

ADDIS COLLEGE
SCHOOL OF POSTGRADUATE STUDIES
DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND
MANAGEMENT
Thesis
On
Construction Quality Management Practice in Building
Contractors in case of Addis Ababa City

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ABSTRACT

One of the pillars of project management is construction quality management. The number of faults and rework in a project can be reduced with good construction quality management. This research assess project quality management practices, investigate the quality performance of the projects and find out what are the challenges faced in implanting quality management in building contractors located in Addis Ababa. There are many Building contractors in Addis Ababa, therefore the assessment only focuses on Grade one Building contractors. The study was conducted based on literatures review, a questionnaire survey and interview. A total of 250 questioner was distributed to 85 contractors on 93 projects. The cases found on the literatures review are more elaborated and connected to the current situation of the study group using interview and questionnaire. The first finding shows that the quality management practices of building contractor in Addis Ababa is poor. The second finding is that the most wide practiced quality management system is quality control and quality assurance. The third finding is challenges faced in quality management among many the top three are material and equipment related issues, communication issues, and system (Quality control, cost control, and safety program) related issues. It is recommended to maintain equipment on a proper time and the supply chain system for material should be free from corruption. train all the staff about quality management system according to their level, the project manager should play a big role in making the communication among the stakeholder and among the staff to be clear and effective It is hoped that these findings will help contractors to improve their quit management practice on their projects for the future.

Keywords: quality management; cost of quality; element of quality;communication

DECLARATION AND APPROVAL

Declaration by the Student

I declare this thesis entitled “Construction Quality Management Practice in Building Contractors in case of Addis Ababa City” is my original effort and has not been presented for an award of a degree or diploma in any other University or institution.

Date: _____

Selamawete Fekdu

Supervisor’s Approval

This thesis is done under my guidance and submitted to the School of Postgraduate Studies and Research, Addis Collage, Department of construction management for examination by my approval as the candidate’s supervisor.

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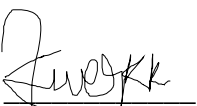

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CHAPTER ONE

INTRODUCTION

1.1. Background

Quality in construction projects encompasses not only the quality of products and equipment used in the construction but the total management approach to completing the facility as per the scope of works to customer/ owner satisfaction within the budget and in accordance with the specified schedule to meet the owner's defined purpose (Abdul Razzal Rumane, 2017) Quality management system has three basic elements named quality planning, quality assurance, and quality control.

Many stakeholders are involved in the provision of the construction project that each has their own role, requirement, and objective. To meet the different demands of the various stakeholders, project managers have to involve these to increase the effectiveness and efficiency of the decisions which are making in the construction project lifecycle. These stakeholders play a great role in assuring the quality of the project. (Joseph Heangery, 2012)

Quality is affected by many Factors according to many researchers, some are limitations of the following elements finance, communication, labor and wage, building plan and construction detail, material and equipment, time, construction methodology, rule, policies, and lack of coordination among department

This research will assess project quality management practices, and quality performance of the project in Addis Ababa building contractors from the perspective of organizational structure, tools and techniques applied, assess the challenges faced in relation to the implementation of quality management

1.2. Research Problem

The construction industry in Ethiopia faces challenges of different kinds. Most of them are characterized by time delay, cost overrun, and poor quality construction mainly because of the poor performance of the contractor. The research problem in this thesis is to analyze the construction sector's activities regarding quality by using existing quality management systems. Currently, in building construction projects around Addis Ababa city, a lot of quality problems and errors are witnessed, some buildings have collapsed because the right quality measures are not taken at the right time, building repairing technics are not being implemented in the right way, quality defects are not being identified on time. The right measures are not being taken for defects detected. Overall speaking the sensitivity of construction quality is not taken to heart by the contractors and their employers. However, there is no adequate research has been studied on the current practice, critical challenging factors, and possible solutions to improve the construction quality management. Therefore, this research has been studied to fill the above-mentioned gaps.

1.3. Research questions

The research was designed to answers the following research questions:

1. What are the practice in project quality management practices in Addis Ababa building contractors?
2. How is the quality performance of the project in Addis Ababa building contractors?
3. What are the challenges faced in relation to the implementation of quality management in Addis Ababa building contractors?

1.4. Objectives of the Research

This study sets the following general and specific objectives

1.4.1. General Objective

The overall objective of this study is to assess the construction quality management practice in building contractors in the case of Addis Ababa city.

1.4.2. Specific Objectives

The specific objectives of the research are:

- To assess project quality management practices in Addis Ababa building contractors
- To investigate the quality performance of the project in Addis Ababa building contractors
- To assess the challenges faced in relation to the implementation of quality management

1.5. Significance of the Study

Successfully managed and implemented qualified projects play a key role in the improvement of human Safety, contributing to improved productivity, and increasing sustainability. Project management in general and quality management, in particular, is at its infant stage of development as a profession, especially in Ethiopia. This research also aims to add to the existing literature and findings for other similar related projects to improve quality problems through successful implementation and management of projects.

Therefore, this research work will contribute to the development of the discipline and adds to the project management body of knowledge by providing additional experiences of the organization.

1.6. Scope of the Study

This study is limited to quality management practices on construction sites limited to Addis Ababa City building contractors According to Construction industry development and regulatory bureau which are 124 in no. This study is also limited to high rise building contractors.

1.7. Conceptual Framework

Based on extensive review Heravitorbati et al. (2011) identified four main sources of quality defects namely, stakeholder's managerial, technical, environmental, material and equipment culture and politics. These main sources of quality defects as identified by Heravitorbati and al. (2011) can be used as a framework to identify causes of quality problems in construction projects.

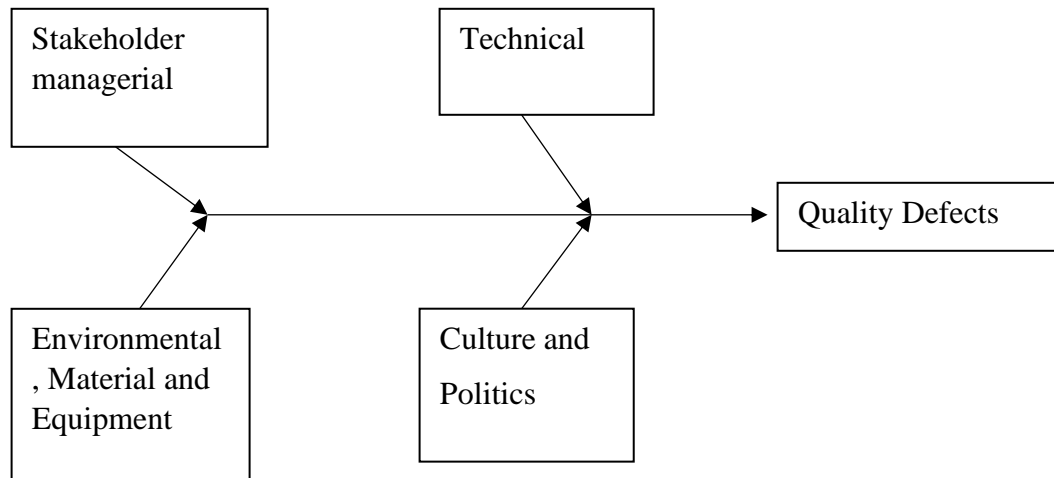


Figure 1 Conceptual framework for quality defects (HERavitorbati et al. 2011)

The researcher examined project quality management practices and quality using the framework provided above, finding issues in quality management and seeking to provide solutions to problems identified as having an impact on quality management practice.

The dependent and independent variables for this are as follows:

Independent variables:

Table 1 independent variables

Environmental, Material and Equipment

- Low quality and poor availability of resources
- Limitation of Material and Equipment
- Limitation of Time
- Project size and complexity
- Poor performance of quality tools
- Nature uniqueness

Technical

- Low quality Drawing and specification
- Design complexity
- Limitation of Building Plan and Construction Detail
- Limitation of Construction Methodology
- Technical talent deficiency
- Lack of onsite data

Stakeholder managerial

- Poor relationship and partnering among project participants
- Supplier impact
- Limitation of Finance
- Subcontractor Mishandling
- Scope Creep
- Last-Minute Changes
- Lack of contractor supervision
- Poor contract and contractor selection

Project management Ability and system

- Poor relationship and partnering among project participants
- Inappropriate method of contractor selecting
- Lack of auditing system
- Poor training system
- Lack of management commitment
- Difficulty application of quality system
- Low effective project management system
- Bureaucracy
- Lack of motivation
- Lack of co-ordination among

Dependent variable s: - Quality Management system

1.8. Ethical considerateion

Communication with participants would be done after the prior appointment and questioner was send by email or other communication media after a proper consent was taken from the participant . Questions were not being forced upon them to answer. Rather the purpose of the study would be explained to them to make them more comfortable replying. The researcher has declared that all participants voluntarily participated in the data collection by collaborating in filling out the questionnaire. By doing so, the respondents are free of any harm and more importantly, their views were very confidential and anonymous. Moreover, the questionnaire does not have any link with the respondents since it is done for educational purposes

CHAPTER TWO

LITERATURE REVIEW

2.1. Quality and Quality Management

The main topic in the research is Quality so let's see how different scholastics define this term. Oxford dictionary defines quality as the standard of something as measured against other things of a similar kind; the degree of excellence of something: "an improvement in product quality" general excellence of standard or level: "a masterpiece for connoisseurs of quality"

"Whilst perfection in any product is desirable, it is unattainable because the nearer one gets to perfection, the greater the likely cost. Therefore quality is concerned with defining the levels of acceptable imperfection or tolerances and assuring the minimum standards are achieved" (K. Dawson linked in)

The ISO 8402-1986 standard defines quality as "the totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs."

Juran explain in Juran's Quality hand book that quality has many meaning among them the basic ones are the following two:

- "Quality" means those features of products which meet customer needs and thereby provide customer satisfaction. In this sense, the meaning of quality is oriented to income. The purpose of such higher quality is to provide greater customer satisfaction and, one hopes, to increase income. However, providing more and/or better quality features usually requires an investment and hence usually involves increases in costs. Higher quality in this sense usually "costs more."
- "Quality" means freedom from deficiencies—freedom from errors that require doing work over again (rework) or that result in field failures, customer dissatisfaction, and customer claims, and so on. In this sense, the meaning of quality is oriented to costs, and higher quality usually "costs less."

In the construction industry, quality can be defined as meeting the requirements of the designer, constructor and regulatory agencies as well as the owner. According to an ASCE study, quality can be characterized as follows.

- Meeting the requirements of the owner as to functional adequacy; completion on time and within budget; lifecycle costs; and operation and maintenance.
- Meeting the requirements of the design professional as to provision of well-defined scope of work; budget to assemble and use a qualified, trained and experienced staff; budget to obtain adequate field information prior to design; provisions for timely decisions by owner and design professional; and contract to perform necessary work at a fair fee with adequate time allowance.
- Meeting the requirements of the constructor as to provision of contract plans, specifications, and other documents prepared in sufficient detail to permit the constructor to prepare priced proposal or competitive bid; timely decisions by the owner and design professional on authorization and processing of change orders; fair and timely interpretation of contract requirements from field design and inspection staff; and contract for performance of work on a reasonable schedule which permits a reasonable profit.
- Meeting the requirements of regulatory agencies (the public) as to public safety and health; environmental considerations; protection of public property including utilities; and conformance with applicable laws, regulations, codes and policies. (Othman, Norfarahhanim Mohd Ghani, and Woon Choon 2019)

2.2. Cost of Quality

The term cost of quality has different meanings to different people. Some equate it with the cost of poor quality (mainly the costs of finding and correcting defective work); and others equate the term with the costs to attain quality. (Juran and Godfrey, 1999). In whichever way it has its own cost, there is an argument among scholars saying Quality has a cost and others saying yes it has a cost but the cost is balanced by the benefits so it is not significant. According to (Project Quality Management: Why, What and How, 2005) it says, in practice, quality does have costs, even if those costs are subsequently outweighed by benefits.

Juran view of cost of quality is as follows

<p>Product features that meet customer needs</p> <p>Higher quality enables companies to: Increase customer satisfaction Make products salable Meet competition Increase market share Provide sales income Secure premium prices The major effect is on sales.</p> <p>Usually, higher quality costs more.</p>	<p>Freedom from deficiencies</p> <p>Higher quality enables companies to: Reduce error rates Reduce rework, waste Reduce field failures, warranty charges Reduce customer dissatisfaction Reduce inspection, test Shorten time to put new products on the market Increase yields, capacity Improve delivery performance</p> <p>Major effect is on costs. Usually, higher quality costs less.</p>
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Table 2 the meanings of quality. [Planning for Quality, 2d ed. (1990). Juran Institute, Inc., Wilton, CT, pp. 1–10.] (Juran, 1998)

Whether it is cost is significant or not we all can agree that quality has a cost so let’s see what this costs are. The sources of cost of quality are three: failure, prevention, and appraisal.

2.2.1. Failure Cost

Failure costs may result from either internal or external failure.

A. Internal Failure

These are costs of deficiencies discovered before delivery which are associated with the failure (non-conformities) to meet explicit requirements or implicit needs of external or internal customers. Also included are avoidable process losses and inefficiencies that occur even when requirements and needs are met. These are costs that would disappear if no deficiencies existed

The major costs associated with internal failures, those that occur before the building has been delivered to the client, are scrap and rework. At the end of some process, the building may not conform to prescribed specifications.`(Nicholas and Steyn 2020b)

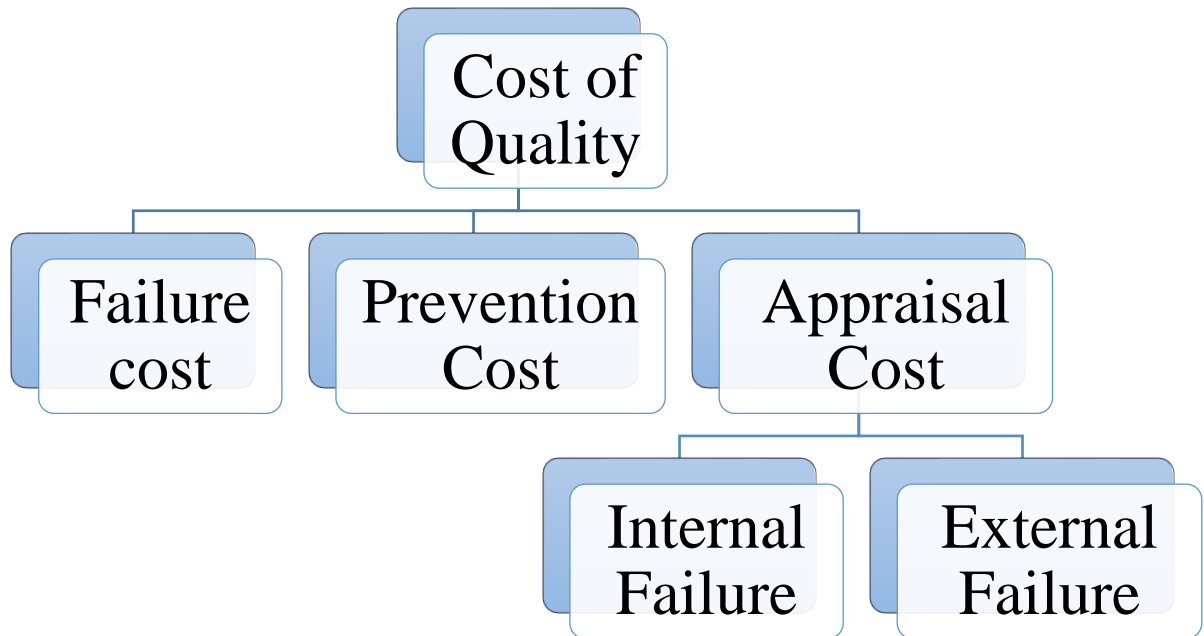


Figure 2 Cost of quality

B. External Failure

These are costs associated with deficiencies that are found after product is received by the customer. Also included are lost opportunities for sales revenue. These costs also would disappear if there were no deficiencies. (Juran, 1998)

External failures, those that occur after a building has been delivered to a client, may generate costs for repairs in accordance with contract obligations. An external failure may also generate liability costs that are far more expensive (Nicholas and Steyn 2020a)

2.2.2. Prevention

Prevention costs are fundamentally different from failure costs. These costs are related to things that an organization does rather than to outcomes of a process. Prevention costs begin with planning.

Prevention costs include both quality planning and audits, and process planning and control. Quality planning establishes the quality management system for the project. Quality audits

ensure that the system works as intended. Generally, an audit is a comparison of performance to plan. A quality audit compares the performance of the organization or project quality system to the quality plan. Process planning establishes the steps to be taken to finish the project. Process control ensures that the process performs as expected.

2.2.3. Appraisal

According to Juran Appraisal costs are costs incurred to determine the degree of conformance to equality requirement. (Juran, 1998). Incurred Appraisal costs begin with inspection of incoming supplies. The computer science phrase “garbage in, garbage out” applies equally here. The quality of a product is significantly affected by the quality of materials that go into its production. (Rose, n.d.)

2.3. Construction Quality Management

Quality Management is an important project management function. It is one of the critical attributes of project success, with the others being cost, time and safety.

The PMBOK® Guide states that quality management processes include all the activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken (Management, 2017)

Quality control in construction typically involves ensuring compliance with minimum standards of material and workmanship in order to ensure the performance of the building is according to the design. These minimum standards are contained in the specification documents. For the purpose of ensuring compliance, random samples and statistical methods are commonly used as the basis for accepting or rejecting work completed and batches of materials. Rejection of a batch is based on nonconformance or violation of the relevant design specifications. (Rumane, 2011)

The nature of the contracts between the parties plays a dominant part in the quality system required from the construction project, and the responsibility for fulfilling them must therefore be specified in the project documents. The documents include plans, specifications, schedules, bill of quantities (BOQ), and so on.

Quality Management involves:

- Setting Quality Standards to achieve both technical and managerial competence,
- Scheduling inspections,
- Managing any required rework,
- Documentation.

The quality of building work is difficult, and often impossible, to quantify since a lot of construction practices cannot be assessed in numerical terms. The framework of reference is commonly the appearance of final product. “How good is good enough?” is often a matter of personal judgment and consequently a subject of contention. In fact, a building is of good quality if it will function as intended for its design life. As the true quality of the building will not be revealed until many years after completion, the notion of quality can only be interpreted in terms of the design attributes. So far as the builder is concerned, it is fair to judge the quality of his work by the degree of compliance with the stipulations in the contract, not only the technical specifications but also the contract sum and the contract period. His client cannot but be satisfied if the contract is executed as specified, within budget and on time. Therefore, a quality product of building construction is one that meets all contractual requirements (including statutory regulations) at optimum cost and time. (Chung ,1999)

As seen above most scholars agree that quality management in a construction project is related to the degree of confirmation the work has to the contract or other documents like design and specification defining. So let’s continue in depth and see what the principle of quality management are in a construing project.

2.4. Principles of Quality Management

ISO 9001 builds upon seven key principles (Standardization, 2015). By following these principles, one is able to reap the rewards of greater consistency, better customer satisfaction and stronger performance. In short, the seven principles of quality management are: Engagement of people, Customer focus, Leadership, Process approach, Improvement, Evidence-based decision making and Relationship management.

From Greenwood perspective setting the some the same principle as the ISO also add other and set 8 principles to quality management which are (Greenwood, 2018) Customer focused organization, Leadership, Involvement of people, Process approach, System approach to management, Continual improvement, Factual approach to decision makingand Mutually beneficial supplier relationships

2.5. The Three Elements of Quality Management

The PMBOK® Guide describes three elements of quality management:

1. Quality planning,
2. Quality assurance, and
3. Quality control.

2.5.1. Quality Planning

The PMBOK® Guide defines quality planning as “...identifying which quality standards are relevant to the project and determining how to satisfy them.” (PMBOK 6th Edition, 2017)

A general framework for quality management plans includes four elements:

- A. Quality policy — this expresses the intended direction of a performing organization with regard to quality. The project team may simply apply the existing organizational quality policy, but only if it is a good fit. Needs of the project may demand a quality policy that is more specific than a generally stated organizational quality policy.

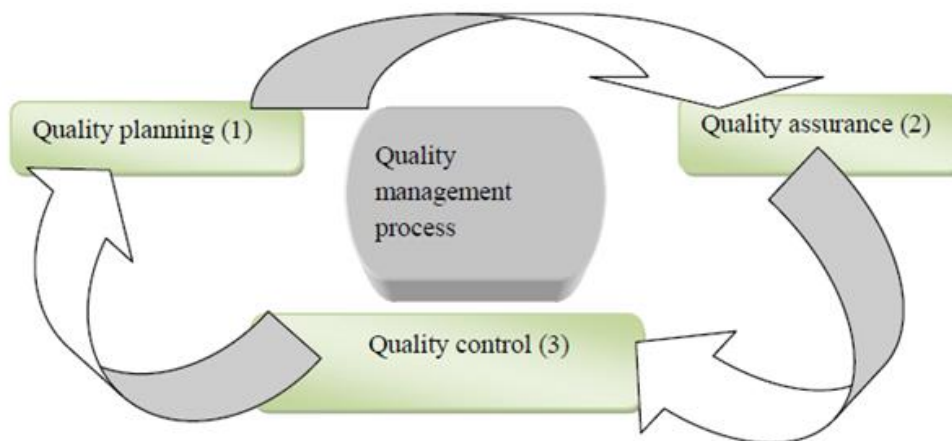


Figure 3: Elements of quality management (Management, 2017)

- B. Who is in charge? — This question is one of three that lie at the heart of quality management. The answer is neither trivial nor simple; it is not just the name of the project manager. A complete answers — one essential to project success — addresses project and organizational infrastructure and describes participants, reporting chains, and responsibilities. There are few more certain paths to project failure than an ambiguous collection of participants in which everyone is in charge, but no one is responsible.
- C. Where are we going? — Managing quality effectively depends on specific performance targets. Goals provide broad descriptions of what the project is expected to achieve. Requirements provide more detailed descriptions. Operational definitions, which describe what something is and how it is measured, provide the means for understanding goals and requirements that may be vague or ambiguous.
- D. How are we going to get there? — The answer to this question should address processes, resources, and standards. Processes define the things the project team will do to meet requirements and achieve project goals. The quality management plan may include a lengthy list of processes covering many different aspects of project work. Resources include more things than money. This part of the plan should describe the people available, participating organizational elements, tools to be used, and, of course, the budget that provides funding for all quality activities. Standards to be applied to project work are an important element of this part of the plan. Remember that, by definition, quality planning is all about identifying relevant standards.

2.5.2. Quality assurance

The PMBOK® Guide defines quality assurance as “...the application of planned, systematic quality activities to ensure that the project will employ all processes needed to meet requirements.”

Developing assurance activities involves more than delegation. Coherent, integrated activities arise from a disciplined process of steps:

- Select the relevant standard or specification.
- Using operational definitions, define an activity that will collect data and compare results to the plan.

- Define and provide resources.
- Assign responsibility to a specific entity.
- Assemble activities into a quality assurance plan.

2.5.3. Quality Control

The PMBOK® Guide defines quality control as “...monitoring specific project results to determine if they comply with relevant quality standards and identifying ways to eliminate causes of unsatisfactory performance.

Monitoring specific project results serves several important purposes:

- Results may confirm that all is well. If results are within specifications (no variance from specifications is indicated), the project team knows that performance is proceeding according to plan.
- Results may provide the basis for corrective action. If results do not conform to specifications (some degree of variance is indicated), the project team knows that something has gone wrong or is going wrong. The project team must take corrective action to fix the existing variance from the plan. The team must also identify the source of the variance and take corrective action to prevent it from recurring.
- Results provide feedback to the quality assurance process. Results obtained during quality control provide data that are examined during quality audits. Performance that does not conform to specifications indicates that the quality assurance activities associated with that performance are not having the desired effect.

Quality assurance activities are intended to ensure conforming performance. If they do not, the project team must analyze the data, determine the shortcoming, improve the quality assurance activities, and update the quality assurance plan.(Walter A. Shewart 2004)

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

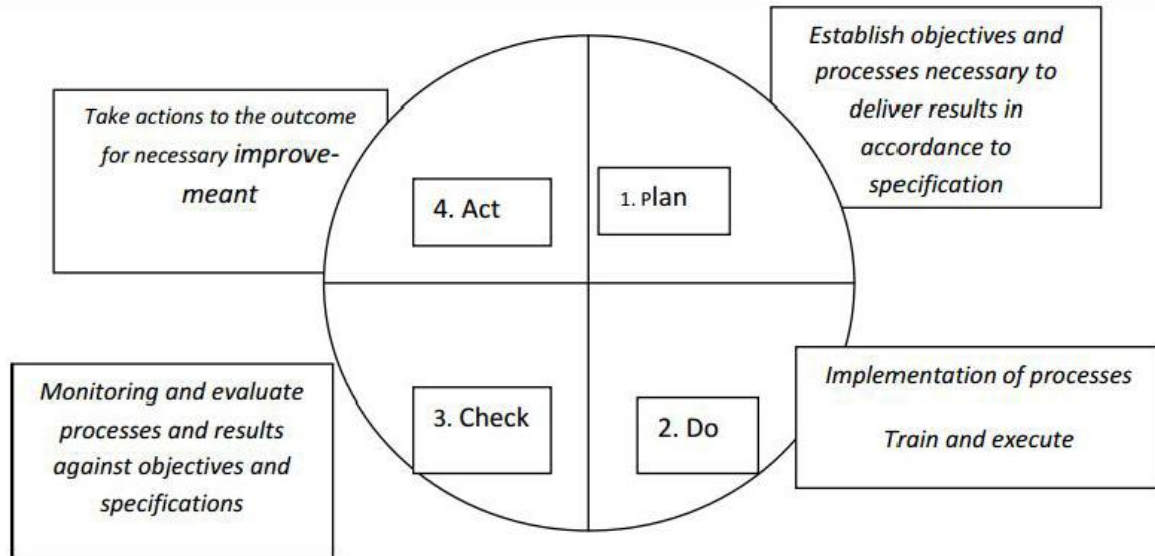


Figure 4: The Deming cycle for improvement

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

2.6. Quality Management Systems

According to department of trade and industry a quality management system can be defined as: ***“A set of coordinated activities to direct and control an organization in order to continually improve the effectiveness and efficiency of its performance.”*** These activities interact and are affected by being in the system, so the isolation and study of each one in detail will not necessarily lead to an understanding of the system as a whole. The main thrust of a quality management system is in defining the processes, which will result in the production of quality products and services, rather than in detecting defective products or services after they have been produced. (ISO 9001, 2008)

According to department of trade and industry in UK a fully documented quality management system will ensure that two important requirements are met:- first The customers’ requirements – confidence in the ability of the organization to deliver the desired product and service consistently meeting their needs and expectations and second the organization’s requirements – both internally and externally, and at an optimum cost with efficient use of the available resources – materials, human, technology and information. (ISO 9001, 2008)

There are three types of quality management system

- A. Total Quality management system
- B. Quality Assurance and Quality control
- C. ISO 9001 Standard

2.6.1. Total Quality Management (TQM)

TQM is a management system for a customer-focused organization that involves all employees in continual improvement. It uses strategy, data, and effective communications to integrate the quality discipline into the culture and activities of the organization. Many of these concepts are present in modern quality management systems, the successor to TQM.

Total quality management (TQM) is an organization-wide effort centered on quality to improve performance that involves everyone and permeates every aspect of an organization to make quality a primary strategic objective. It is a way of managing an organization to ensure the satisfaction at every stage of the needs and expectations of both internal and external customers.(Androwis et al. 2018)

TQM in construction projects typically involves ensuring compliance with minimum standards of material and workmanship in order to ensure the performance of the facility according to the design.

Most scholars agree on the eight principles of total quality management that are listed below:

Customer-focused: The customer ultimately determines the level of quality. No matter what an organization does to foster quality improvement training employees, integrating quality into the design process, or upgrading computers or software, the customer determines whether the efforts were worthwhile.

Total employee involvement: All employees participate in working toward common goals. Total employee commitment can only be obtained after fear has been driven from the workplace, when empowerment has occurred, and when management has provided the proper environment. High-performance work systems integrate continuous improvement efforts with normal business operations. Self-managed work teams are one form of empowerment.

Process-centered: A fundamental part of TQM is a focus on process thinking. A process is a series of steps that take inputs from suppliers (internal or external) and transforms them into outputs that are delivered to customers (internal or external). The steps required to carry out the process are defined, and performance measures are continuously monitored in order to detect unexpected variation.

Integrated system: Although an organization may consist of many different functional specialties often organized into vertically structured departments, it is the horizontal processes interconnecting these functions that are the focus of TQM.

Micro-processes add up to larger processes, and all processes aggregate into the business processes required for defining and implementing strategy. Everyone must understand the vision, mission, and guiding principles as well as the quality policies, objectives, and critical processes of the organization. Business performance must be monitored and communicated continuously.

An integrated business system may be modeled after the Baldrige Award criteria and/or incorporate the ISO 9000 standards. Every organization has a unique work culture, and it is virtually impossible to achieve excellence in its products and services unless a good quality culture has been fostered. Thus, an integrated system connects business improvement elements in an attempt to continually improve and exceed the expectations of customers, employees, and other stakeholders.

Strategic and systematic approach: A critical part of the management of quality is the strategic and systematic approach to achieving an organization's vision, mission, and goals. This process, called strategic planning or strategic management, includes the formulation of a strategic plan that integrates quality as a core component.

Continual improvement: A large aspect of TQM is continual process improvement. Continual improvement drives an organization to be both analytical and creative in finding ways to become more competitive and more effective at meeting stakeholder expectations.

Fact-based decision making: In order to know how well an organization is performing, data on performance measures are necessary. TQM requires that an organization continually

collect and analyze data in order to improve decision making accuracy, achieve consensus, and allow prediction based on past history.

Communications: During times of organizational change, as well as part of day-to-day operation, effective communications plays a large part in maintaining morale and in motivating employees at all levels. Communications involve strategies, method, and timeliness.

TQM in a construction project is a cooperative form of doing the business that relies on the talents and capabilities of both labor and management to continually improve quality

A. Total Quality Management in Construction Industry

According to H James Harrington The development of the TQM concept originally took place in the manufacturing industry. Thus, most literature addresses that industry and this gives the misleading impression that the TQM concept cannot be applied to any industry other than manufacturing. One of the main principles of the TQM concept is to achieve customer satisfaction and this is an important objective for any organization, including construction firms. However, the implementation of TQM might differ from one industry to another. The construction industry differs from the manufacturing in such a way that makes introducing TQM more challenging. While the manufacturing industry is characterized by steady-state processes, the construction industry is usually a onetime process (uniqueness). Construction industry is also unique in the following ways: (H.James Harrington, 2012)

- (1) The mobility of staff;
- (2) Diversity in the types, forms, and shapes of construction projects;
- (3) Geographical dispersion;
- (4) The contractual relationships;
- (5) Frequent prototyping of projects; and
- (6) The subtle forms of waste that often go unnoticed.

2.6.2. Quality Assurance/Quality Control (QA/QC)

Quality assurance and quality control are two aspects of quality management. While some quality assurance and quality control activities are interrelated, the two are defined differently.

According to ISO 9000:2015: Quality management systems—Fundamentals and vocabulary:-

- **Quality assurance** consists of that “part of quality management focused on providing confidence that quality requirements will be fulfilled.” The confidence provided by quality assurance is twofold—internally to management and externally to customers, government agencies, regulators, certifiers, and third parties.
- **Quality control** is that “part of quality management focused on fulfilling quality requirements.” While quality assurance relates to how a process is performed or how a product is made, quality control is more the inspection aspect of quality management. Inspection is the process of measuring, examining, and testing to gauge one or more characteristics of a product or service and the comparison of these with specified requirements to determine conformity. Products, processes, and various other results can be inspected to make sure that the object coming off a production line, or the service being provided, is correct and meets specifications.

2.6.3. ISO 9001 Standard

Quality control systems were originally developed from United Kingdom (UK) nuclear and military standards, and then rolled out as BS5750:1979 in the manufacturing industry. It was much later (in the 1980s and early 1990s) that the systems were adopted by UK construction companies to meet local and national government requirements for the construction industry, when companies were required to have certified quality systems in order to take up offered bidding opportunities (Thorpe and Sumner 2004).

The first series of ISO 9000 developed by the International Organization for Standardization-Technical Committees (ISO-TC 176) in 1987, was updated in 1994 and 2000, with the latest version of this standard being ISO 9001:2008. The 2008 version did not introduce any major changes relative to the 2000 version, and therefore does not require the re-writing of quality documents to suit the most recent version. The ISO 9001 standard is actually a generic one,

which can be used successfully in construction companies and on their projects, even though every project is unique and involves different sub-contractors and suppliers.

The QMS, ISO 9001 standard is made up of five main clauses and 23 sub-clauses, each of which contains requirements that should be fully implemented to gain the potential benefits from the adoption of the system. There are 20 elements of ISO 9001 which are used as the basis of ISO 9001:1994. These elements have been replaced by five clauses for undertaking quality processing. However, the twenty elements are clearly identifiable within the process-based approach for implementing ISO 9001:2008. The twenty elements have been adapted for construction procedures to cover a wide scope of quality related activities of construction-related firms as QMS elements to meet construction organization and project conformity needs.

ISO 9001 is a standard that sets out the requirements for a quality management system. It helps businesses and organizations to be more efficient and improve customer satisfaction. A new version of the standard, ISO 9001:2015, has just been launched, replacing the previous version (ISO 9001:2008).

ISO standards are reviewed every five years and revised if needed. This helps ensure they remain useful tools for the marketplace. The challenges faced by business and organizations today are very different from a few decades ago and ISO 9001 has been updated to take this new environment into account. For example, increased globalization has changed the way we do business and organizations often operate more complex supply chains than they did in the past. In addition, there are increased expectations from customers and other interested parties and, with more access to information; today's wider society has a stronger voice than ever before. ISO 9001 needs to reflect these changes in order to remain relevant (moving from ISO 9001:2008 to ISO 9001:2015).

2.7. Expected Quality Management systems by contractors

Typical quality system management requirements for a construction project are discussed below.

1. **Management responsibility and organization:** - The Contractor shall define his proposed organization for undertaking all aspects of the work. Organization chart(s) including lines of communication shall be included in the Quality Manual and maintained for the duration of the Contract. (DESFA Slide ,2013)
The responsibilities and authority of key staff, (foremen and above), shall be documented in the Quality System. Clearly defined responsibilities and authority shall be assigned to adequately qualified project personnel
2. **Management review:** - The Contractor's Management shall review the implementation of the quality management system during the various construction stages to ensure its suitability and effectiveness. Information to be provided in the management review meetings include: Results of Audits, Customer Feedback , Construction Performance and Conformity , Results of Inspection and Testing Activities , Status of non-Conformances , Changes Affecting Quality and Recommendations for Improvement. Records from management review meetings shall be maintained (Con. Quality plan , 2007)
3. **Resource management:** - The Contractor shall determine and provide all the resources needed to perform every construction activity according to the required technical specifications, quality system requirements and time schedule.(Parsons, 2007) Such resources include:
 - The necessary type and quantity of equipment needed for every construction activity
 - Properly trained and qualified personnel based on project technical requirements
 - The required premises (buildings, warehouses) and supporting services (transport, communication)
4. **Control of documents and quality records:** - Documents shall be uniquely numbered in accordance with a specific numbering system. Document control procedures shall include the issue/receipt of documents outside the Contractor's organization. All transmission of technical documents shall be made with a transmittal sheet. The Contractor shall initiate

develop and maintain a Master Document List. The List shall include all documents, and drawings required for the completion of the project. The Master Document List shall also cover documents and drawings produced/to be produced by suppliers and sub-contractors. All documents shall be revised and approved by Contractor prior to submission to the project owner. The owner reserves the right to approve/reject, pass comment and/or request modification of any document. (Con. Quality plan , 2007)

5. **Design control:** - The Quality System shall ensure that no design work is carried out until necessary design input has been reviewed and approved in accordance with the quality manual. The Quality System shall ensure that design input incorporates the requirements of Contract specifications. Any incomplete, ambiguous or conflicting requirements shall be resolved with those responsible for drawing up these requirements. The contractor shall follow the owner's Technical Query (TQ) procedure in all such matters. Design activities shall incorporate the requirements of relevant regulatory authorities. Review/Approval of Drawings issued for construction is performed by Supervising Engineer or Engineering Reviewer (Graham C. Good win 2000)
6. **Procurement:** - The Contractor shall establish and maintain records of acceptable vendors and sub-contractors. The Contractor shall continuously monitor and document the performance of vendors and subcontractors. In particular, he shall monitor and document their quality performance. The Contractor shall maintain in a single index the names of appointed sub-contractors and vendors. The index shall include date of appointment and a summary of scope of supply/work for which they are approved. For the procurement of critical materials and/or services approval of the vendors and sub-contractors may be required.
7. **Manufacture fabrication and construction:** - The Contractor shall segment manufacturing fabrication, manufacturing and construction work in to logical and manageable activities and this shall be included in the Quality Plan. No fabrication, manufacturing or construction activity shall take place which is not covered by an approved Quality Plan and associated approved procedures/ method statements etc.
8. **Inspection and testing:** - The Contractor's Quality System shall include procedures to ensure that inspection and test status is satisfactory before progressing to subsequent activities.

The Contractor shall initiate and maintain an overall program for all testing and inspection activity. This will be incorporated in the Quality Plan. The program shall indicate the dates on which tests/inspections shall take place and shall also show who shall be present. The Contractor shall maintain a schedule of all inspection, measuring and test equipment which is used in activities covered by his test and inspection plans. Equipment shall be given a unique identification number/code. The schedule shall include the previous and next calibration dates. Test numbers and dates shall be recorded against the identification number of the equipment.

- **Control of non-conformances:-** Non-conformance reports (NCR) shall be copied to the owner for every identified non-conformance. Each NCR shall be uniquely identified in an NCR register. Date of issue, person issuing, person responsible for disposition and the current status of the non-conformance shall be indicated. If corrective action is pending or in progress, the date for disposition shall be included in the List.

When the non-conformance has been dealt with, the date of disposition shall be included and corrective or rectification action shall be referenced. Disposition action taken shall be added to the revised non-conformance report and forwarded to owner for information. All non-conformance reports, together with revisions as they are actioned, shall be immediately transmitted to the owner.

- **Quality audits:** - Quality and safety are two of the areas of a business which are constantly under scrutiny and can be audited at any point in time. A good quality system will maintain version control and audit trails of all documents and interactions so that auditors can see exactly what has happened, and how processes and actions are actually implemented on a daily basis.

The Contractor's Quality System will be subject to audit by the OWNER or their representative. Audit frequency shall be at the owner's discretion. The Contractor shall modify his Quality System in line with any findings of audits. The Contractor shall conduct internal audits of the performance of the Quality System to an audit schedule agreed by the owner. All audits shall be documented. All findings and recommendations shall be actioned within the specified time scale

- **Continual improvement:** - The Contractor shall throughout the construction period improve the effectiveness of the quality management system through the use of the quality

policy, quality objectives, audit results, analysis of data corrective and preventive actions and management review. Documented procedures shall be established to define requirements for the management of corrective and preventive actions in order to ensure that non conformities do not recur and potential future problems are prevented. (DESFA slide, 2013)

2.8. Tools and Techniques to Be Used In Quality Management

According to the Project Management Institute (PMI), there are seven basic quality tools (7QC Tools) which are used to solve quality-related problems (Management, 2017). This seven tools are accepted by many scholars the tools are listed below

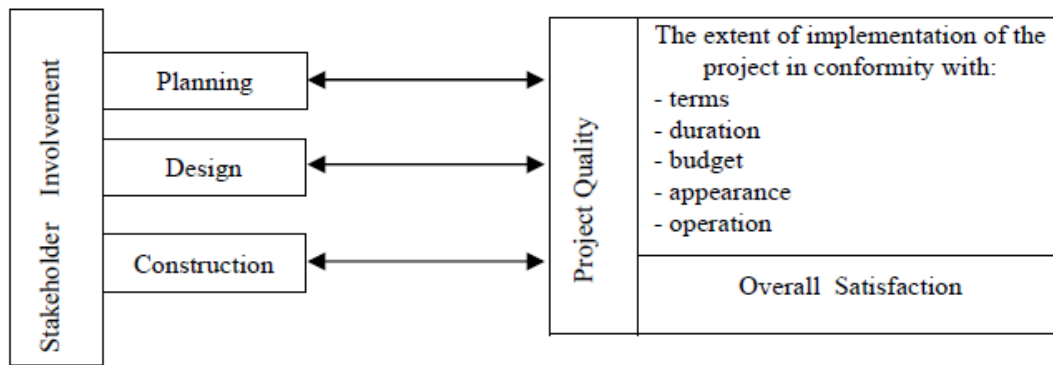
- A. Cause-and-effect diagrams, which are also known as fishbone diagrams or as Ishikawa diagrams. The problem statement placed at the head of the fishbone is used as a starting point to trace the problem's source back to its actionable root cause.
- B. Flowcharts, which are also referred to as process maps because they display the sequence of steps and the branching possibilities that exist for a process that transforms one or more inputs into one or more outputs
- C. Check sheets, which are also known as tally sheets and may be used as a checklist when gathering data. Check sheets are used to organize facts in a manner that will facilitate the effective collection of useful data about a potential quality problem.
- D. Pareto diagrams, exist as a special form of vertical bar chart and are used to identify the vital few sources that are responsible for causing most of a problem's effects.
- E. Histograms, are a special form of bar chart and are used to describe the central tendency, dispersion, and shape of a statistical distribution. Unlike the control chart, the histogram does not consider the influence of time on the variation that exists within a distribution.
- F. Control charts, are used to determine whether or not a process is stable or has predictable performance. Upper and lower specification limits are based on requirements of the agreement. They reflect the maximum and minimum values allowed
- G. Scatter diagrams, plot ordered pairs (X, Y) and are sometimes called correlation charts because they seek to explain a change in the dependent variable, Y, in relationship to a change observed in the corresponding independent variable, X. The direction of correlation may be proportional (positive correlation), inverse (negative correlation), or a pattern of correlation may not exist (zero correlation). If correlation can be established, a

regression line can be calculated and used to estimate how a change to the independent variable will influence the value of the dependent variable

2.9. Stakeholder Involvement and Quality Management

Stakeholder Management is about connections between an organization and their groups intrigued or partners. These connections influence the people and their associations that could be certain, or impact any fruitful venture. Along these lines, the Stakeholders from any venture ought to be required by the associations with the standpoint to minimize the negative effects and ensure that there are no hindrances in the method for a fruitful venture. Stakeholder administration concentrates on comprehension stakeholder' needs and desires, tending to issues as they happen, overseeing clashing interests and encouraging suitable stakeholder engagement in venture choices and exercises (Seddon, 2008).

Many stakeholders are involved in the provision of construction project that each has their own role, requirement and objective. To meet the differing demand of the various stakeholders, project managers have to involve these stakeholders in order to increase effectiveness and efficiency of the decisions which are making in the construction project lifecycle (Saghatforoush, Trigunarsyah, Too, & HeraviTorbati, 2010). Achterkamp and Vos (2008) reported that the main purpose of involving the stakeholder conception in the industry is to give meaning to a project's success or to verify that the varying views on project success depend on the stakeholders concerned. Yang (2010) also placed an emphasis on the recognition of the fact that there are several stakeholders whose expectations and influences must be include in the project management process. It has been emphasized if a project's stakeholders are not satisfied with the quality of the project management or the final project, the project team will require adjusting scope, time and cost to meet stakeholder requirements and expectations on quality issues. Bubshait (1994) provides a clear interaction between project quality and stakeholder involvement shown in Fig. below



Source: (Adapted from Bubshait, 1994)

Figure 5: Stake holder Involvement in project quality

As it is shown in the Fig, stakeholder involvement in different phases of a project is in direct relationship with the project quality. Therefore, efficient stakeholder involvement will improve the total quality of constructed project.

2.10. Challenges of quality management practice

According to Ashokkumar .D, (2016), states some of the factors that affects construction quality. Those factors are failure factors that affect the quality of building construction projects:

- **Limitation of Finance:** This was the main factor of construction and in every type of work where contractor had to plan for financial payment to eliminate the risk because it might affect the project.
- **Limitation of Communication:** Construction site sometimes was located in rural areas or far away from the community. It might be a cause which affected transportation causing difficulty and delay, therefore it was a limitation that contractor had to consider.
- **Limitation of Labor and Wage:** In many different local areas, the problem related to labor such as lack of skilled labor, complex work, not being able to find labor might occur, which might be causes of work difficulty, delay and low quality.
- **Limitation of Building Plan and Construction Detail:** Problems of building plan and construction detail were found such as drawing not clear, drawing mistake, so they also became big problems in construction.

- **Limitation of Material and Equipment:** Some construction works might use special machines or equipment which contractor had to study carefully regarding performances, suitability for work and prepare enough equipment for each work.
- **Limitation of Time:** finishing construction project on time is very important for the success of construction project. If not time constraints in schedule affect the other elements of construction projects like quality and cost. This may lead failure on construction project.
- **Limitation of Construction Methodology:** Construction works in some areas could not be performed by regular method because there were buildings around construction site, so the contractor had to find new methods that were suitable to construct and sometimes used specialist engineer when some construction works were in step of construction.
- **Limitation of Rule or Regulation:** This problem also greatly affected construction such as problem from traffic which had an effect on transportation, problem of labor hiring, problem of building construction regulation, etc.
- **Training Policies:** Looking into the general training policy, the ISO 9001 registered companies have more concern on the training of their employees than the nonregistered ones. They not only pay for the course fees, but also allow them to receive training during working hours. For non-registered companies, the company may reimburse the course fees but employees have to attend training sessions outside of working hours. Moreover, regular training programs on technical and computer knowledge were commonly provided in many companies. The most popular training program organized by ISO 9001 registered companies was quality knowledge.
- **Lack of co-ordination among departments:** Coordination is very important for project successful. Because co-ordination between the departments is failed that may leads to wrong execution or may affect the sequence of work. For example consider the MEP (Mechanical Electrical Plumbing) department not properly co-ordinate with execution team, now execution team done the plastering work before plumbing works are not done due to lack of coordination. Here definitely rework required so automatically quality is misplaced.

Ruta Patel on her article of factors that affect construction quality management has listed 10 factors that affect construction quality management listed the following

- **Complex Design:** Superfluous complexity is the adversary of great work. Designers should limit complex strategies and surprising highlights at whatever point conceivable. Although to have advance designs in infrastructure and commercial projects, there might be a little complexity noted, but it should not be excessive. Anything in excess is harmful.
- **Supplier and Vendor Failures:** Sometimes due to lack of ethics, the suppliers and vendors swap the material that has to be delivered by a lower quality version to gain more profits. This has to be handled carefully by regularly checking that the material supplied is of the same type as the approved and the suppliers are adhering to the contract. Clear expectations have to be set and conveyed to all suppliers and random checks should be carried out to avoid such happenings.
- **Low Quality Materials:** Under-quality material has a large impact on quality and can compromise the safety of the structure to a great extent. Material is the core of any construction element and degrading the material will to structural failures and building collapse. Such situations will further incur the cost of rework and serious penalties.
- **Poor Project Management:** Even if everything is in place including the material, manpower, funds, etc., if the management fails to cater the quality control and quality assurance, the entire idea of quality management goes to waste. Therefore, it is essential to closely manage the quality aspects of the construction project. Implementing a quality management system based around mobile apps is a flexible and fast way to bring current projects under control.
- **Miscommunication between Teams:** The single biggest problem in communication is the illusion that it has taken place. The most important role of the construction manager is to communicate clearly the quality requirements to the project team. Miscommunications lead to misapplications of techniques that can further lead to poor quality of work.
- **Failure to Document Changes and Practices:** All the substitutions and replacements should be recorded, which can otherwise lead to confusion and lack of information in the project team. Using a digital file management system not only reduces paperwork but also simplifies the process of updating documents and ensures ease of access at all times.

- **Subcontractor Mishandling:** Human error is another reason for the poor quality of work. Procuring the contractors and subcontractors having rightful skills and quality workmanship is essential to ensure the overall quality of the project. Screening of subcontractors based on their past work and experience plays a major role in avoiding situations.
- **Scope Creep:** Scope creep is an unplanned expansion. And failing to plan can lead to some serious quality issues. It is natural to have scope changes in any construction project but should be handled wisely with planning. Managing the scope of a construction project ensures the contractors can maintain the same level of quality over the entirety of the work.
- **Ignored Audits and Testing:** Ignorance is a voluntary misfortune. Often testing is done regularly on construction sites, but the results are ignored. This can be due to weak organizational strength where the quality control reports are bounced from the project manager to the engineer without a clear address or workflow. Defining responsibilities and abiding by them is the work ethic that has to be in place in the construction sector, to avoid compromising on any aspect of the construction project, including quality management.
- **Last-Minute Changes:** At the point when basic highlights are as yet being designed or talked about at late stages in the development cycle, these very late changes frequently lead to genuine quality issues. Set cut-off times by which plans can't be modified any longer or make courses of action to broaden the cut-off times and put in a safe spot a lot of time for confirming and testing any progressions to the current plans.

Table 3: Quality problems Factors

Lack of contractor supervision	(Arditi & Gunaydin, 1998: Wong & Fung, 1999)
Poor relationship and partnering among project participants	(Arditi & Gunaydin, 1998: Jha&lyer,2006: Tang etal, 2009)

Reduce subcontractor responsibility	(Leonard, 2008; Pheng & Wei, 1996; Wong & Fung, 1999)
Inappropriate method of contractor selecting	(Arditi & Gunaydin, 1998; Wong & Fung, 1999)
Poor quality procedure and department	(Chan & Tarn, 2000; Moody, 2005; Sarph, et al, 1989)
Lack of auditing system	(Pheng & Wei, 1996; Samuels, 1994)
Poor training system	(Arditi & Gunaydin, 1998)
Low quality continues improvement	(Joaquin et al., 2008; Pheng & Wei, 1996)
Lack of process improvement	(Pheng & Wei 1996; Saraph, et al., 1989)
Lack of management commitment	(Hiyassat, 200; Marosszeky, et al., 2002; Yung & Yip, 2010)
Low effective project management system	(Anderson, 1992; Chan & Tarn, 2000; Yung & Yip, 2010)
Bureaucracy	(Marosszeky, et al., 2001)
Supplier impact	(Arditi & Gunaydin, 1997; Wong & Fung, 1999)
Low quality Drawing and specification	(Arditi & Gunaydin, 1997; Pheng & Wei, 1996)

Design complexity	(Chan & Tarn, 2000)
Poor performance of quality tools	(Arditi & Gunaydin, 1997; Leonard, 2008)
Difficulty application of quality system	(Mohammed & Abdullah, 2006; Serpell, 1999)
Project size and complexity	(Chan & Tam, 2000; Jhan & Lyer, 2006)
Material/Equipment Specification	(Hiyassat, 2000; Pheng & wee, 2001)
Project Environment	(Chan & Tam 2000)
Low quality and poor availability of resources	(Joaquin, et al., 2008; Yung & Yip , 2010)
Lack of motivation	(Marosszeky, et al., 2002; Pheng & Wee, 2001; Serpell, 1999)

Source: (Denuga, 2013)

2.11. Suggestion to enhance quality management

David Rditi and H Murat Gunaydign (Gunaydin, 1997) suggests project managers and company administrators should consider the following points to enhance the quality management in a centurion project

- Management commitment to quality and to continuous quality improvement is very important in each phase of the building process. Management must participate in the implementation process and be fully committed to it if TQM is to succeed.
- Construction industry professionals are aware of the importance of quality training. Engineering, architecture and construction management students who eventually become the industry's future leaders must be instructed in the basics of quality management.

Education and training in TQM theory and practice at all levels (management as well as operative levels) and in all phases (design, construction, and operation phases) are essential to enhance competitiveness.

- Teamwork is necessary to allow each person to get the assistance required to be successful individually, and collectively as a team. The whole construction industry is project oriented; so improved quality performance must be project-related and must include the whole project team. Manufacturer, subcontractors, main contractor, vendors, professional designers, project managers and above all, the owner must be involved in the process. Partnering arrangements between these parties will enhance total quality.
- Statistical methods are essential problem solving tools and are very important in monitoring quality in manufacturing industries. But they are not perceived as very useful by construction professionals; yet, there appears to be potential for a feedback system in the construction process. As the project is being completed, feedback loops originating at the end of each phase could be used to upgrade the original quality standards adopted at the beginning of the project.
- Taking measures to achieve high quality cost money. This cost should not be considered an expense but an investment. Construction organizations that achieve reputation for high quality can maximize their competitiveness and increase their business opportunities.
- The construction project should be considered as a process where all customers must be satisfied. These customers include internal customers (employees, units, departments within an organization) and external customers (owner, designer, contractor, etc.).
- The requirements of the owner must be clearly defined at the beginning of the project and be agreed to by both the owner and design team. The more time and effort are spent at the beginning in defining requirements, the more smoothly the project will progress. Objective setting is important because it provides a focus for scope definition, guides the design process, controls the construction process, and influences the motivation of the project team.
- Drawings and specifications received from the designer affect the quality of the construction. Drawings are the only documents given to the constructor that show the design concept, size and scope of the job. It is critical that drawings and specifications be

clear, concise, and uniform. The project must be constructible by those retained to build the project. Design professionals must be familiar with construction materials and techniques that constructors will be using in the project.

From other perspective Eng. Mosab Elashir in his paper suggested (Elbashir, 2018)

- Quality is a culture an attitude, without the commitment and support of the top management of the organization, no quality program is going to success
- No matter how qualified resources the organization has, without quality system the output will always be poor
- Quality planning, quality assurance and quality control are an essential component of the quality system.
- Senior management hold the responsibility to overcome the quality barriers

CHAPTER THREE

METHODOLOGY

3.1. Methods

This research use both qualitative and quantitative method for data gathering and analysis. As a qualitative research method a one-to-one interview and text analysis is used and as quantitative method a survey research is done.

The research is conducted in three stages. At first stage a literature review and desk study of previously conducted researches is done in detail and second stage an interview with direct interview is conducted with experienced project manager face-to-face to obtain the information about their current practices in quality management system of their company, a questioner is used to address other professional and nonprofessionals parties involved in the construction sector specifically in building construction.

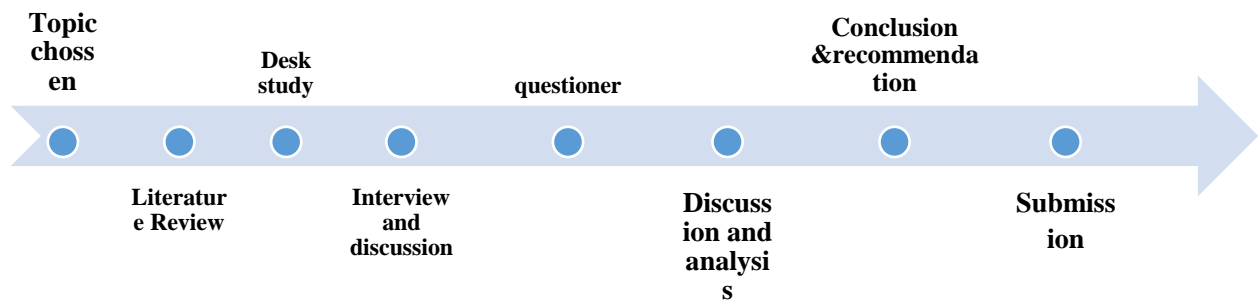


Figure 6 Research method

3.2. Study Area

The study area of this research is Addis Ababa Ethiopia. Addis Ababa has previously 10 sub city under the city administration but on its 8th year 1st regular session of Addis Ababa city council has passed a draft proclamation to restructure the city in to 11 sub cities establishing an additional one named “Lemi Kura”. The old map of Addis Ababa is attached below as references

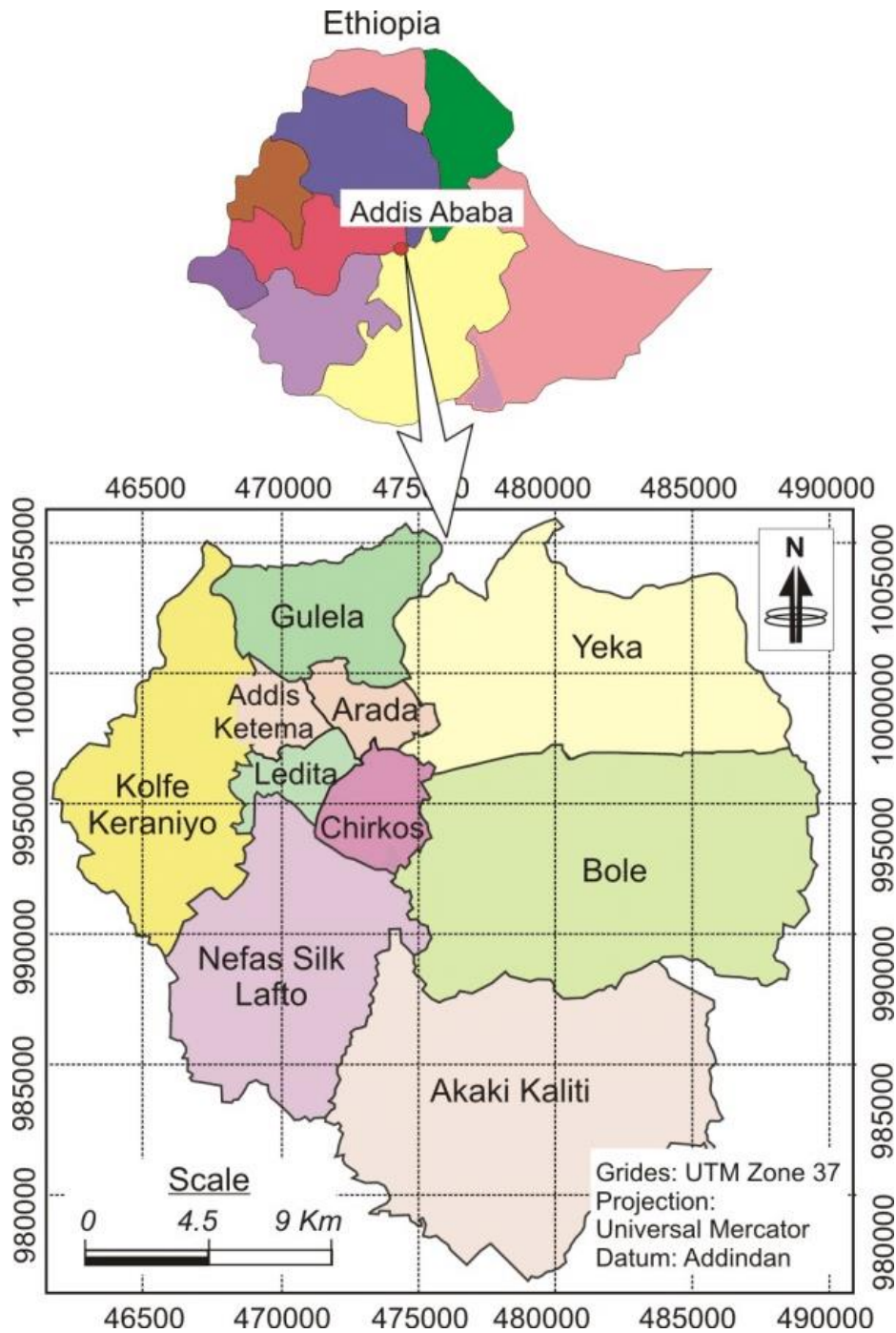


Figure 7 study Area map

Most of the high rise building are located around the center of the city, while around the boundaries most build are industrial buildings. Our more focused is going to be around the center and on the structure of the high rise buildings

3.3. Data source and type

The data source of the study is both primary which is gathered through interview and questioner and secondary data which is gathered from previously done researches and public Publications, etc. The primary sources of data is employees (professionals and non-professionals) on selected projects. Documents review and analysis of secondary data from various sources is used as useful source of information for the study. Relevant books, text books, journals, organization's past and current written documents on the relevant issues also is used. Project documents like contracts, plans, inspection book and other data on site is used also

The study tries to explore, examine and identify the major problems in quality management practices, and it implements more of descriptive, exploratory and both qualitative analysis and quantitative approach.

3.4. Population of the study

The population of the study is Addis Ababa grade one Building contractors as determined construction industry development and regulatory bureau the total numbers of grade one and two Building contractors registered in Addis Ababa for the year 2017 G.C are 124.

The populations that is used in this research are randomly selected building contractors located in Addis Ababa, the main participants is major stakeholders in the projects such as, owners, contractors and consultants of projects. Also professional and nonprofessional working under the contractors. The kind of projects to be selected in this research are high rise buildings with more than 50% of the structure work has been done. Therefore, the population of this study was 124 Building contractors.

3.5. Targeted population

The target population is “the entire aggregation of respondents that meet the designated set of criteria” (Burns & Grove 1997:236) saying the above for the interviews the main in target population is going to be the project managers and/or the site inspectors working in the building construction project. From 124 projects 250 respondents was targeted.

3.6. Sample Size

According to construction industry development and regulatory bureau the total numbers of grade one and two building contractors registered in Addis Ababa are 124

To select the sample size for 124 companies; the equation shown below is used for unlimited population (Creative Research System, 2001):

$$SS = \frac{Z^2 \times P(1-P)}{C^2}$$

Where: SS = Sample size

Z = Value (e.g. 1.65 for 90% confidence level)

P = Degree of variance between the elements of population (0.5)

C = Confidence interval (0.05).

$$SS = \frac{1.65^2 \times 0.5(1-0.5)}{0.05^2} = 272.2 = 273$$

Correction for finite population use the following equation

$$New\ SS = \frac{SS}{1 + \frac{SS - 1}{POP}}$$

Where: POP= population

$$New\ SS = \frac{273}{1 + \frac{273-1}{124}} = 85$$

From 124 Building contractors total 85 building contractors should be part of the survey. From the 85 Building contractors at least 1 project will be surveyed which will give at least 85 projects to be surveyed.

3.7. Sampling Technique

The purpose of sampling is used for data collection. Systematic and simple random sampling technique were used for selecting the projects. The questionnaires are distributed for contractors at their sites, for were distributed at the offices. By simple random sampling, for some projects a face to face interview is conducted.

3.7.1. Inclusion and Exclusion Criteria

Inclusion criteria

The study includes

1. professionals with the field of study related to construction
2. nonprofessionals that work in the construction sector
3. Experience with more than 5 years for professionals
4. Experience with more than 10 for non-professionals
5. Location around the center of Addis Ababa

The study excludes the following

1. Professionals who's field of study doesn't relate with construction
2. Fresh and junior construction professionals

3.8. Interviews

The interview is conducted face-to-face with the interviewees asking questions selected individuals. The interview is a useful technique for collecting data which would probably not be accessible using techniques such as desk study and questionnaires. Unstructured (open) types of interview is conducted with project managers and site engineers to gather information on: organization quality management; organization quality problem; factors affect the quality of construction projects; and the sub factors important for the quality of construction.

3.9. Questionnaire Design

It is simplest and time saving method to collect data effectively from a huge numbers of respondents. Formulating questions from the identified variables, the questionnaire is designed to gather data from professionals and nonprofessionals witch are currently working in building construction sector in Addis Ababa. This questionnaire survey has both open-ended and closed-ended questionnaires.

3.10. Validity and Reliability

The researcher checked the validity of questioners developed for this study. Before distributing the final questionnaires to the respondents, it was be checked and commented by friends and the advisor of the researcher and pilots done to check the valid.

Reliability analysis was carried using Cronbach's alpha and in principle Cronbach's alpha of 0.7is acceptable for internal consistency of data obtained from respondents. So cronbach's alpha for factors afacitng quatliy was 0.74, for quality managment was 0.78, for quality control was 0.762, for top management commitment was 0.83, for quality management tools and techniques was 0.84, and for quality management implementation challenges was 0.781 by using SPSS.

3.11. Data Analysis

This research used questionnaire and interviews as its main data source. The analysis used the frame work developed in chapter one and the concepts form the literature review in chapter two finally based on the survey data and interview try to Analysis the quality management system

Questionnaire was designed and disturbed online by Google drive, then the data was imported to Microsoft Excel and the data where analyzed.

Quantitative data was organized and put into tables to prepare for analysis. after, these data were analyzed using descriptive statistical methods like mean, standard deviation and

percentages. Qualitative data was transcribed and then coded and put into categories and discussed.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

4.1. Introduction

This chapter analyses the data gathered from questionnaires and interviews. This chapter includes the general information about respondent building contractors' profile that helps the research to get the necessary information from the firm. Then concept of quality and quality management adopted in the construction process are assessed. Finally factors affecting quality practices in the building construction projects also investigated. Data were captured and the responses were analyzed using the Microsoft Excel software package. Then the information is ranked in different position by using relative important index.

4.2. Response Rate

The contractors included in this research are grade one and two building contractors in Addis Ababa which have high rising building

250 questioners were distributed to 93 projects of 85 Building contractors. Among 250, 209 returned back and 194 where found to be valid for the research.

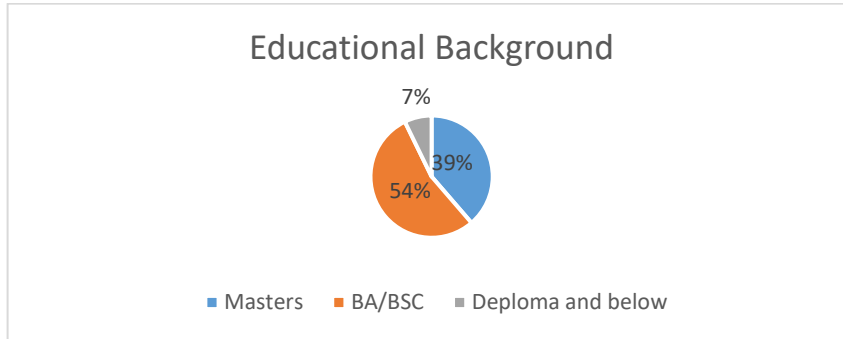
NO.	Descripton	Qty in no.
1	Distributed qutstionery	250
2	Surveyed Bulding contractors	85
3	Projects surveyed	93
4	Returned Qustienny	250
5	Valid qustienry	209

Figure 8 rate of response

4.3. General information of respondents

The general information of the respondents are shown below

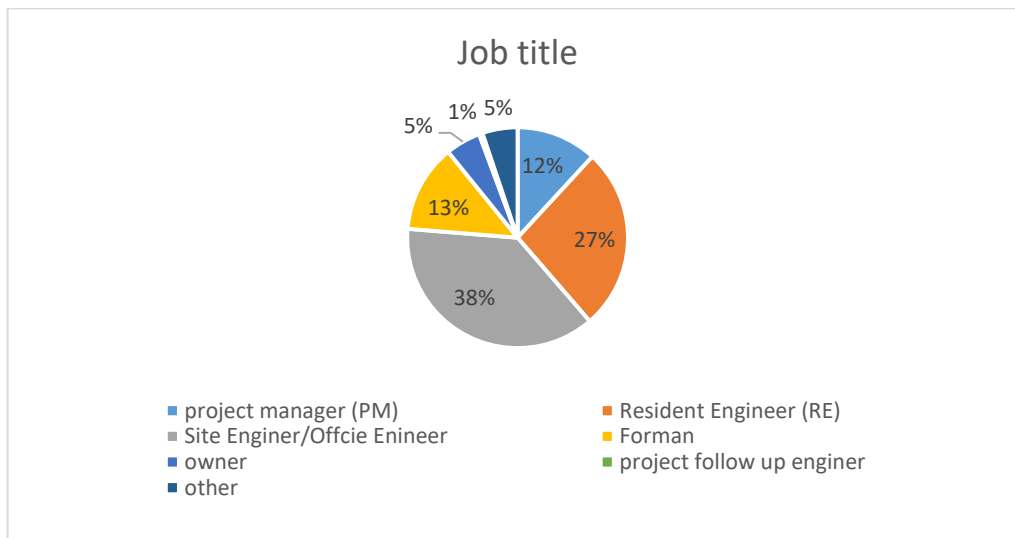
4.3.1. Educational Background



Pie Chart 1 Education Background

From the above statics we cans see that more than half of the respondents are with bachelor's degree qualification. From the sample 14 (7%) of the respondent have an educational background, most of respondents in this category are working as Forman. even though they don't have higher educational certificates, this respondents have been working more than 10years in the construction sector. The other 75 (39%) have a MSC/MA degree, some in construction and some in other fields. while the rest 105 (54%) have a BA/BSc most of it in construction and related filled.

4.3.2. Job title



Pie Chart 2 job title

The pie chart shows the distribution of the respondents based on their job title. As seen among the respondents 23 (12%) are project managers, 52 (27%) are resident engineers, 73 (38%) are site engineers and office engineers, 25 ((13%) are formaners, one (1%) of our respondent labeled himself as project follow up engineer and 10(5%) are have other job titles but within the construction sector

4.3.3. Year of experience of respondent

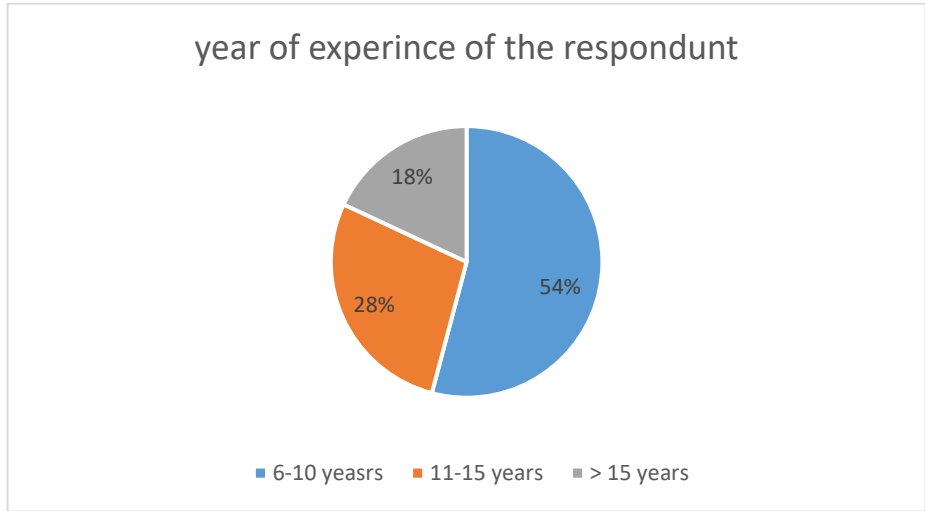
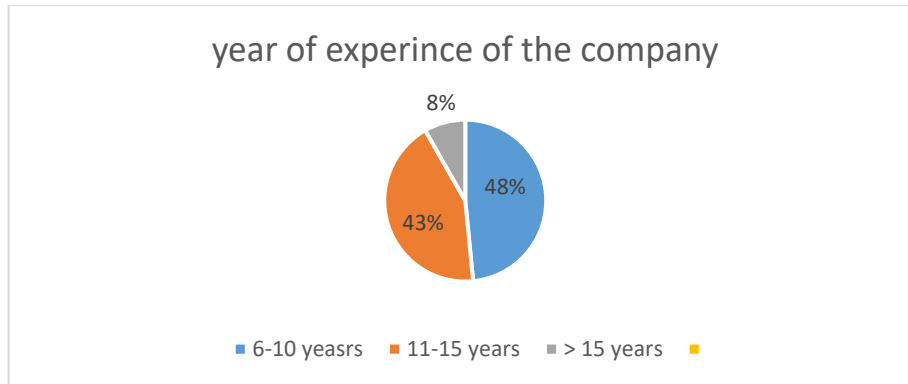


Figure 9 year of experience of respondunt

If the respondents have more experience in the field of construction the research is more reliable, since the more time they spend on the filed the more depth of insight they have on the topic. The respondents with less than 5 years of experience have found to be invalid and excluded from the research.

Among the respondents 35 (18%) have an experience of six to ten years, 54 (28%) have an experience of eleven to fifteen years and 105 (54%) have an experience more than fifteen years.

4.3.4. Year of experience of the company



Pie Chart 3 Year of experience of the company

Building contractors with less than 5 years of experience have been excluded. 94 (48%) of the companies have six to ten years of experience in the field of construction and 84 (43%) have eleven to fifteen years of experience while 16 (8%) have more than 15 years of experience.

4.4. Quality perception

Quality have different meaning from individual to individual, also form company to company. If the company perspective doesn't correlate with the individual perception this will create a gap in the quality management program. The perception of the meaning will influence the outcome of the system. The individual might think of quality as Expensive and the company might define it as meeting specification and requirement .The perception of this has a big effect on the application the individual might not apply the right quality measure on the work thinking it is an extra added cost on the contract and might underestimate the quality of the work and the work will not be done at the standard of the company. So the researcher has tried to see from both the individual and company level.

4.4.1. Individuals quality perceptions



Graph 1 Individuals Quality perception

In the questioner asking for individual's quality perception, multiple answers have been allowed to see full image of the individuals.

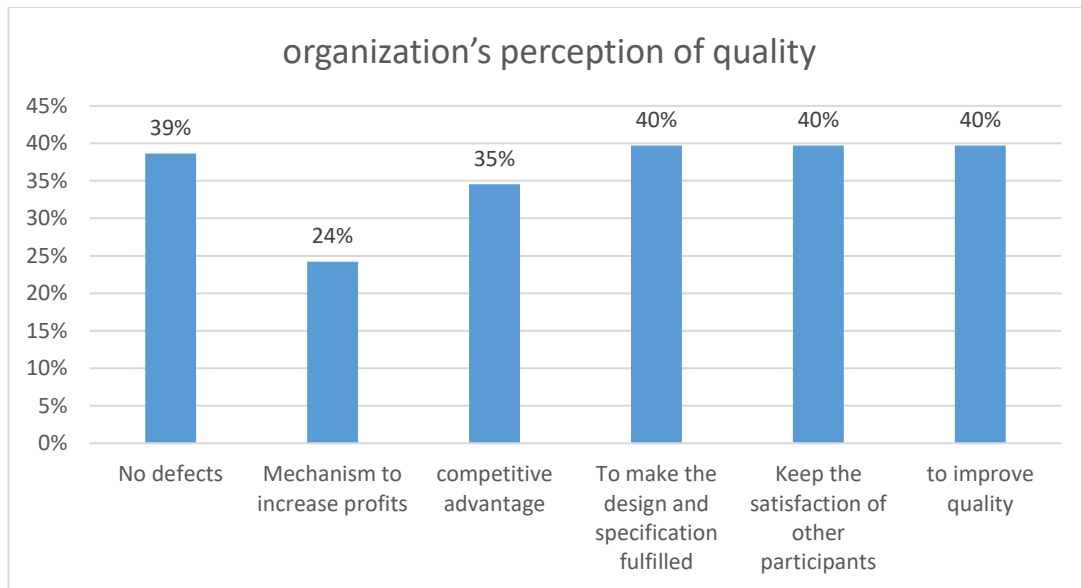
Most of the contractors agreed the quality means meeting specification and requirement (60%), the other 36% think quality means perfection, while 28% person said quality is a means to increase profit but none of the individuals thought quality is expensive. Maning the individual have good perception of qulity.

4.4.2. Quality perceptions of companies

The objective one of this study was to assess project quality management practices in Addis Ababa building contractors. To achieve this objective

Just like the individuals perception of quality, the company perception of quality can be multiple so the respondents were let to answer more than one answer.

For the data presented it can be seen that 40% of the respondents said their company define quality as a means to make the design and specification full filled, a means to keep the satisfaction of other participants and a means to improve quality of the work and 39% said their company sees quality as no defect while 24% said quality is a mechanism to increase profits



Graph 2 Organization's perception of quality

4.5. Quality management system

We asked the respondent if quality management system is implemented in their company. The table shows 33% of the respondents' company has no quality management system of which only 12% are considering to implement and 67% has quality management system of which 29% has implemented way before the rest which is 38%.

Table 4 how many of the respondent company have quality management system

company have quality management system	frequency	percentage
NO	40	21%
it is under consideration	24	12%
has been implemented recently	74	38%
has been a part of corporate	56	29%
total	194	100%

Since there are different kinds of quality management systems we asked the respondent whom said their company has a quality management system, which quality management system are they implementing since there are different kinds of quality management systems.

Table 5 type of quality management system the respondent company use

Type of Quality management system	frequency	percentage
ISO 9000	39	30%
Total Quality Management	0	0
Quality control/Quality Assurance	78	60%
Other/Traditional	13	10%

For the 67% of the respondent which say their company have quality management system we asked them which type of quality management system does their company implement they respond as 28% said they use ISO 9000 5% said Total quality management system, 60% said the use quality control or quality Assurance while the rest use other traditional way of quality management. But after deeply Most of the companies use Quality Control/Quality Assurance quality management system.

4.6. Quality performance of the project in Addis Ababa

We have asked the respondent if their project has a quality problem there response with 1 is low extent and 5 is very high extent

Quality defect on your project	5	4	3	2	1	Total
Frequency	10	64	65	50	5	194
Percentage	5%	33%	34%	26%	3%	100%

From the respondents only 3% think their work there work is defect free and the work is executed to the quality of the requirement by the contract document and also 3% of the respondent said their work quality doesn't match with the requirement of the standard and specification but most are in the normal phase saying they try as match as possible to meet the requirement of the quality as specified in the quality document but due to many reasons they didn't meet those requirement but they have worked to the extent they can to achieve them

4.7. Main factors affecting quality in construction projects

The third objective of this study was to assess the challenges faced in relation to the implementation of quality management. There are money factors that affected the quality of construction project. From different literature and personal experience the researcher has

listed down the reasons. These factors are ranked on the effect they have on the construction projects or expresses the defect and faulty work due to the factors especially some have great effects on construction project.

Relative Importance Index Technique is used determine the relative importance of the various factors affecting quality in construction projects. The five-point scale ranged from 1 (strongly agree) to 4 (strongly disagree) is adopted and transformed to relative importance indices (RII) for each factor as follows:

$$RII = \Sigma W / (A * N) \quad \text{----- Where,}$$

W is the weighting given to each factor by the respondents (ranging from 1 to 5),

A is the highest weight (i.e. 5 in this case), and

N is the total number of respondents.

Table 6 Factors affecting Quality in a construction project

Factors affecting Quality in a construction project	Degree of Importance					RII	Rank
	1	2	3	4	5		
Design related issues							
Project (type and complexity) related issues	40	10	66	65	13	0.601	8
Time-related issues	10	25	70	80	9	0.655	7
Contract related issues	5	24	48	87	30	0.716	6
Design related issues	10	10	47	65	62	0.764	4
Materials related Equipment related issues	0	0	62	20	112	0.852	1
Labors related issues	2	28	48	43	73	0.762	5
Subcontractors related issues	10	50	70	60	4	0.598	9
Systems(quality control, cost control, safety program)	4	17	21	59	93	0.827	3
Communication related issues	1	5	23	87	78	0.843	2
Site staff (cooperation, understanding, experience)	45	44	28	32	45	0.588	11
Financial issues	85	12	4	12	81	0.592	10

4.7.1. Materials and Equipment related issues

In construction project a lot of raw materials are combined together using different equipment to give the desired final output of the project, which might be a building, bridge, dam etc...

But the effect of this raw materials and equipment on the output is highly effective. In order to build a safe and stable structure, the type of materials used should be of high quality

4.7.2. Communication related issues

Communication is an important tool in a construction, but it's especially important when work is delegated amongst various parties (owner, consultant, contractor, governmental bodies, financial institution etc.). Without clear and effective communication, important tasks can slip through the cracks and the team can remain unaware of an issue until it's too late to rectify.

The following are communication related issues collected during our interview

- Not setting a clear goal to the project
- Lack of communication with the project stakeholder and project manager
- Not communicating correctly and on time
- Not keeping everyone in the loop (from top management to lower management)
- Not having or not reviewing project document (project plan, site data, etc.)

4.7.3. System related issues

The way the system work on a project site affect the quality of the work. According to the survey it is ranked in 3rd place. If this systems especially quality control system are active on the project, there is a high degree of the work being finished to the best quality as stated in the standard and quality of the project document.

For a project to have a best system it has to balance between the quality of the project, the cost of the project and the work has to be done as safe as possible

According to the survey the biggest quality problem related to system is to begin with projects don't have a specific system to guide the quality management, even if they have the system are not being applied appropriately as specified.

4.7.4. Time-related issues

According to the Project Management Institute (PMI), the term Project refers to” to any temporary endeavor with a definite beginning and end”. Construction is a project with a defined starting point and ending point. If this given period of time has to be given in detail and shall fit with the project type. Out respondent listed Short period of time to finish the work, end loaded scheduling, in appropriate scheduling (time and task assigning) and giving works the below minimum or minimum time to continue the next work as problem related to time.

4.7.5. Labors related issues

Labors are an important resource we use to construct building especially when the resource for equipment are limited and also some work could not be done by equipment only so, using labors are necessary. In Ethiopia the construction needs a lot of labors these are some of the issues related to labors that cause lower quality are the communication skills of labors being low, the experience level of the labors being less, the system to keep the labor motivated is not sufficient, training is not given to the labors and the payment or wage of the labors is low.

4.7.6. Contract related issues

The contract consist of the bill of quantity , standard and specification, drawing and etc. on the document a parties are assign related to quality supervision and quality control and also prices are set on how to achieve those specified quality standards. The respondent have listed poorly defined contract and not having clear definition of assignment are the reason for poor quality related to contract

-

4.7.7. Design related issues

According to some literature and the conducted survey, Complex design takes the time to understand and it is more challenging to construct a building with such designs. In the process of trying to understand the complex nature of the design, one may miss out on the important tiny details. Other design related issues are the completeness and consistency of design documents, working drawing are prepared in detail, codes and standards conformant with the design and bill of quantity accuracy

4.7.8. Project (type and complexity) related issues

Unnecessary complexity is the enemy of high-quality work. While some level of complexity is unavoidable in cutting-edge infrastructure and commercial construction projects, designers should minimize complex techniques and unusual features whenever possible.

4.7.9. Subcontractors related issues

In big projects wide works are done by sub-contractors, this subcontractors are the one in direct contact with the work. Just like the labors this sub-contractors have effect on the quality output of the project, some of the issue of the sub-contractors in affecting the quality of the construction are method and procedures used in selecting this subcontractors, cooperation between subcontractors and main contractor, system to evaluate the subcontractors performance and subcontract contract conditions

4.7.10. Financial issues

Financial issue is the main factors affecting construction success especially when there is no proper financial control and management. Cash flow problem may cause inefficiency of construction Company (contractors). Inefficiency contractors may also affect quality construction. This indicates that with a good cash flows management, companies could be kept efficient and financially healthy.

Finance related factors affecting quality are the amount of contactors cash flow and the non-delay of interim payment

4.7.11. Site staff

In a construction project the site staff have to work with each other to achieve one goal, which is finish the project with in the give time and the available finance with the desired quality. Without the cooperation of the staff any perfect scenario would not end up in a quality achieved project.

The staff responsible for implementation of quality is inadequately trained and in most construction projects on-site quality checks are carried out by relatively less experienced supervisory personnel. The skill and experience of supervision staffs are very important for quality management practices. The contractor's staffs skill and experience are also very important for quality management practice.

Cooperation between supervision and contractors staff and understanding of contract administration are some of the issues on site staff found to have effect on quality

4.8. Tools and techniques used

The tools and techniques used by the selected Building contractors is almost the same. Most use on site an inspection to check out the quality at site and apply different tests on the raw material and end structure (destructive and nondestructive), use sampling techniques to identify the quality level of the built structure before and after construction.

The upper level management use the check list method, a check list which are driven from specification and standards in the contract document and other official standard books. This check list will be done on site and reviewed and also a flow chart is used to see the work in detail and inspect the work at different level.

4.9. Summary of results and findings

The quality management practices in Addis Ababa building contractors from the research can be summarized as

Quality performance of Grade one and Grade two building contractors is moderate . The assessment of project concept of quality and quality management system is well understood. Most of the contractor have quality management system but even if some of the contractors don't have the system they try to manage the quality by default or other technique and the most widely used quality management system in the research area is Quality control/quality assurance

The quality performance of the project in Addis Ababa building contractors from the perspective of organizational structure

Most of the contractor don't have specific assigned person to assess quality only. Most of the quality check done by higher level managers. Since this managers have other duty at hand the quality performance will be in question. In most of the contractor there is no reporting mechanism in the organization structure to see if the quality of the work is to the desired quality or not the reporting is only done when there is a suspect there a problem in the quality

The quality performance of the project in Addis Ababa building contractors from the perspective of tools and techniques

Most of the contractors use as a tool to control the quality of their project check list and flowchart . Works are inspected through an assigned person and inspected for any defect before passing to the next stage. Testes on the raw materials are done on the raw material before application and the end product (the structure) also undergo some inspection tests to identify if the quality is satisfactory. Most contractors do the quality performance check when they are required by the governmental body or the consultant and are not self-driven which will affect the end output.

The challenges faced in relation to the implementation of quality management are the quality of the material or equipment in use being low, In appropriate Storage and handling of the material and equipment is seen in most of the projects, Corruption between the material supplier and the contractor is noticed, unavailability of the desired material or equipment for the work, not maintain equipment on time wich lead to defect on the work, not setting a clear goal to the project , their is lack of communication with the project stakeholder and project manager even if they do it is not on time communication, not keeping everyone in the loop (form top management to lower management), not having or not reviewing project document (project plan, site data, etc.), Projects don't have specific system to guide the quality management, Quality management system are not applied correctly , there is Short period of time to finish the work so most of the scedules are end loaded, the time and task assingigi on sceduleing is not appropriate,

Realted to labours the challnges faced to implement quality are the experience level of the labors is low, the system to keep the labor motivated is not attractive, training is not given to the labors, the payment or wage of the labors is low,

Other realtied challnges being faced are Poorly defined contract, not clear definition of assignment , completeness and consistency of design documents, working drawing are prepared in detail, codes and standards conformant with the design , bill of quantity is not accuratex the project being complex, method and procedures used in selecting this subcontractors is week, cooperation between subcontractors and main contractor, the system to evaluate the subcontractors performance is not strong,the amount of contactors cash flow, cooperation between supervision and contractors staff, not having Skill and experienced staff

CHAPTER FIVE

Conclusion and Recommendation

5.5. Conclusion

The following conclusion are drawn from the result and discussion

The concept Quality and quality management is well known around Building contractor in Addis Ababa. The concept of quality in individuals working in the sector and the company policy of quality don't show a big gap.

More than 60% of the building contractors have a quality management system implemented in there company. Which shows quality management system is part of the company policy most of the building contractor who implement the quality management system implement the Quality control/Quality Assurance management system

The staff need training on tools and techniques used to control the quality of the project. The projects need to apply more than check list ad work flowchart.

The quality reporting system is only for poor quality, this is not right a structure quality status should be reported weather it is good or bad so that the end user or other bodies can understand the quality state of the building.

Among difference reasons contributing to low quality of construction work the major one listed is the material and equipment related issue, which shows there is mishandling of equipment and material on site during procurement, supply, storage and construction. Form corruption then knowledge gap to unavailability of material

The communication gap between the upper levels to lower level management also between the site staff have a big impact on the quality issue. This related to the labor at site not having enough skill or training, their income level is low so their motivation being low will have big impact on the quality of the project

the project complexity, design being not clear and the contract document not being full is the other major issue on a project site affecting the quality of the project

5.6.Recommendation

The project manager is the key person for the success of the project and should be highly competent. The project manager should set a clear management system and set a clear goal how to achieve them then communicate effectively this system with the stakeholder and the lower management

The contractor should give training to their workers about quality management system and quality management techniques to their staff at different level according to their level and job title

Labors are the first person from which quality gets affected and should be properly managed trained and selected on basis of their skills

Complex and unclear document and drawing should be avoided as much as possible, and the clarity and fullness of each document should be rechecked before the starting of the work, if there are any uncertainty this shall be cleared before the task has been started Sub-contractors should be selected purely on the basis of their experience and skill

Regular maintenance of construction equipment should be done in order to manage them effectively. Durable equipment equipped with advance technology should be purchased and used

Communication between all the participants of the projects should be continuous and effective. The staff should be de selected with a selection criteria which is based on skills required at the site

5.7.Recommendations for future study

For future researches it is recommended to do a research in lower grade building contractors where higher degree of quality defects are noticed in addition it is helpful to do research in quality aspect in different construction contractors like road contractor and water contractors.

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APPENDIX

Apendex A.
QUESTIONNAIRE

Dear respondent,

My name is Selamawete Fekadu and I am currently undertaking a MSc. degree in Construction Technology and Management at Addis Collage. Currently, I'm researching research on "Construction Quality Management practice in Building Contractors in case of Addis Ababa city".

We see you as a professional with vast experience in the construction industry. We request you to kindly fill up this questionnaire, which will be of enormous help in our study. To save your precious time all questions are framed in multiple-choice formats and some technical writing questions. We assure you, this study is only intended for academic purposes and the confidentiality of your response is guaranteed.

Thank you in advance! Best Regards, Selamawete Fekadu

If you have any difficulties, please do not hesitate to contact us via email/ phone
Principal investigator Co-investigator

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+251 913100211

*Required

Mark only one oval.

Option 1

General Information

Part one

Name of the respondent

Name of your company or organization

Grade and category of the company *

You are working in witch side *

Job title *

- Project
- manager (PM)
- Resident
-

Engineer (RE)

Site

Supervisor

Site Engineer/office

Engineer/Foreman

Other: _____

Years of experience of the respondent *

- <5 Years
- 6-10 years
- 11-15 years
- >16 years

Year of experience or the company *

- <5 Years
- 6-10 years
- 11-15 years
- >16 years
- Other: _____

Part two

Quality and quality management (Your answers are not limited to one answer)

In your view, which of these words best define quality? *

Tick all that apply.

- Expen
- sive
- Perfec
- tion
- Increa
- sed
- Profit
- Customer's Satisfaction
- Meeting Specification requirement
- Other: _____

What is your organization's perception of quality? *

Tick all that apply.

- No defects
- Mechanism to increase profitscompetitive advantage
- Other: _____

Does your organization have a quality management system? *

Tick all that apply.

- NO
- It is under consideration
- Has been implemented recently
- Has been a part of corporate policy for some time now
- Other: _____

If you answer to the question above is NO, why don't your organization don't have quality management system

Tick all that apply.

- It's expensive
- It's not that important
- The work is perfect without implementing the system
- Other: _____

If your organization implement it, what type of quality management system do you have?

Tick all that apply.

- ISO 9000
- Total Quality Management
- Quality Control / Quality Assurance
- Other: _____

The major objectives of your quality management systems are: - *

Tick all that apply.

- Increase productivity
- cost reduction
- Involvement of employees in the quality building effort
- compliance with statutory, environment and safety requirement
- Other: _____

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

Mark only one oval.

1 2 3 4 5

Very low high

To what extent in your organization is stakeholder's engagement quality management *
System of the projects?

Mark only one oval.

1 2 3 4 5

Very low extent very great extent

To what extent is the engagement of these parties in Quality management in building *
 Construction projects?

1 is low extent and 5 is very high extent)

Mark only one oval per row.

	1	2	3	4	5
The owner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(Client)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manager	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Site	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engineer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Office	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engineer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Forman	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Site	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supervisor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quality controller	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lower level site worker(DL, Helpers etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In your opinion witch of the following has a big effect on quality management in a *
 Construction project?

Tick all that apply.

- Stakeholder's
- involvement
- Technical management
- Environment, material and equipment
- Culture and politics
- Other: _____

In stakeholder management which of the following has main effect on quality *

Management

Tick all that apply.

- Poor relationship and partnering among project
- participant's supplier impact
- Financier finance
- limitation sub-
- contractor
- mishandling poor
- contract
- management
- Other: _____

From technical Aspect which of the following have main impact on quality management *

Tick all that apply.

- Low quality drawing and
- specification Design
- complexity
- Technical knowledge
- deficiency lack of onsite
- data
- Lack of construction detail
- Other: _____

From environmental, material and equipment Aspect which of the following have main *

Impact on quality management

Tick all that apply.

- Low quality and poor availability of
- resources limitation of material and
- equipment

Time limitation

Project nature

uniquenessproject

location

Other:

From management ability and system Aspect which of the following have main impact on *

Quality management

Tick all that apply.

- Poor training of the
- staffbureaucracy
- Lack of motivation among
- the staff coordination
- Lack of management
- commentpoor
- communication

- Other: _____

Does your organization have quality problem?

Mark only one oval per row

1 is low extent and 5 is very high extent)

Mark only one oval.

1 2 3 4 5

Very low extent very great extent

Part Three:

Main Factors affecting quality in construction projects during the construction phase are *

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

Tick all that apply.

	1	2	3	4	5
Project (type and complexity) related issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design related issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Contract related issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time-related issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Materials related issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Equipment related issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Labors

related

issuesRow 7

Subcontr
actors
related
issues

Site
layout

of the
project

Systems
(quality
control,
cost
control,
safety
program)

Commu
nication-

related
issues

Site
staff
(coopera
tion,
understa
nding,
experien
ce)

Financial issues

If you have any other comment please feel free to add it here!!
