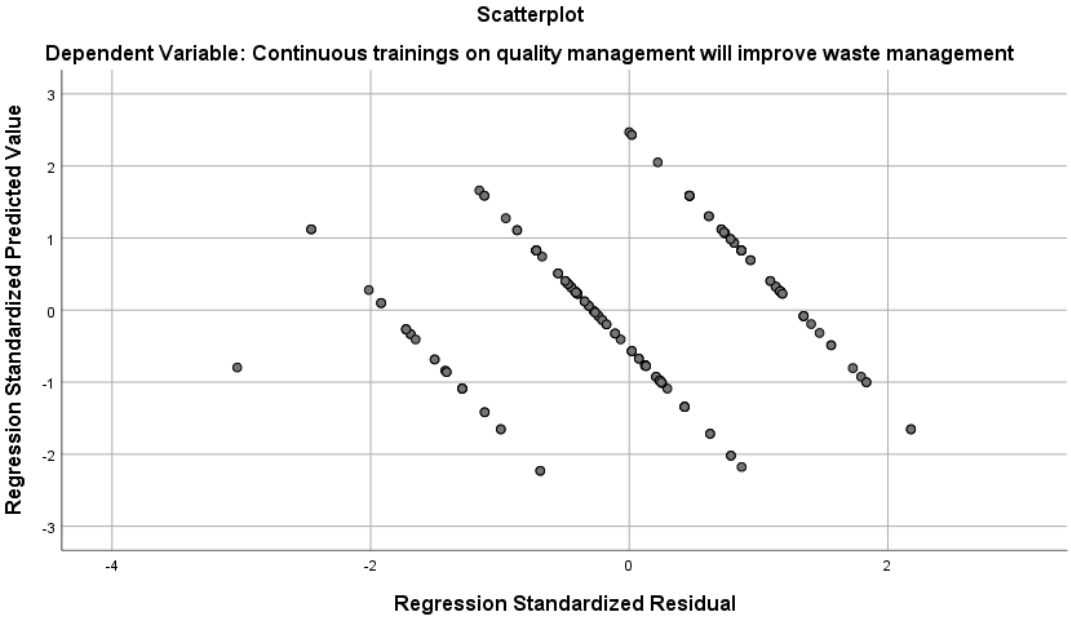
Please tick on the space you feel is appropriate for the following. Scale rating description: 5= Very Strongly Agree, 4= Strongly Agree, 3= Agree, 2= Strongly Disagree, 1= Very Strongly Disagree.

S No.	Quality Improvement	Rate				
		5	4	3	2	1
1.	Continuous trainings given on quality management practices will improve my attitude towards waste management					
2.	Continuous trainings given on quality management practices will improve my attitude towards attaining the required level of quality					
3.	Adopting quality documentations and records on-site					
4.	Company's mindset towards attaining international quality certifications					
5.	Respecting the code of working ethics					
6.	Conformance to standards and drawings					

Appendix II - Normal and Linear Distribution Figures

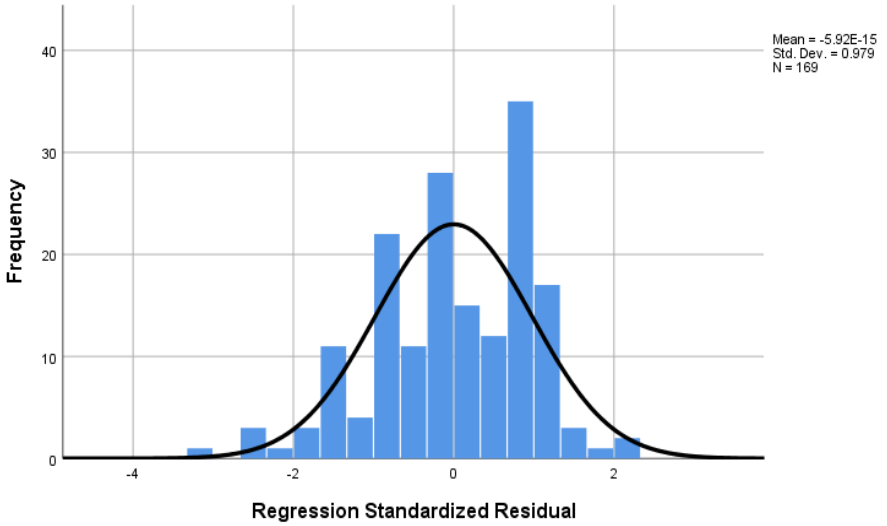






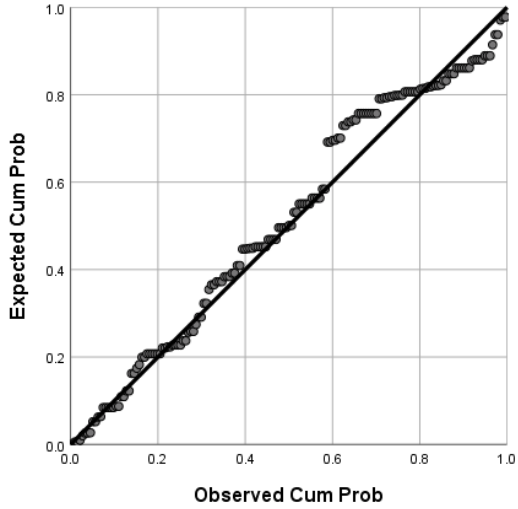
Histogram

Dependent Variable: Continuous tranings on quality management will help attain required level of quality in construction



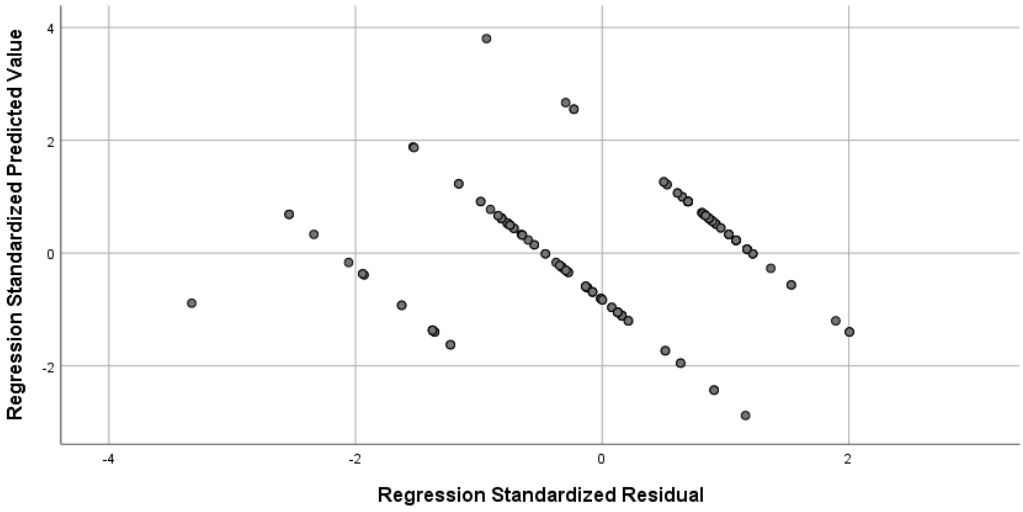
Normal P-P Plot of Regression Standardized Residual

Dependent Variable: Continuous tranings on quality management will help attain required level of quality in construction



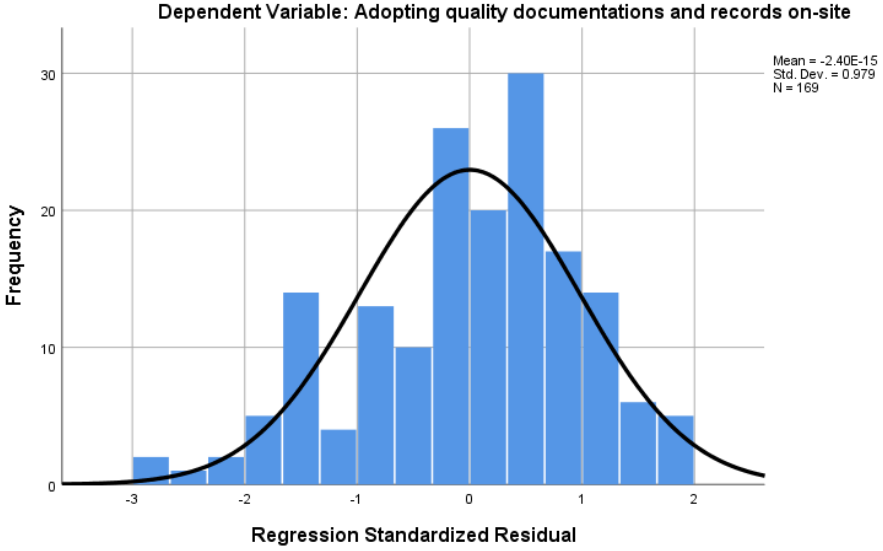
Scatterplot

Dependent Variable: Continuous tranings on quality management will help attain required level of quality in construction



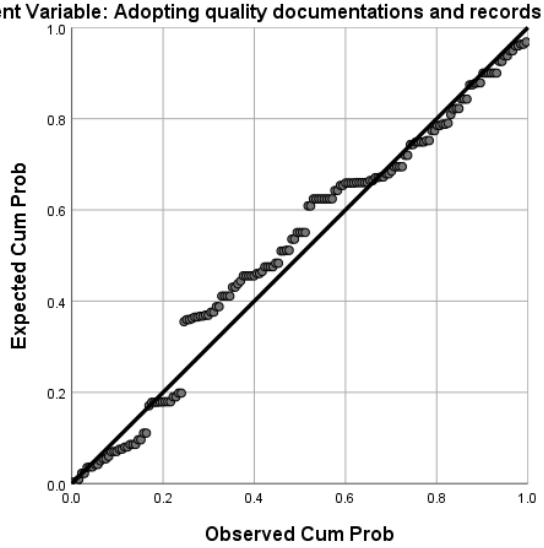
Histogram

Dependent Variable: Adopting quality documentations and records on-site



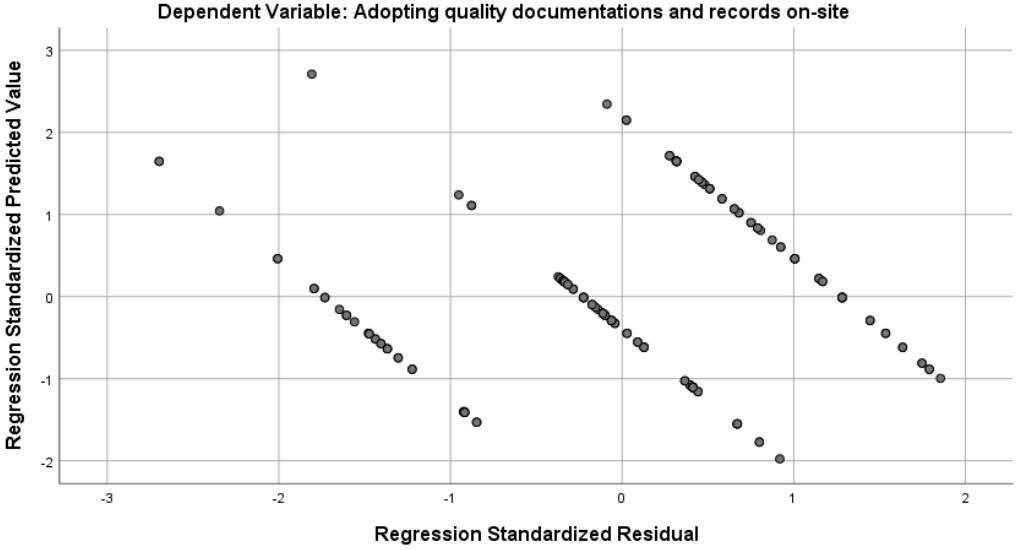
Normal P-P Plot of Regression Standardized Residual

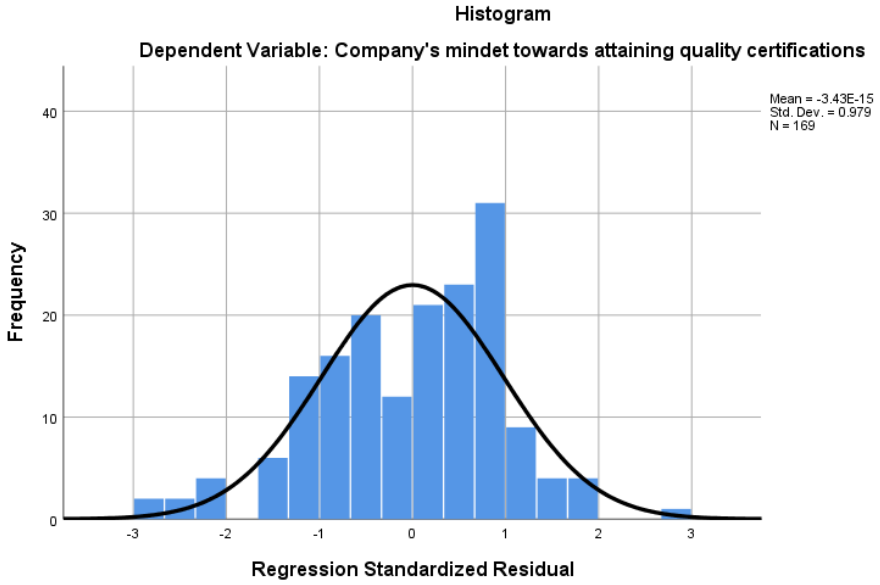
Dependent Variable: Adopting quality documentations and records on-site

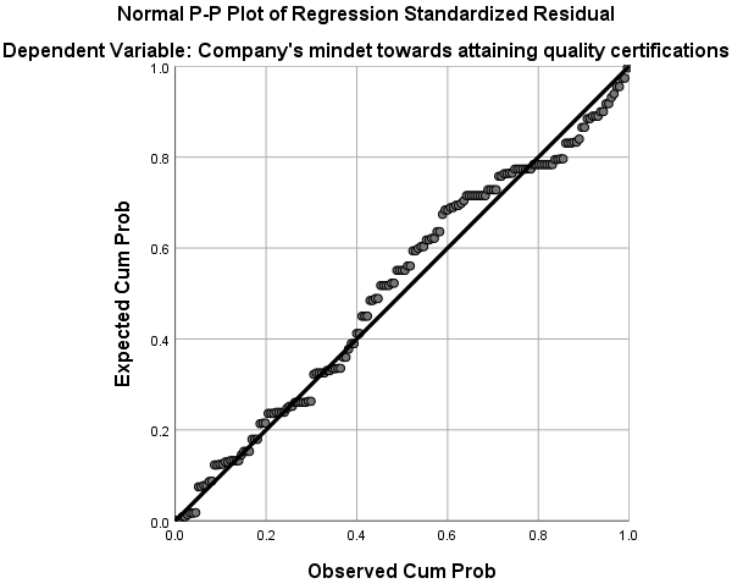


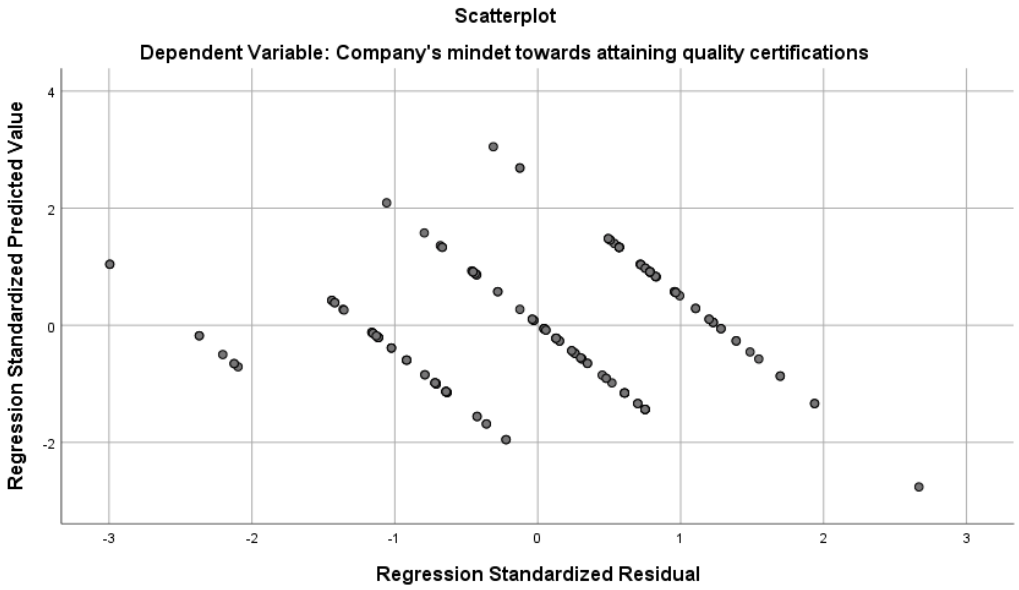
Scatterplot

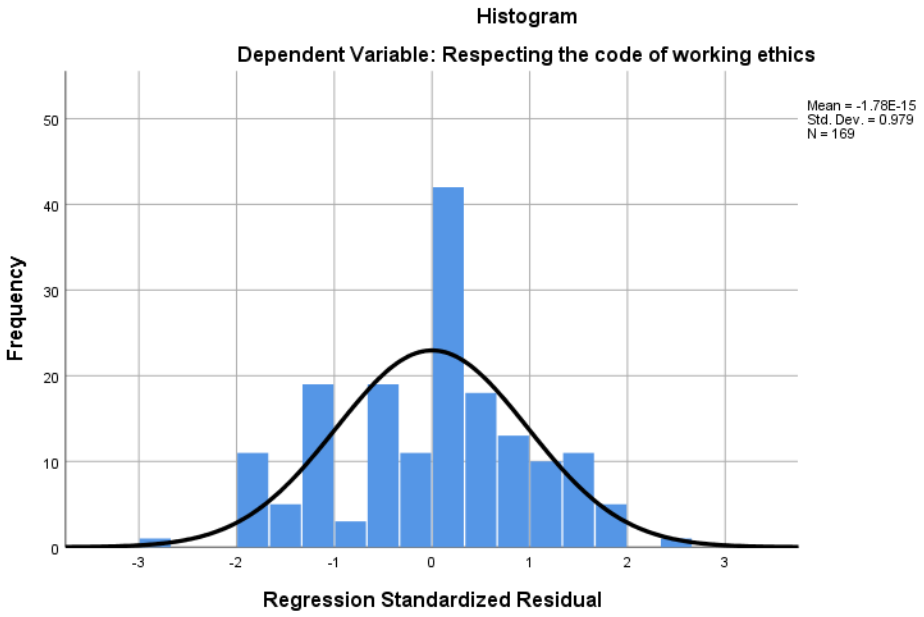
Dependent Variable: Adopting quality documentations and records on-site

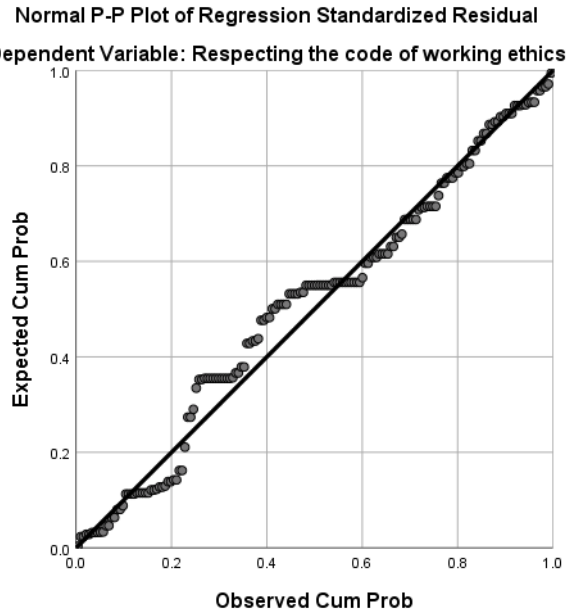


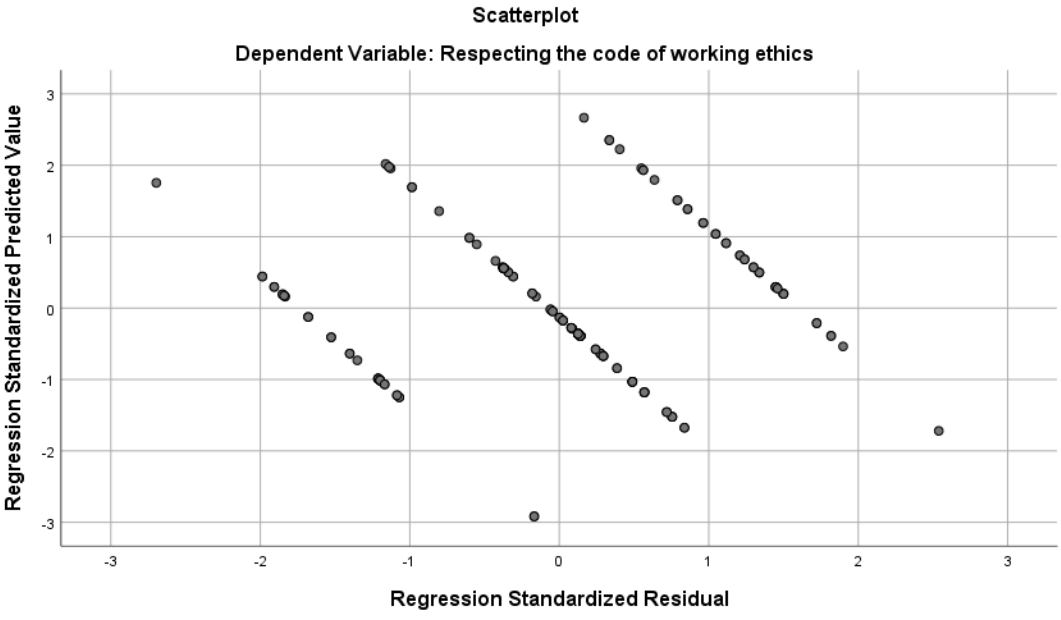

Histogram
Dependent Variable: Company's mindet towards attaining quality certifications
Mean = -3.43E-15
Std. Dev. = 0.979
N = 169
Frequency
Regression Standardized Residual

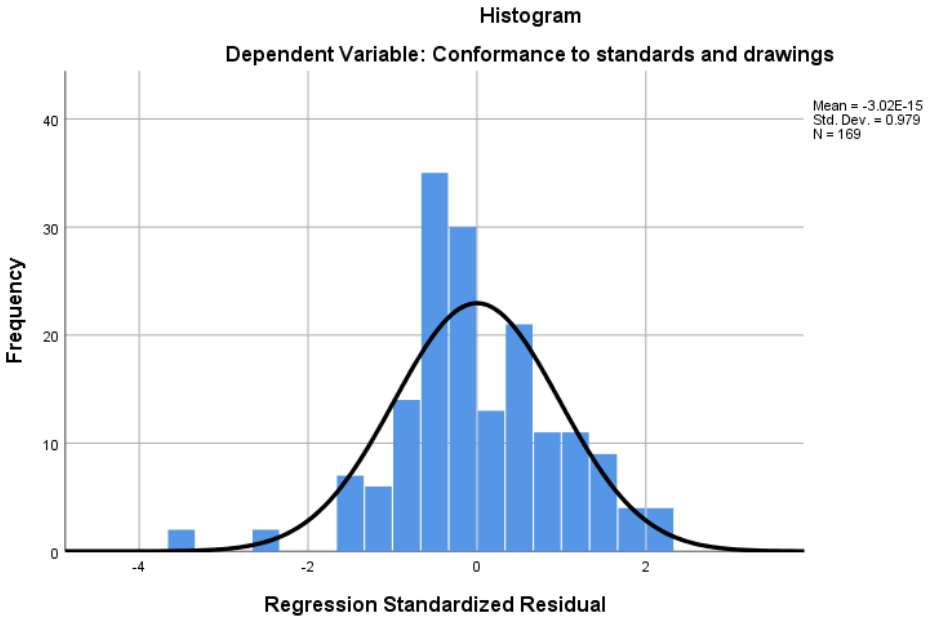

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Company's mindet towards attaining quality certifications
Expected Cum Prob
Observed Cum Prob

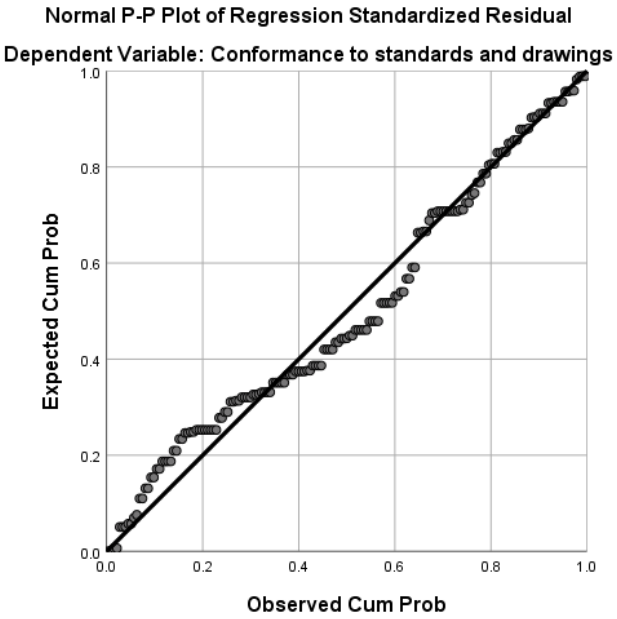

Scatterplot
Dependent Variable: Company's mindet towards attaining quality certifications
Regression Standardized Predicted Value
Regression Standardized Residual

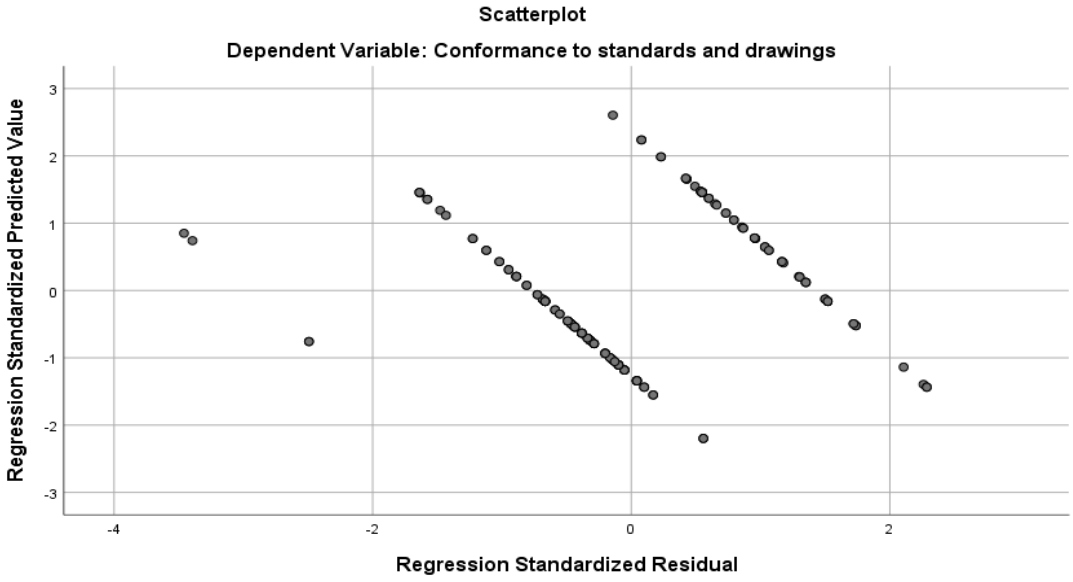

Histogram
Dependent Variable: Respecting the code of working ethics
Mean = -1.78E-15
Std. Dev. = 0.979
N = 169
Frequency
Regression Standardized Residual


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Respecting the code of working ethics
Expected Cum Prob
Observed Cum Prob


Scatterplot
Dependent Variable: Respecting the code of working ethics
Regression Standardized Predicted Value
Regression Standardized Residual


Histogram
Dependent Variable: Conformance to standards and drawings
Mean = -3.02E-15
Std. Dev. = 0.979
N = 169
Frequency
Regression Standardized Residual


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Conformance to standards and drawings
Expected Cum Prob
Observed Cum Prob


Scatterplot
Dependent Variable: Conformance to standards and drawings
Regression Standardized Predicted Value
Regression Standardized Residual