

ADDIS ABABA UNIVERSITY
ADDIS ABABA INSTITUTE OF TECHNOLOGY
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING



Assessment of Quality Management System Practices on ISO 9001:2015
Certified Contractors in Addis Ababa, Ethiopia

By: Mahlet Kebede
Advisor: Prof. Abebe Dinku (Dr. –Ing)
Co-Advisor: Addis Mesfin (MSc.)

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Approved by the Board of Examiners:

_____	_____	_____
Chairman of Graduate committee	Signature	Date
_____	_____	_____
Advisor	Signature	Date
_____	_____	_____
Internal Examiner	Signature	Date
_____	_____	_____
External Examiner	Signature	Date

Declaration

I declare that, except where explicit reference is made to the contribution of others, that thesis entitled “**Assessment of Quality Management System Practices on ISO 9001:2015 Certified Contractors in Addis Ababa, Ethiopia**” is my own work and has not been submitted for any other degree in any other university.

Candidate Name: Mahlet Kebede

Signature: _____

Date: _____

Place: Addis Ababa, Ethiopia

This is to certify that the above declaration made by the candidate is correct to the best of my knowledge.

Advisor: Prof. Abebe Dinku (Dr. –Ing)

Signature: _____

Date: _____

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Abstract

Since the past twenty years, ISO 9001 standard has shown its capacities to bring down cost, increase efficiency, and fulfill clients in the organizations. Even though ISO 9001:2015 standard has demonstrated its advantages to various areas in all over the world, there is still discussion among researchers and practitioners concerning the effectiveness of applying ISO 9001:2015 in construction projects.

The objective of this research is to assess the current practice and benefits of implementing ISO 9001 Quality Management System in Addis Ababa construction companies, to identify the problems faced by construction companies in implementing ISO 9001 Quality Management System and to identify the strategies adopted by the ISO certified construction companies in overcoming or minimizing the implementation problems. As part of the approaches to achieve these objectives, the study used different literature reviews. Questionnaire and interview approach has been selected to collect data for this research.

The key findings of this research showed that the QMS has improved the overall organization performance in terms of documentation as well as productivity. The general approach for improving processes and products is quality improvement. Quality control activities are carried out to minimize defects during processing. Quality assurance is a process of meeting international standards to assure product and process quality. Audits and reviews are used to improve the quality of a company's quality management system. Although aspects such as quality manuals, quality procedures, and customer satisfaction are mentioned in the main components, more focus is needed. It also showed that they have benefited from implementing the QMS, however there was still room for improvement in attending the key performance indicators and fully integrating the ISO principles and requirements within the construction industry.

Keywords: Contractors, Customer Satisfaction, ISO 9001:2015, Quality Management System.

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List of Abbreviations

AACCSA	Addis Ababa Chamber of Commerce and Sectoral Associations
ECAE	Ethiopian Conformity Assessment Enterprise
ESA	Ethiopia Standard Agency
EQA	Ethiopian Quality Award
FIDIC	Federation Internationale Des Ingenieurs-Conseils
ISO	International Organization for Standardization
PDCA	Plan-Do-Check-Act
QA	Quality Assurance
QC	Quality Control
QM	Quality Management
QMS	Quality Management System
ROI	Return On Investment
TQM	Total Quality Management

CHAPTER 1 INTRODUCTION

1.1 Background of the Research

During the last decade, public and private expenditure on infrastructure and other construction works was a catalyst for the rapid economic development of Ethiopia. The country has consistently invested systematically more than 30% of GDP in the gross financing of fixed capital since 2010 and consequently, Ethiopia has emerged as one of the fastest-growing economies in the world. The market value of the construction sector is currently estimated at over \$7 billion. According to the 2017 edition of African economic outlook, construction activities in Ethiopia represented 15.9% of GDP at current prices during the fiscal year 2015/16 (Veitch, 2018). This shows that, Ethiopia construction industry plays a key role in benefitting towards the development of the country's economy as well as providing the necessary infrastructure and enhanced facilities for social comfort (Beshah, 2011).

According to Beshah & Kitaw (2014) delivering quality projects is a challenge for the construction sector in Ethiopia. Most construction projects encounter a range of challenges in terms of completing projects including defects, delays, and cost overruns (Neyestani, 2016). In developed nations, quality has been used as an important strategic weapon in winning markets and survival in a highly competitive international environment. Changes in the global economy have caused Ethiopian companies to look at the way they and others have done business in the past (Kitaw & Bete, 2003).

Hence, to overcome the challenges faced in the construction industry having a system in place is important. In which a quality system is a framework for quality management. It embraces the organizational structure, the procedure, and processes needed to implement quality management. The adequacy of the quality system, and quality of products, services, and processes are judged in accordance with specific standards. The standards have important economic and social repercussions. They are useful for industrial and business organizations of all types, the government, to other regulatory bodies, professionals of conformity assessment, suppliers and customers products and services both in the public and private sectors, and for people in general on their role as customers and users. The standards offer

governments with a technical base for health, safety, and environmental legislation (Rumane, 2017).

Quality in the construction sector should be applied to different areas, such as workmanship, processes, and materials. The result of inadequate quality in one of these areas can potentially lead to significant problems throughout the sector. Furthermore, after having a previous experience and knowledge of QM (Quality Management), QM represents a powerful way for problems related to the quality that are currently prevalent in the construction sector. Therefore, it is important to adopt a system that offers a platform for this aspect to be addressed (Tang, et al., 2005).

According to Mane & Patil (2015), Quality Management System is a continuing process of development regarding the core elements a company. The wider goal of quality management system is to avoid a mistake preceding to their occurrence. The three stages about QMS are similarly as quality planning, quality control and quality assurance. It is a process to follow in reducing errors in work. The keys to continuous improvements are commitment and teamwork.

The basic reason is that the implementation of the contract in the law, after a vast nonconformance has already been conducted, cannot reverse the damage already done. Therefore, a client, when awarding a contract, considers the ability of the construction companies to do well the first time and every time, which is underlying philosophy of quality assurance. Customers in both private & public sectors are looking for confidence that can be provided by a company with an effective QMS. Thus, the base for the awarding of the contract or the business is changing from 'only price' to a price and quality combination (ISO 9001:2015, 2021).

According to Ahmad, et al., (2012), to reap internal and external benefits of ISO 9001, a company needs to properly utilize the QMS in day-to-day business and publicize its ISO 9001 certification. Studies also indicated that implementation of ISO 9000 can benefit organizations by improving production performance and quality awareness of the employees in diverse industries. Hence, the general target of this study is to assess the current practice and level of awareness of the QMS implementation within ISO 9001:2015 certified contractors in Addis Ababa.

1.2 Statement of the Problem

Quality management systems has been widely implemented and adopted in the construction industry especially those companies which are able to manage megaprojects in modern countries like Japan, UK, and USA. According to a survey of Xiao and Proverbs (2002), contractors in Japan, the USA and the UK, contractor quality overall performance is examined as well as compared. It is discovered that Japanese contractors finish the construction projects of theirs with less defects, offer greater defects liability periods and are called upon fewer occasions during the defect's liability phase compared to the UK as well as USA. UK as well as USA contractors do find much more standard comments from the clients of theirs compared to Japanese contractors and mostly comparable levels of customer satisfaction are accomplished in the three countries based on quality performance (Xiao & Proverbs, 2002).

As mentioned in the study of Leong, et al., (2014), several research have been conducted to study the relationship of quality management systems with various industries (e.g., manufacturing, food, service, etc.), there is a lack of relevant studies on the construction industry. This is because researchers are more interested to investigate the quality and costing of projects rather than QMS (Xiao & Proverbs, 2002).

The problem of quality has turned into a major concern within the construction industry. Of all the typical concerns discussed are reduced quality of construction materials, building defects, construction delays, increased accident rates, and environmental impact. Due to these incidents, public's trust towards the image of the construction market has reduced. That is why the implementation of ISO 9001 QMS is essential to overcome these problems (Keng & Kamal, 2016).

Thus, all construction firms that want to use ISO 9001 QMS should be ready for the upcoming difficulties that could be encountered throughout the procedure. Nevertheless, it is vital to be aware that quality of a construction projects will not always enhance whether the contractor is made to put in place an excellent management system. This is since the mindset of the contractor to quality improvement is the essential aspect which governs the profitable implementation of the system (Said, et al., 2009). The study findings by Keng and Kamal (2016), concluded that enhanced company's management & work efficiency as the most

essential advantage from the implementation of the system while lack of awareness on the system among staff members is regarded as the significant concern (Keng & Kamal, 2016).

Previous studies in Ethiopia by; (Asefa, 2018; Kefyalew, 2020; Beshah, 2011; Kidan, 2014; Tigestu, 2019; G/Kristos, 2020; Beide, 2018) indicate that Ethiopian construction industry is in an infant stage in the implementation of QMS compared to the number of licensed construction companies in Addis Ababa. As per Kidan (2013), ISO 9001 certified companies face challenges during implementation of QMS, which are: Resistance to change, inconsistency in implementing QMS and turnover.

Therefore, the purpose of this research is to assess the current practices of quality management systems on ISO certified contractors in Addis Ababa in addition the benefits achieved after implementing the ISO 9001 QMS and the challenges encountered.

1.3 Objective of the Research

1.3.1 General Objectives

The main objective of this thesis is to assess the current practice, benefits, and challenges of Quality Management System (QMS) implementation on ISO 900:2015 Certified construction companies in Addis Ababa, Ethiopia.

1.3.2 Specific Objectives

1. To assess the current practice and awareness of Quality Management System on ISO 9001:2015 certified contractors in Addis Ababa.
2. To identify the effectiveness of Quality Management System implementation on ISO 9001:2015 certified contractors in Addis Ababa.
3. To assess the major challenges encountered by construction companies in implementing Quality Management System and recommend the possible remedies.

1.4 Scope and Limitation of the Study

This research investigates the quality management practices of construction companies in Addis Ababa. The scope of this research is limited to contractors that are ISO 9001:2015 certified and are actively implementing the quality management system.

In addition, due to time constraints, the researcher could not cover the other stakeholders therefore, its limited to contractors at organizational level only and does not include the practice at project level.

1.5 Significance of the study

This study will provide a better grasp of how to create a quality management system for all construction companies. The result of the research enables creating quality being raised to brand new heights. Aside from that, the study can facilitate ISO 9001 certified contractors to comply with clause 8.4 and clause 8.5.1 under ISO 9001:2015 requirements. Hence it can improve the effectiveness of the identified QMS. A good QMS, results in elimination of quality associated issues at earlier stage just before nonconforming occurrences (Ali, 2014). Furthermore, by assessing the current practice of QMS implementation this study will leave room for improvement for future QMS implementation endeavors.

1.6 Organization of the Research

This research is structured into five chapters, a brief outline of the content of each chapter being given below.

Chapter 1: An introduction describes background of the research, statement of the problem, objective of the research, scope, and limitation of the research, followed by the anticipated significance of the research and organization of the research.

Chapter 2: This chapter consists of a review of findings from a comprehensive literature search that was conducted as part of this research. A literature search was used as one of the means to understand more about existing research works on this topic and to get better knowledge in quality management system in the construction industry, which also consists theoretical

background of ISO 9001 family and important findings from different literatures and the gap identified in the current practice of quality management practice.

Chapter 3: This chapter provides a brief outline of the research methodology that was adopted, which includes the sample design and data collection methods.

Chapter 4: A description of results of questionnaire surveys and the analysis of that data, by first evaluating the status, benefits, and challenges of QMS implementation using SPSS-descriptive statistical analysis. And discuss the data obtained from interview with respect to the results arising from the finding from this analysis.

Chapter 5: Finally, this chapter summaries the main conclusions and gives recommendations.

CHAPTER 2 LITERATURE REVIEW

This chapter is covering the theoretical base by reviewing literature from various experts as well as scholars that were related to Quality Management System (QMS) in building with special focus on ISO 9001:2015. The concept of quality management system and, the benefits of QMS ISO 9001 standards, are presented before discussing about the problems and QMSs to the implementation practice in the construction industry. An overview of existing Ethiopian construction companies' approaches, and the process of various other developed countries is reviewed.

2.1 Introduction

Based on ISO 9000:2005, describes quality as "the degree to which a set of inherent qualities fulfills requirements". Requirements that have being fulfilled in a contractual scenario usually relate with the provision of a certain product, service. Requirements might be claimed or implied. In a contractual scenario, stated requirements are specified in contract needs and converted into certain service or product functions, qualities, and functions with specified acceptance criteria. Implied requirements on the other side are simple attributes and features which are identified as well as defined by the manufacturer, based on awareness of the marketplace expectations.

According to Rumane (2017), Quality has different meanings for different people. The American Society for Quality (ASQ) glossary defines quality as follows: A subjective term for which, each person has his or her own definition. In technical usage, quality can have two meanings:

1. The characteristics of a product or service that bear on its ability to satisfy stated or implied needs.
2. A product or service free of deficiencies.

It could therefore be stated that ‘quality’ includes all the characteristics of an organization’s products, services, processes, support, and management system that contribute to meeting requirements and enhancing customer satisfaction (ISO 9001:2008, 2021).

Quality is among the crucial factors in the achievements of construction projects. Quality of construction projects could be viewed as the fulfilment of expectations of the stakeholders (Priya & Anu, 2018). Sepani & Thushangi (2012), emphasizes that quality, like every additional dimension of business, should be smartly managed at the company level. Quality improvement works concentrate exclusively on quality advancement programs and the strategy for enhancing certain processes; however, these initiatives typically overlook the impact on the entire organizations.

Sepani and Thushangi (2012), discussed that firms just practicing independently good management techniques to implement better quality, fail because these techniques are sometimes not aimed with the firm's technique or not correctly coordinated with one another. Thus, their analysis established that highly effective quality management cannot be practiced in isolation from the overall approach of the firm.

Project implementation and management focuses on three simple parameters: quality, cost, and time. An effectively managed project is done at the designated stage of quality, if a challenge is accomplished on or earlier than the deadline, with certain level of quality and within the planned budget it shows that it has been efficiently managed. On the different hand, customer satisfaction can additionally point out success and opportunity for sustainability (UN Centre for Regional Development, 2000).

The International Organization for Standardization (ISO) is a non-governmental organization whose responsibility is facilitating the standardization and global control of manufacturing standards, which is in Switzerland. ISO initially released the ISO of its 9001 standards in 1987 and later released an updated version in 1994. To deal with the changing needs of the users, ISO once again updated the standard in 2000 as well as 2008 and then in 2015. The most recent version is widely known as ISO 9001:2015 (Tang & Kam, 1999).

2.2 Quality Management

According to ISO 9001:2008, Quality Management is "coordinated activities to point as well as manage a company with regard to quality". A management structure developed as well as implemented. Quality management is essential for facilitating the competitiveness of modern-day profitable organizations. Excellence in quality management is a requisite for construction organizations who seek to remain competitive and successful (Watson & Howarth, 2011).

The principal goal of any company is making money and remain in business. It accomplishes this by offering a product or maybe service that meets the requirements and demands of the marketplace (APB Consultant, 2021). Customers prefer to work with those companies that can consistently meet its quality expectations: delivery of the right product and quantity; in the right packaging; at the right time and place; at the right price; that meets requirements and satisfies the customer. Customers demand assurance that its suppliers can measure up to this expectation for consistency and will take active measures to provide this assurance (Souki & Cid, 2008). The challenges presented by competitive construction markets and large projects that are dynamic and complex necessitate the adoption and application of quality management approaches (Ekpenyong, 2016; Watson & Howarth, 2011).

Quality management structure standard supplies guarantee using the four tools: Planning activities (Quality Planning), Prevention activities (Quality Assurance), Conformity activities (Quality Control) along with Continual improvement activities (Quality Improvement) (Owino, 2013). To apply these four tools, an organization may use the controls (requirements) of the ISO 9001 standard and the seven quality management principles (Anup, et al., 2015).

2.2.1 Quality Planning

Anup, et al. (2005), defined quality planning as the part of quality management focused on setting quality objectives and specifying necessary operational processes and resources to fulfill quality objectives. The organization must determine the processes, resources and controls needed to achieve the established quality objectives (customers and organization). The specific requirements in the ISO 9001 standard, together with the requirements of customers and organizations, are used to plan the realization of quality planning requirements. Quality

planning will also include planning for the quality assurance, quality control and quality improvement activities (Anup, et al., 2015).

2.2.2 Quality Assurance

Quality assurance is an element of quality control focused on offering confidence that quality requirements will be fulfilled (David, 2019). It provides all the initiative-taking controls to prevent issues, associated price, and client dissatisfaction. There is a requirement to provide an assurance that design and construction aspects have the capability to produce a product that is effective and efficient, whether that product is the design of the building or the construction of the building, and these aspects are not mutually exclusive. The pursuit of quality commences with the client and continues through the production process to the utilization of the building. Quality assurance is therefore an integral part of the total construction process (APB Consultant, 2021).

Quality assurance must be actively employed throughout the total construction process, from initial briefing and conceptual design, through the assembly process, to the completion of the project. It is essential that clear communication is planned for and encouraged, at the critical interfaces of project responsibility and control (Watson & Howarth, 2011). This is a mechanism for guaranteeing the construction process takes place inside the framework of a quality management system (Ekpenyong, 2016).

2.2.3 Quality Control

Quality control could be described as part of quality management focused on satisfying quality requirements." While quality assurance relates to the way a procedure is conducted, quality control is much more the inspection element of quality management (Lance & Coleman, 2021). Rather, prevention-based controls must avoid issues from occurring, though no method is guaranteed, and issues do occur. Accordingly, settings to detect quality issues should be started so that customers receive just items that meet their demands (APB Consultant, 2021). Detection based controls are reactive – the problem and cost have already occurred, and the company is resorting to damage control (Anup, et al., 2015).

2.2.4 Quality Improvement

According to Mitra (2016), Quality improvement is described as the part of quality control focused on boosting the capability to satisfy needs. Continual improvement outcomes from recurring actions taken to improve product qualities or improve procedure success and efficiency. This is among the primary key characteristics which differentiate a quality management system from a quality assurance, i.e., having the ability to enhance the effectiveness as well as efficiency and of a procedure by establishing measurable goals and utilizing performance data to control the achievement of these goals (Rabiae & Aziz, 2018).

Continuous improvement will advance the effectiveness and efficiency of an organization. In which effectiveness referees to the extent to which planned activities are realized and planned results are achieved. And Efficiency is defined as the relationship between result achieved and resources used (Anup, et al., 2015). It must be noted that ISO 9001 requires businesses to obtain QMS efficiency through continuous enhancement as well as quality assurance activities. QMS performance is appealing, although not presently required by ISO 9001 (Anup, et al., 2015).

ISO 9004 provides guidelines which consider both the effectiveness as well as efficiency of the QMS. Quality improvement actions can include measuring as well as analyzing situations, establishing improvement objectives, looking for potential solutions, evaluating these remedies, implementing the selected remedy, verifying, measuring, and analyzing outcomes and formalizing the changes (Rabiae & Aziz, 2018).

2.3 Quality Management System

The Quality Management System (QMS) in construction industry describes quality planning, quality control, quality assurance (Mane & Patil, 2015). The primary objective of construction industry is usually to guarantee that building projects are successfully completed to the constraints of maximum quality, stated time and at least likely price. The study based on QMS suggested that construction companies must develop an adaptable and favorable organizational atmosphere which stimulates the improvement of quality management process in all elements of their work (Nitesh, 2014) .

The primary goal in implementing quality management system is enhancing product quality and constantly enhance a service. Quality Management System is among the key managements in construction industry. However, there are still doubts regarding the effectiveness of this system in construction industry (Shaari, et al., 2017).

Based on different authors (Abdullah, 2006; Abdul Hakim Mohammed, et al., 2006; Mane & Patil, 2015; Coffey, et al., 2011; Shaari, et al., 2017; ASQ, 2021; ISO 9001:2015, 2021) Quality management system (QMS) is described as "all tasks of the overall management feature which figure out the quality policy, responsibilities and goals, and apply them by means including quality planning, quality control, quality assurance as well as quality improvement within the quality system". Additionally, quality management system (QMS) is described as a formalized process which documents responsibilities, procedures, and processes for obtaining quality policies as well as goals. A QMS can help coordinate as well as manage an organization's activities to meet regulatory requirements and customer and enhance its efficiency and effectiveness on a consistent schedule (Lance & Coleman, 2021).

ISO 9001:2015, (2021), defined quality management system (QMS) as a set of policies, procedures as well as processes necessary for planning and execution in the core business area of an organization. QMS have uses in the construction industry and implemented often in the company or the project level (Daw, et al., 2016). The quality in the construction industry relates to client's satisfaction and the implementation of a quality management system is a vital instrument of reliably and consistently controlling the aim of customer satisfaction (Priya & Anu, 2018).

QMS is often referred to as Quality Control and Quality Assurance. Quality Control is engineering activities and monitoring, evaluating and following-up activities order to the terms that have been set is reached, while the term Quality Assurance means all planned and systematic actions applied, to reassure customers that the process of the work the contractor will meet the requirements (Rauzana, 2017).

2.3.1 Benefits of Quality Management System

Applying a quality management system affects every element of an organization's overall performance. The positives associated with a documented quality management system include meeting the customer's needs, which really helps to encourage trust in the business, subsequently triggering a lot more customers, more revenue, and more repeat business (Lance & Coleman, 2021). Some of these advantages could be measured using financial metrics like return-on-investment (ROI). Stanton (2020), study shows the typical QMS implementation yields 300 % ROI. The studies confirm that companies also achieve less easily measured returns. Most often a much better awareness of quality, happier customers, enhanced brand valuation, as well as much more consistent operation.

According to Low, et al., (1997); Keng & Kamal (2016), there are numerous advantages which could be attained by the contractors like; common language for communicating quality assurance, basic guideline for a company in any market to create an excellent management system, encourages final party auditing as well as certification, enhance customer confidence, enhance competition for greater quality services and products, reduces remedial costs. Keng and Kamal (2016), meanwhile classify the gains attained by construction industries in into two groups that are internal and external benefits.

1. Internal Benefits: Enhanced company communication, enhanced documentation, enhanced technique of working, enhanced quality of work accomplished, greater customer concentration, enhanced employee morale, enhanced performance appraisal and improved productivity and effectiveness (Keng & Kamal, 2016).
2. External Benefits: Access to local area market, far better competitive advantage, advanced quality of work accomplished, enhanced profitability, a chance to access overseas market, getting an invaluable advertising tool, enhanced customer satisfaction, enhanced supplier relations (Keng & Kamal, 2016).

These benefits provide extra advantages, such as defining, improving, and controlling procedures, reducing waste, avoiding errors, reducing expenses, facilitating, and determining

exercise opportunities, engaging employees, setting organization wide path, and talking a readiness to create results that are consistent (Lance & Coleman, 2021).

2.4 ISO 9000 Series Standards

The history of the ISO 9001 standard can trace its origins back to the 1950s with US and UK government departments establishing standards for military procurement. Many organizations that supplied government procurement agencies had to comply with a variety of quality assurance requirements for each contract awarded. This led the defense industry to adopt mutual recognition of NATO AQAP, MIL-Q and Def Stan standards. The first universally applicable quality management system standard was published in 1979 by the British Standards Institution. The ISO 9001 standard was developed by the International Standards Organization (ISO) to extend the reach of Quality Management to an international audience. The passage was agreed and adopted, and first published in 1987. The standard is regularly reviewed every 5 to 8 years by the ISO technical committee to ensure that it is relevant to the demands of global business, demonstrating its own continual improvement cycle (Spedan, 2018). The timeline below provides an overview of the history of ISO 9001 with the significant changes as shown in figure 1.

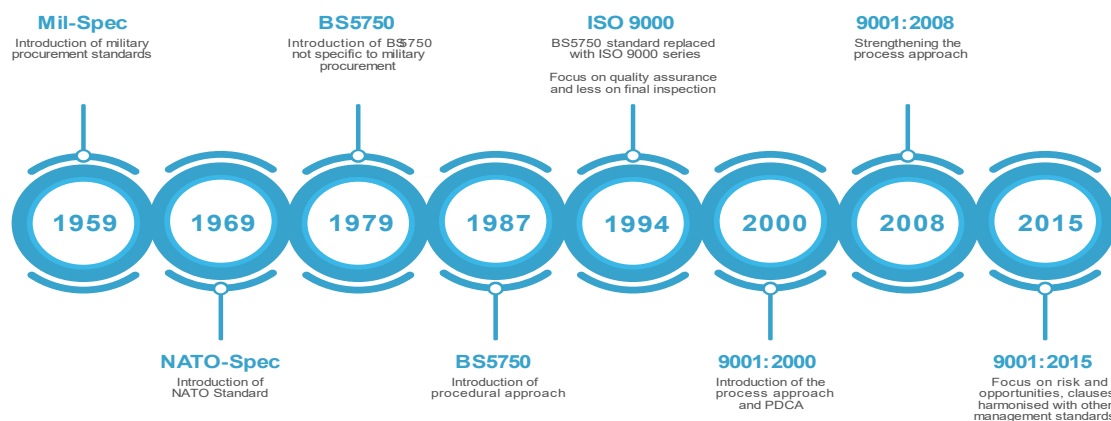


Figure 1 An overview of the history of ISO 9001 (Spedan, 2018)

The International Organization for Standardization (ISO) adopted the ISO 9000 series as being a standard for quality management system. It was primary launched in 1987 after which revised in 1994. These two versions are quality assurance standards. The goal of the ISO 9000 series is meeting a conformance standard format, instead of a performance standard. It all depends on creating the formal methods for all those that are involved. The series clarify the difference as well as inter-relationships with the primary quality principles and offer recommendations on quality system for both external and internal quality assurance purposes (Tang, et al., 2005).

Watson and Howarth, (2011), lists the reasons for adopting the ISO Series. The Standards are internationally recognized as well as acknowledged and, the sequence have quality assurance conditions that allow quality methods to produce. Additionally, the Standards provide confidence to clients by third party auditing and certification. These standards have been created to guide organizations of all sizes and types to implement and operate efficient quality management systems (ISO 9000:2005, 2005). Within this series of requirements, the ISO 9000 family features four standards that are found in the figure 1.

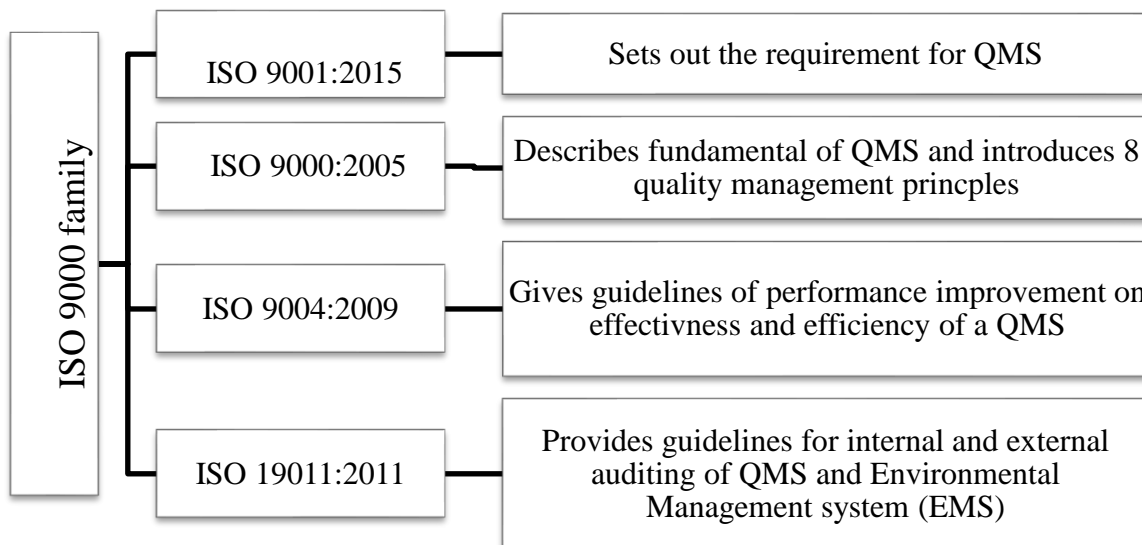


Figure 2 Family of ISO 9000 (ISO, 2021)

According to ISO 9001:2015 cited in Tang, et al., (2005), ISO 9001 is the most thorough quality assurance standard of all the series stated in above. ISO 9001 offers a set of standardized demands for a quality management system, no matter the user organization's business, sizing, or even whether it operates in private sector or the public. In the family of ISO requirements,

it is the only series which organization could be certified - though certification is not a compulsory necessity of the standard. The ISO 9001 standard is suitable for organizations that require an established pathway to follow to take a systematic approach to the management of processes, so that they can consistently produce goods and services to satisfy the expectations of their customers (Tezera, 2021).

2.4.1 Introduction to ISO 9001:2015

During World War II, the use of statistical methods in US defense contractor plants was mandated by the US Department of Defense. When the war ended and companies returned to producing goods for civilian use, there was no mandate to use these statistical methods and they fell into disuse. In the 1980s and 1990s business experts developed the concept of Quality Management Systems (QMS). The idea was that proper leadership, customer focus, continual improvement using a process approach, employee involvement, and fact-based decision making would lead to higher customer satisfaction and business success. By 1980s, national and international guidelines for effective Quality Management Systems (QMS) appeared. In the US, the Baldrige Award criteria went a step further in creating a competition among organizations. Award winners shared their strategies and very impressive results have been documented. In which the introduction of the Six Sigma approach has yielded enormous results in customer satisfaction and business success to project-by-project improvement. The Six Sigma approach is compatible with the ISO 9000 requirements and the Baldrige Award criteria. Due to the organizational structure of a Six Sigma company, the use of the statistical tools advocated by Deming. The techniques used in the DMAIC process are guaranteed to be consistent with Six Sigma (Lawson, 2021).

There are various countries, industries as well as governments all had varying quality devices which suppliers must follow to provide items across the globe. Currently, there are around sixty programs as well as awards which reward firms for enhancing quality globally (Aba, et al., 2015). There are many organizations that produce standards; some of the best known organizations in the quality field are the following; International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), American Society for Quality (ASQ), American National Standards Institute (ANSI), American Society for Testing

and Materials (ASTM), American Society of Mechanical Engineers (SME), American Society for Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), National Fire Protection Association (NFPA), Institute of Electrical and Electronic Engineers (IEEE), European Committee for Standardization (CEN), European Committee for Electrotechnical Standardization (CENELEC) and British Standards Institution (BSI) Standards produced by these organizations/institutes are recognized worldwide. These standards are referred in the contract documents by the designers to specify products or systems or services to be used in a project (Rumane, 2017).

The most well-known ones are the Total Quality Management (TQM), Malcolm Baldrige, Six Sigma, and ISO. A global standard was essential to simplify international standards. This gave rise to ISO - the International Organization for Standardization (Tezera, 2021). ISO 9001:2015 outlines a framework for improving satisfactory of expertise for any organization trying to offer products and services that constantly meet the necessities and expectancies of clients and other relevant interested parties. The QMS is the combination of all the strategies, resources, assets, and cultural values that guide the purpose of purchaser satisfaction and organizational efficiency (ISO, 2019).

According to Christopher (2018); Brookes (2020), the ISO 9001 quality management standard format continues to be applied by over one million organizations in more than 187 nations after the launch of its in 1987. ISO 9001 sets out the requirements for a quality management system and can be used by any business, small or large, no matter the field of its activity.

Tezera (2021), presents how the ISO 9001 worldwide acceptance is increasing, which implies that companies are benefiting from their ISO 9001 certification. China is having the highest ISO 9001 certificates i.e., 383,869 certificates followed by Italy (97,771), Germany (60,480), Japan (45,318), and Spain (35,088). According to ISO 2019 survey the world's highest-ranking economies in Gross Domestic Product (GDP) per capital, we can say that one of the reasons for their highest performance in their economies is having countless number of certificates in ISO 9001 which improved their performance.

According to ISO survey 2019, construction sector is ranked fourth out of 39th sectors. Ethiopia currently certifies ISO 9001 in 18th sectors out of the 39th. Ethiopia has forty-eight certificates

in 18 sectors and ranked 132 out of 191 countries in the world and five out of 9 countries in East Africa respectively in number of total certificates issued in ISO 9001. These indicate that Ethiopia has less ISO 9001 certificates which may contribute to the low economic development of the country and to the low competitiveness of its products and services in international market (Tezera, 2021).

2.4.1.1 Difference between ISO 9001:2008 and 2015

The ISO 2008 edition did not present significant changes compared with 2000 edition, and consequently does not involve the re writing of quality files to fit the newest version. The ISO 9001 standard is a generic one, that may be used in construction companies and on the tasks of theirs, although each project is different & calls for various suppliers and sub-contractors. ISO 9001 does not specify exactly what the objectives associated with "quality" or "meeting consumer needs" must be. Rather, it calls for organizations to define these goals themselves and continuously improve the operations of theirs to reach them (Neyestani, 2016). Table 1 shows the clause requirements for each ISO 9001 2008 & 2015.

Table 1 Comparison between the clauses of ISO 9001:2008 & 2015 (Neyestani, 2016)

Clause	ISO 9001:2008	ISO 9001:2015
1	Scope	Scope
2	Normative references	Normative references
3	Terms and definitions	Terms and definitions
4	Quality Management System	Context (Environment) of the organization
5	Management Responsibility	Leadership
6	Resource Management	Planning
7	Product Realization	Support
8	Measurement, Analysis, and Improvement	Operation
9	-	Evaluation
10	-	Improvement

Accordingly, ISO 9001: 2008 also as 2015 both are based on process approach. The intention of the process approach is growing an organization's effectiveness as well as efficiency for accomplishing its defined objectives in addition to customer's satisfaction. Moreover, it can assist the businesses to control the linkages between procedures and the interfaces between the purposeful hierarchies of the organization. ISO 9001:2008 also as 2015 have around the same requirements. The first three clauses of ISO 9001:2008 as well as 2015 are not appropriate in process approach, these clauses just create a bit of essential information applicable to the needs of QMS implementation (Neyestani, 2016). Table 2 shows the main changes within the ISO 9001:2015 in comparison with ISO 9001:2008 in relation to the P-D-C-A cycle.

*Table 2 The interpretation of PDCA methodology in ISO 9001:2008 & 2015
 (Neyestani,2016)*

	Plan	Do	Check	Act
ISO 9001:2008	Set the goals as well as tasks necessary to provide results in accordance with client specifications as well as the organization's policies.	Implement the processes.	Monitor as well as product and measure processes against policies, demands and objectives for the item and report the results.	Take actions to continually improve process performance.
ISO 9001:2015	Set the objectives of the system and processes to provide results.	Implement and control what was planned	Monitor as well as measure processes as well as results against policies, requirements and objectives and report results.	Take actions to improve processes performance

The primary modifications inside the ISO 9001:2015 in comparison with ISO 9001:2008 are a necessity for risk based thinking to knowing much better process approach; a lesser amount

of focus on documents, along with much less prescribed needs; increased focus on organizational context; improved leadership needs, and also; higher focus on obtaining desired results to boost consumer satisfaction (Neyestani, 2016).

2.4.2 Principles of ISO 9001:2015

Based on ISO 2015 cited in Neyestani (2016), Quality management principles are a set of basic beliefs, rules, norms, and values which are accepted as genuine and may be utilized as a foundation for quality management. ISO 9001:2015 and associated quality management standards are derived from 7 quality management principles. These concepts may be used by groups as a framework to enhance performance. Figure two shows the 7 principles of quality management system.

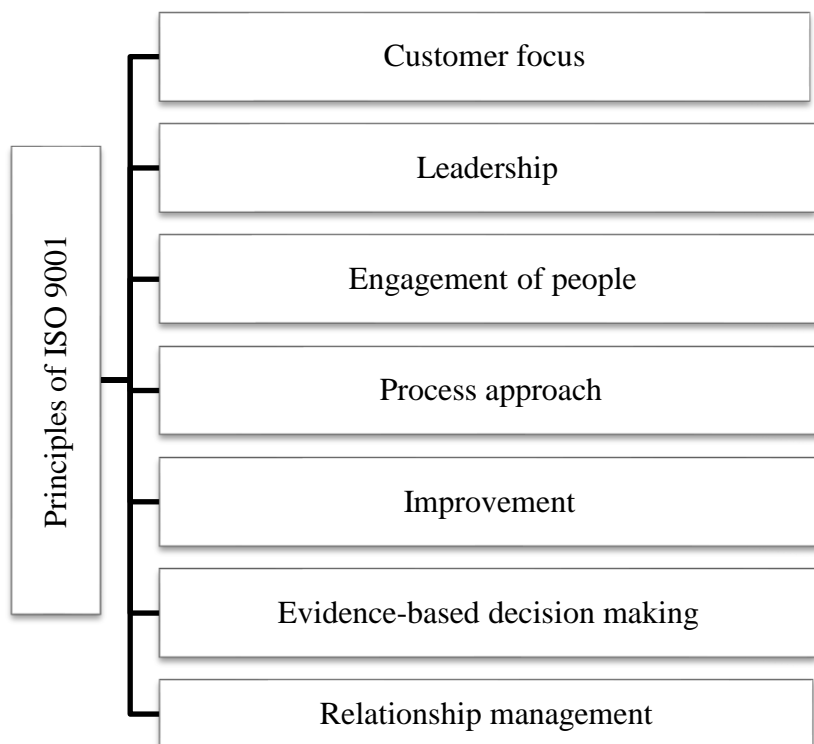


Figure 3 Quality management system principles (ISO, 2015)

The ISO 9000, ISO 9001, and associated ISO quality management standards are derived from seven quality management concepts (QMPs). The achievement of those QMPs, is crucial for the effective and efficient management of any business globally (ISO, 2021) .These principles

have become the strategic grounds for all choices associated with quality management in the organization and are infused in almost all elements of the ISO 9001:2015. Every organization is going to prioritize each principle in an alternative way at various stages of the development of theirs (Seland, 2019).

2.4.2.1 Customer Focus

Customer focus means exceeding consumer expectations and giving value and pleasure with every consumer interaction. It takes a company to link every company objective to customer needs and also to understand that customers are the ones that have both indirect and direct relationships with a company (Seland, 2019). Therefore, there is an ongoing need to identify aspects of quality in each industry and measure customer satisfaction against relevant aspects of quality to improve the organization's processes (Sharabi, 2015). According to Ekpenyong, (2016) total customer satisfaction is the goal of entire system. The goal of the construction companies is to handover the projects that meet the needs of the customer.

The focus of quality management is meeting customer demands and to try to exceed customer expectations. Sustained satisfactory results is achieved when a company attracts as well as retains the confidence of clients along with other interested parties (Tezera, 2021). Every issue of customer interaction offers a chance to generate more value for the customer. Understanding future and current requirements of clients along with other interested people contributes to sustained satisfactory results of the organization (ISO 9000:2015, 2021). Improved consumer value; Increased customer satisfaction; Improved customer loyalty; Enhanced repeat business; Enhanced status of the organization; Expanded customer base; Increased revenue as well as market share have become the crucial advantages (ISO, 2015).

2.4.2.2 Leadership

Leaders in all levels establish unity of direction and purpose and create conditions where individuals are interested in attaining the organization's quality goals. Development of unity of purpose as well as engagement and direction of individuals allow a company to align the methods of its, processes, policies, and information to achieve its goals (Tezera, 2021). Enhanced efficiency and effectiveness for meeting the organization's quality objectives; better

control of the organization's processes; enhanced interaction between features and amounts of the organization; improvement and development of the ability of the business and the individuals of its to provide desired outcomes will be the key benefits (ISO, 2015).

2.4.2.3 Engagement of people

Competent, empowered as well as engaged individuals in all levels through the company are vital to improve the capability of the organization to develop as well as provide value. To manage a company efficiently and effectively, it is essential to involve all individuals at all levels and to respect them as people. Recognition, empowerment, and enhancement of competence facilitate the engagement of individuals in obtaining the organization's quality goals (Tezera, 2021). Enhanced understanding of the organization's quality goals by individuals in the organization and also improved motivation to attain them; enhanced participation of individuals in improvement activities; enhanced personal development, initiatives, along with creativity; enhanced individuals satisfaction; enhanced cooperation and loyalty through the entire business; Increased focus on shared values as well as lifestyle through the entire company will be the key benefits (ISO, 2015).

2.4.2.4 Process approach

Predictable and consistent outcomes are attained better as well as effectively when tasks are understood and managed as interrelated tasks which perform like a coherent system. The quality management process consists of interrelated procedures. Finding out how outcomes are made by this product allows a company to enhance the device as well as its performance (Tezera, 2021). Reduced costs as well as shorter cycle times, through the real utilization of information; enhanced, predictable and consistent outcomes; concentrated as well as prioritized advancement opportunities; systematically defining the activities required to attain a preferred result; creating clear accountability and responsibility for dealing with main tasks; calculating and examining the ability of crucial activities; determining the interfaces of key tasks within & between the features of the building business; concentrating on things like resources, strategies in addition to supplies which will enhance important tasks of the construction organization; evaluating risks, impacts and consequences of tasks on customers, vendors along with other interested people and also controlling appropriately are the primary key benefits (ISO, 2015).

2.4.2.5 Improvement

Successful businesses provide a continuing focus on improvement. Improvement is crucial for a company to keep today's levels of effectiveness, to respond to changes in its external and internal problems and to produce fresh opportunities (Tezera, 2021). Improved procedure efficiency, organizational features, and client satisfaction; enhanced target on root cause exploration as well as dedication, followed by corrective actions and avoidance; enhanced ability to count on as well as respond to external and internal opportunities and risks; enhanced factor of both incremental plus cutting edge enhancement; improved usage of learning for development; enhanced drive for innovation will be the key benefits (ISO, 2015).

2.4.2.6 Evidence-based decision making

Decisions depending on the analysis as well as evaluation of data as well as information tend to be more appropriate to produce desired outcomes. Decision making could be a complicated process, and yes it often involves uncertainty. It usually involves multiple sources and types of inputs, in addition to the interpretation, which may be subjective (Tezera, 2021). It is essential to recognize cause-and-effect relations and possible unintended consequences. Facts, evidence along with information analysis led to greater confidence and objectivity in decision making. Improved decision-making processes; improved assessment of procedure performance as well as power to attain objectives; improved functional efficiency and effectiveness; increased capacity to discuss, challenge as well as alter decisions and views; increased ability to exhibit the usefulness of previous choices will be the key benefits (ISO, 2015).

2.4.2.7 Relationship management

According to the publication prepared by International Organization for Standardization, (ISO Central Secretariat ,2015, as cited in Meretu,2021), for sustained achievement, a company manages the relationships with interested parties, like suppliers. Interested parties influence the functionality of a company. Sustained achievement is much more appropriate to be attained once the company manages interactions with all its interested people to enhance the impact of theirs on the overall performance. Relationship management with the dealer of its and partner networks is of specific value. Enhanced functionality of the business and the interested parties

by answering the chances as well as restrictions associated with each interested party; common understanding of values and goals among interested people; increased capability to produce value for interested people by discussing competence and information and also controlling quality related risks; a well-managed supply chain which offers a healthy flow of products plus services will be the key benefits (ISO, 2015).

2.4.3 Requirements and Elements of ISO 9001:2015

The QMS demands specified in ISO 9001 are complementary to demands for product. The regular sets demand for organization's QMS, while demands for product come from regulatory authorities and clients (Malkawi, 2016). ISO 9001:2008 standard can be utilized by external and internal parties, which includes certification bodies, to evaluate an organization's potential to satisfy the, regulatory, and customer organization's own requirements (APB Consultant, 2021). One of the most apparent distinction between the 9001:2008 and the 9001:2015 standard is the clause structure. ISO 9001:2008 has eight clauses (Clauses 4-8 are requirements) whereas ISO 9001:2015 has ten (Clauses 4-10 are requirements). ISO 9001 states the necessities for the organization Quality Management System (QMS). There are ten sections (clauses) in ISO 9001, with extra sub clauses associated to the Plan-Do-Check-Act system. However, solely sections 4-10 incorporate requirements that are auditable. To effectively implement ISO 9001:2015 within the organization, you need to satisfy the requirements within clauses 4-10 alongside with gathering customer and relevant statutory and regulatory requirements (ISO 9001:2015, 2021).

Plan-Do-Check-Act (PDCA) is the operating principle of ISO 9001. Organizations apply it to all processes and the QMS (Ekpenyong, 2016). Figure 3 shows how clauses 4 to 10 of ISO 9001 can be categorised in relation to PDCA.

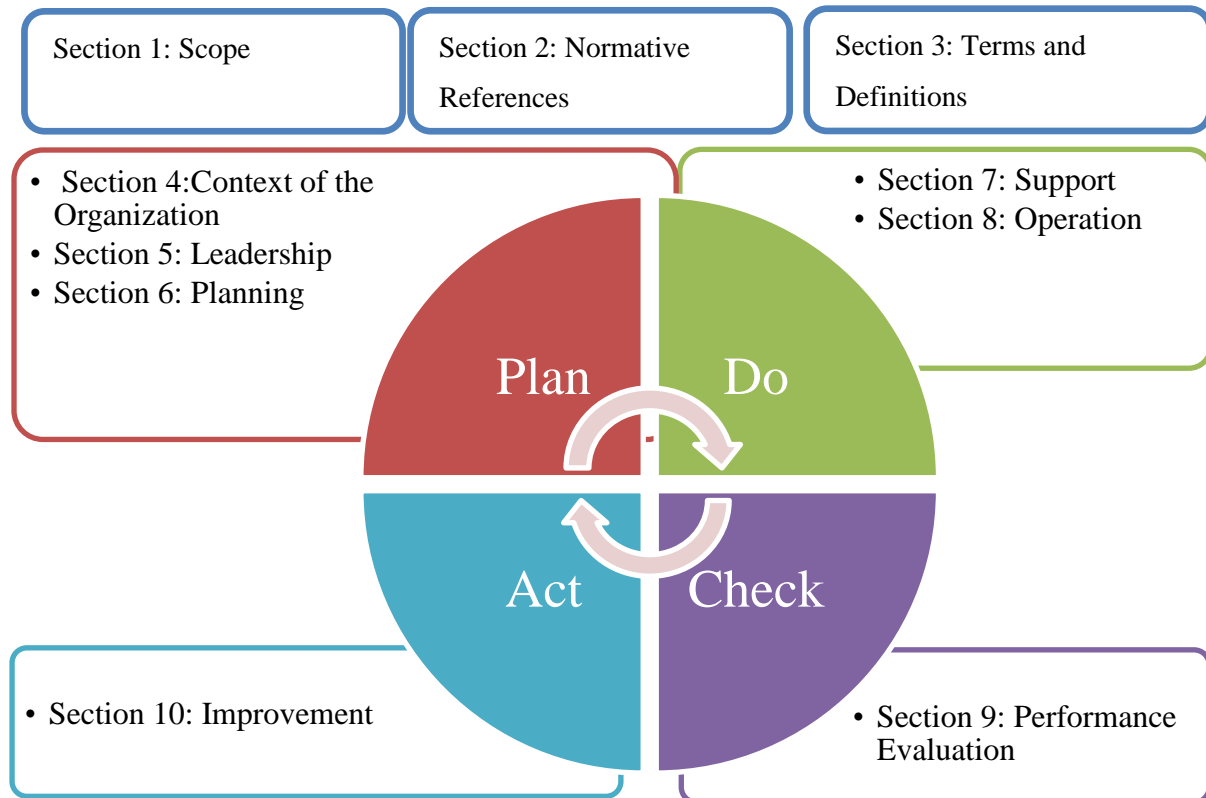


Figure 4 Structure of QMS applied to PDCA cycle (ISO 9001:2015, 2021)

According to ISO 9001:2008, (2021) PLAN-DO-CHECK-ACT (PDCA) - is a useful tool for construction management and the ISO 9001 standards highly recommends the use. PDCA is a powerful cycle which may be put on to any type of organization's procedures, and towards the system of processes. It may be utilized to plan, control, implement, and continuously improve both product realization along with other QMS processes. Continual enhancement and maintenance of QMS procedures could be accomplished by applying PDCA to operations in all levels within organization (ISO 9001:2015, 2021).

- **Plan:** Establish the goals as well as tasks necessary to provide results in accordance with client requirements as well as the organization's policies (ISO 9000:2015, 2021).
- **Do:** Implement the processes

- **"Check:** Monitor as well as product and check processes against policies, demands and objectives for the product and report the results (APB Consultant, 2021).
- **Act:** Take actions to continually improve process performance ISO 9001 specifies requirements for a quality management system that can be used for internal application by organizations, or for certification, or for contractual purposes. It focuses on the effectiveness of the quality management system in meeting customer requirements (ISO 9000:2015, 2021).

ISO 9001:2015 specifies requirements to prepare, review, monitor, operate, implement, establish, maintain & continuously improve a documented management device utilized to control quality. The requirements established in ISO 9001:2015 are useful, flexible, and generic to other kinds of organizations. Consequently, this ISO Management System Standard could be aimed as well as incorporated with other Management Systems because of their related structure. ISO 9001:2015 is the first quality management standard to be fully compliant with the new guidelines from Annex SL (“High level structure and identical text for management system standards and common core management system terms and definitions”) (Christopher, 2018).

It's been created in reaction to requirements users' critics that, while present standards have a lot of typical elements, they're not adequately aligned, making it hard for businesses to rationalize the methods of theirs and to interface an incorporate them (Rene, et al., 2020).

2.4.3.1 Elements of ISO 9001:2015

The nine core elements of a QMS must consist of quality objectives, data management, organizational responsibilities, quality manual, and various other practices (Kelderman, 2020). Depending on the seven ISO principles, nine elements are already created by the International Organization for standardization. Organizations should adopt an inter-disciplinary series of quality controls to attain these principles. The elements relate to quality capabilities necessary for each component which are crucial for the organization quality improvement (Willar, 2012). The elements are and quality functions are summarized in Table 3.

Table 3 Summary of the nine elements of ISO 9001 standards (Willar, 2012)

No.	ISO 9001:2015 Elements	
1	Quality objectives	<ul style="list-style-type: none"> • Management defines quality policy with a strategic goal
2	Quality manual	<ul style="list-style-type: none"> • Describe the scope of the QMS • Detail the requirements of the QMS standard or framework • List elements of the QMS that are excluded from the implementation • Reference specific quality procedures used within the organization • Provide visual documentation of critical processes via flowchart • Explain the organization’s quality policies and objectives
3	Organizational structure & responsibilities	<ul style="list-style-type: none"> • Clear and updated type of the organization's responsibilities and structure of all people within the business (Kelderman, 2020).
4	Data management	<ul style="list-style-type: none"> • Consistent product quality, operating efficiencies, compliance risks, customer satisfaction, and profitability.
5	Processes	<ul style="list-style-type: none"> • Identify organizational processes • Define process standards and corrective action if any • Establish methods for measuring continuous improvement • Document a standardized approach to ensuring quality output • Drive continual improvement
6	Customer satisfaction with product quality	<ul style="list-style-type: none"> • Satisfaction Surveys • Complaints Procedures • Analytical Applications to measure satisfaction trends • Management Review of customer satisfaction
7	Continuous improvement	<ul style="list-style-type: none"> • Quality Planning Procedures • Compliance Requirements • Safety Design • Risk-based Thinking • Corrective Action • Gradual and Breakthrough Improvement • Innovation • Assessment of the QMS

8	Quality instruments	<ul style="list-style-type: none"> • Intervals for instrument calibration • Recognized Standards for instrument calibration • Manufacturer Instructions for adjustment • Procedures for identifying and documenting calibration • Controls against tampering or adjustment post-calibration • Methods to protect instruments and equipment from damage
9	Document control	<ul style="list-style-type: none"> • Management charts, other method and charts of analysis figure out how effectively a procedure is working as well as facilitate continuous improvement • Review and approve documents prior to issue • Review and approve document changes prior to issue • Control distribution and updating of document • Communications, evidence, QMS conformity and knowledge sharing

2.4.4 Implementation of ISO 9001:2015

Prado-roman, et al., (2018); Harris & McCaffer (2001), concluded that ISO 9001 yields positive benefits for organizations. These studies have consistently shown it is not sufficient to formally implement ISO 9001 simply to stay within the trend or even improve the organization's image. The standard must be effectively implemented in parallel with the internal development of basic quality management principles such as the systematization of processes, continuous improvement, involvement of the entire organization and customer focus (Prado-roman, et al., 2018).

Studies conducted by Low, et al., (1997); Keng & Kamal (2016); Manders (2015); Rauzana (2015), have classified the positive outcomes from implementing ISO 9001 in two groups: internal aspects (Enhanced company communication, improved documentation, improved method of working, improved quality of work done, greater client focus, improved employee morale, improved performance appraisal and increased efficiency and productivity) and external aspects (Improved profitability, access to overseas market, having a valuable marketing tool, improved client satisfaction, improved supplier relations).

The setup of any QMS must be a strategic choice of the company applying QMS. A range of factors influence the layout as well as implementation of QMS (Keng & Kamal, 2016). These

include - requirements as well as opportunities of organizations; objectives and goals; complexity of services and products provided; quantity of & complexity of procedures employed; and structure and size of the business. Because of these along with other fundamental elements, the ISO 9001 standard does not call for uniformity of QMS framework or documentation (Malkawi, 2016).

There is no quick step-by-step for implementing ISO 9001 according to ISO 9001 into any other serious standard. but there are too many steps to do and to go through thoroughly making the implementation process complicated. The implementation of a formal management system is best managed as a specific project with a professional project manager, who should be a key member of the organization's management team and having sufficient authority and trust of the personnel involved. In the ideal situation this person will also be the Management Representative, but skills in project management are essential. It is important that none of the stages in the flow chart are omitted. The existing system of management and working practices must be known in detail before the framework of the formal QMS-documentation can be designed. The system is best designed around existing processes as the development of new systems that require additional resources may simply delay the implementation process (Purushothama, 2015).

Figure 4 shows the total flow chart for the implementation of the QMS. The total implementation process for QMS takes fourteen steps below shows the step. There are checklists provided in each stage before proceeding in the next step and the detail requirements for each stage is attached in the appendix A.

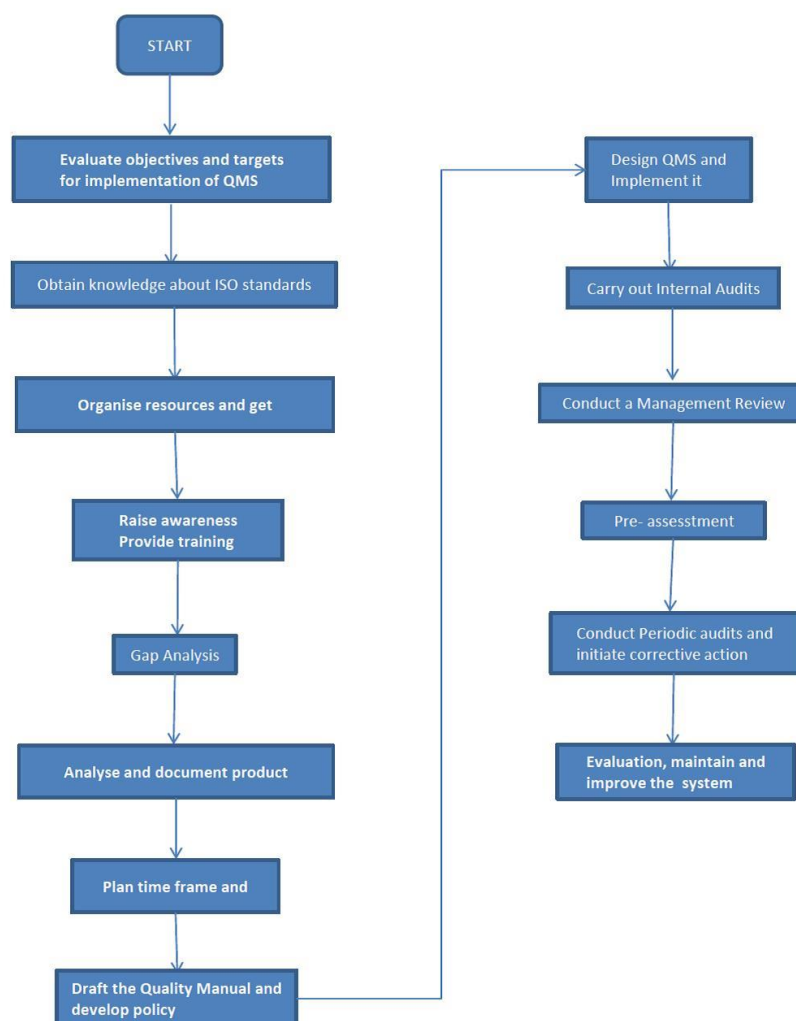


Figure 5 QMS Implementation flow chart (APB Consultant, 2021)

2.5 Effective QMS in ISO 9001:2015

The International Standards encourages the adoption of a process approach when developing, implementing, and enhancing the usefulness of quality management system, to improve consumer satisfaction by fulfilling consumer demands. Understanding & meaning interrelated process as a method plays a role in the organization's efficiency and effectiveness for achieving its intended result (Aba & Badar, 2013).

The primary goal of ISO 9001 is providing trust in the organization's potential to constantly provide clients with conforming services as well as products. ISO 9001:2015 introduces Risk

Based Thinking like an organized approach to risk that ought to be integrated through the entirety of the QMS, instead of treating risk as a single element. This forces to become initiative-taking instead of reactive which encourages continual improvement. In earlier revisions of ISO 9001 preventive activity became a standalone clause inside the standard format (ISO 9001:2015, 2021).

To conform to the demands of International Standards, a company must plan and implement action to deal with opportunities and risk. Addressing both opportunities and danger establishes a foundation for boosting the usefulness of the quality management process, achieving enhanced result, and avoiding unwanted effects. Opportunities can come up due to a scenario favorable to attaining a planned consequence, for instance, a set of situations which enable the organization to draw in customers, create services & items brand new, reduce waste, or perhaps boost efficiency (Wang, 2001). Action to address opportunities also can include consideration of related risks. Danger will be the outcome or uncertainty, and such uncertainty is able to have negative or positive consequences. A beneficial deviation arising from a threat can provide an opportunity, although not all results of risk lead to opportunities (ISO 9000:2015, 2021). A construction contractor normally has three quality documents for running a quality management system (Patel & Pitroda, 2021). The three quality documents are as follows (Tang, et al., 2005).

2.5.1 Quality Manual

This is a company-wide document setting out the overall quality policies, procedures, and practices of the organization (Patel & Pitroda, 2021). A quality manual usually comprises; company policy statement which includes a statement, a summary of activities undertaken and the firm's policy objectives towards implementing a quality system in accordance with the requirements of a standard; General statement to amplify the company's commitment to implementing a quality system ; Amendment re-issue and distribution ; Authority and responsibility included in the firm's organization and ; Summary of different procedures (Tang, et al., 2005).

2.5.2 Quality Procedures

These are documents describing the tasks concerned in doing business that are vital to the achievement of quality, e.g., directions to create concrete would call for a quality process. They are method statements which relate to relevant specification documents (Patel & Pitroda, 2021). The quality procedures include the following: Scope and purpose of the procedures; Sequence of actions; Persons responsible in the execution of duties and for ensuring that requirements are met; Remedial actions if non-conformance is detected. In preparing the quality procedures, the construction firm should already have in-house procedures in controlling its work. Therefore, a substantial part of the preparation of the quality documents entails collecting, documenting, and systematizing existing procedures, instructions, and practices. The quality documents should be based on the existing practices if they are following the established policies (Tang, et al., 2005).

2.5.3 Quality Plan

The quality manual and the quality procedures are applicable to the entire company, while a quality plan is applicable only to a particular project (or a construction contract) undertaken by the organization (Patel & Pitroda, 2021). Therefore, there can be quality plans for a company, depending on the number of individual projects it is undertaking (Tang, et al., 2005). A quality strategy is the document produced from the quality system setting out the particular quality methods, resources, plus activities applicable to a specific task or contract agreement (Patel & Pitroda, 2021). Normally, a quality plan comprises an organization's quality manual, the relevant standard quality procedures, and any additional specific quality procedures (Tang, et al., 2005).

The ISO 9000 quality management system demands instructions which contains a quality manual along with quality procedures, and work directions as well as quality records. All information should be managed based on a document control procedure. The framework of the quality management process depends mostly on the management system in the organization (Rumane, 2017). The effectiveness of QMS can be summarized as illustrated in figure 5.

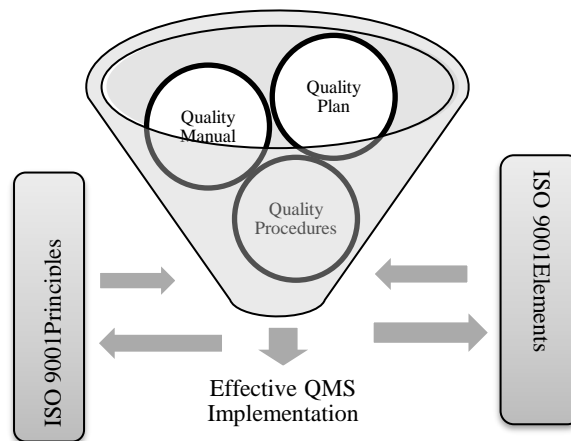


Figure 6 An effective company’s QMS complies with ISO 9001 principles and elements
 (Willar, 2012)

2.6 Benefits of Effective QMS in Construction

Effective QMS implementation has benefits that can contribute to all interested parties as shown in table below.

Table 4 Benefits of Effective QMS in Interested Parties (Abuhav, 2016)

	Interested Party	Benefits achieved by meeting their needs and expectations
1	Customers	Improve customer satisfaction, Delivery of quality, price, and performance of products according to specifications and, Appropriate communication channels with the organization.
2	Owners/shareholders	Increased revenue and market share, Sustained profitability, Flexible and fast responses to market opportunities and, Evaluation of risks and opportunities
3	Employees of the organization	A clear job description, good working environment, Appreciation and rewards and, Personnel competency development and improvement (training)
4	Suppliers and partners	Appropriate communication channels between the organization and the supplier, Provision of resources, Mutual benefits and continuity, sticking to payment conditions and, Handling of property belonging to external providers
5	Society in which the organization is active	Environmental protection, Ethical behavior and, Delivering product in accordance with the social, economic, and local cultural aspects.
6	Regulators	Compliance with statutory and regulatory requirements, and, Understanding the labor market and its effect on the loyalty of people in the organization

Effective implementation of a quality management system (QMS), and adopting quality values, by virtue of operating a QMS ISO 9001:2015, potentially provides benefits that are needed, even in the most competitive construction environments (Willar, 2012). Table 4 summarizes the potential benefits of ISO 9001 deployment for construction companies.

Table 5 Benefits of Applying ISO in Construction Companies

Area of Improvement	Benefits of ISO 9001	Sources
Project Quality	<ul style="list-style-type: none"> • Project scope can match with the task proposal as well as compliance with contract specifications • Quality assessment and control framework • Product defect rate decreases • Product and service quality improvement • Quality incentive system; motivation for quality improvement • Quality training/ meetings 	(Watson & Howarth, 2011; Neyestani, 2016; Willar, 2012)
Project cost	<ul style="list-style-type: none"> • Budget and cash flow management • Reduce cost of rework • Increased return on investment (ROI) and profit can be caused by reduction of cost • Improved resources consumption • Optimizing performance can lower expenses by effective process management as well as resources • Lower production costs • A well-managed supply chain can reduce expenses 	(Watson & Howarth, 2011; Neyestani, 2016; Willar, 2012)
Project time	<ul style="list-style-type: none"> • Meeting proposed implementation timeliness with actual timeliness of the task completion • Improved project delivery time • Ability to help as well as solve issues of the project completion • Reduction of delay because of turn over and rework • More reliable construction project scheduling and delivery • Documented methods are easier for the staff to check out toward reduction time 	(Watson & Howarth, 2011; Neyestani, 2016; Willar, 2012)

Customer Satisfaction	<ul style="list-style-type: none"> • Number of disputes/claims has been reduced • Number of reworks has been reduced • Less number of defects • Information coordination; improved customers relationship, communication, and reporting • Improved quality of product 	(Ahmed , et al., 2005; Watson & Howarth, 2011; Willar, 2012)
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2.7 Construction Quality Management System Practice in Ethiopia

Ethiopia’s economy was the fastest growing in East Africa in the construction industry. From 2007/08 to 2017/18 the country registered an average growth of 10% compared to a regional average of 5.4% (Team, 2020). The results of a study on quality in construction by the Federation Internationale des Ingenieurs-Conseils (FIDIC), has clearly indicated that the failure in construction quality is a major issue worldwide. In the light of such reports and to attract customers, ISO certification has become a trend in most industries including construction industry (Anup, et al., 2015; Willar, 2012; Rumane, 2017).

According to the results of ISO 2020 survey, there are more than a million companies and organizations in over 191 countries that are ISO 9001 certified. And from the five main sectors in ISO 9001 certifications, construction around the world is ranked in fourth place with a total number of 71,097 which makes ISO 9001 one of the most widely used management tools in today’s world. From which Ethiopia has 264 certificates in eighteen sectors. That places Ethiopia 132 of 191 international countries in the world and fifth out of the nine countries of East Africa, respectively in number of total certificates issued in ISO 9001. These indicate that Ethiopia has ISO 9001 certificates that could also make contributions to the low economic development of the country and to the low competitiveness of its products and services in international market (Tezera, 2021).

According to Yohannes (2020), ISO 9001 certified construction companies in Addis Ababa have not gotten tangible benefit. The main reason for failure is that construction companies do not give emphasis to internal benefits of the standard such as process efficiency and effectiveness, inadequate training, inadequate motivation etc. In addition to this, the support and encouragement of governmental bodies to certified companies lacks continuity. The top

main challenges that certified companies faced during ISO implementation are change resistance, inconsistency in implementing QMS and Turnover.

Another study by Selamawit (2019), shows that the performance of Ethiopian consultants with respect to effective implementation of ISO QMS is poor. It is due to lack of adequate knowledge on activities to make the system effective, the difficulty to interpret the standard requirement, lack of top management commitment and engagement of employees, lack of technical expertise to establish and control the implementation of the system, lack of intensive internal audit, and lack of exhaustive surveillance audit made by the certification agent. And showed that the involvement of construction consultants in the country on QMS is negligible. From the total number of 350 consultants less than 3% of construction consultants have been certified for the system. And her analysis from the data she collected shows that QMS benefits are not clearly understood by the consultants. Yohannes (2020), attempted to examine the construction practices in relation to quality management among four grades of building contractors in Addis Ababa. The findings outline: Trainings and inductions related to quality management system are highly given in Grade 1 construction companies (41.3%) as compared to the other three contractor grades. Basing on the ISO 9001:2015 data the seven quality management principles: customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision making, and relationship management were considered as the control variables.

2.8 Construction Quality Management System Practice in Other Countries

Ahmed, et al., (2005), has done a comparative analysis of quality management system in the construction industries involving USA and Hong Kong construction businesses. That provides practical and useful insights to the differences as well as similarities of this two countries construction industries. Thus, the cause the study suggests that various perceptions towards the implementation of proper quality management system been around between the two locations. Generally, because of the lack of promotion and effort from equally governments and customers, construction companies in the USA have failed to find out the desire to get the ISO 9000 certification. In Hong Kong, nonetheless, the government's initiatives have generated a highest percent of organizations having certified on the ISO 9000 standards. That also suggest

that, although organizations utilized various resources for quality measurements, such measurements had been primarily for checking and for capturing purposes (Ahmed, et al., 2005).

According to Tang, et., al., (2005), in the UK construction industry, the development of ISO 9000 has been considered a continuation of its pre-successor the BS5750 Quality Systems. Since BS5750 was written primarily to meet the needs of the manufacturing industry, there has been an on-going debate as to the suitability of ISO 9000 to the unique conditions of the construction industry. A survey was conducted by Shamma-Toma et al. (1996), to examine the implementation of ISO 9000 in the UK construction industry from the viewpoint of the experiences and perceptions of quality assurance managers. The results of the survey indicated that client demand was the main reason for the adoption of QA systems by construction firms, rather than a belief in the value of such systems. Most managers confirmed that this client demand was by no means universal or mandatory. Other reasons such as marketing advantage and competitive edge were also reported.

One of the major impacts of the ISO certification was the raising of consciousness on quality issues among the top management. In contrast, site employees were not so keen on the implementation of ISO 9000 because of their lack of education and training. While most companies had inevitably experienced increases in paperwork and administrative cost, the majority agreed that the ISO 9000 standards had formed the basis for an efficient quality management system in the construction industry and had also provided the foundation and consciousness for a future move to TQM (Moatazed-Keivani, et al., 1999).

Chini and Valdez (2003), also conducted a survey in the United States. Entering the international market and meeting customer requirements was the main motivation for certification. Therefore, it is not surprising that the most frequently mentioned benefit is gaining a competitive advantage and using ISO 9000 as a marketing tool. The research shows that, the most common difficulties encountered was related to documentation and the development of the quality manual. As a comparison a survey of construction firms not certified for ISO 9000 was also conducted simultaneously in the study. From this, it concluded

that ISO 9000 is an appropriate and effective tool for construction firms in the United States, although obstacles affect its implementation and acceptance among construction organizations.

Looking at the Hong Kong construction industry before the 1990s, the quality of construction projects was based on traditional quality control (QC) methods, but today, the customers of the Hong Kong construction industry have managed to get their contractors to obtain ISO 9000 certification. Although they experienced benefits after the implementation of the quality system Lau & Tang (2009), research shows that they still face problems and difficulties (Ahmed et al. 2005). Unsurprisingly, most studies have reached the same conclusion: customer drive is the main motivation for certification. Lau & Tang (2009), reported on the most important benefits of certification, such as clearer workflows, better documentation, and competitive advantages. Kumaraswamy and Dissanayaka (2000), conducted another survey to examine the positive and negative results of ISO 9000 certification from the contractor's perspective. The two most common negative results are more paperwork and more management time; the two main positive results are system record keeping and improve internal communication.

A study conducted in Indonesia showed that not all ISO 9000 principles have not yet been fully implemented, and that certain important Key Performance Indicators (KPIs), namely, innovation and new product development, were initially at an unsatisfactory performance level. Global market contract capability is also at an exceptionally low performance level. However, the research shows that high performance KPIs are related to providing quality services and products, improving profitability, increasing sales and market share, developing sustainable building products, and employee satisfaction. The study also conducted statistical tests on the relationship between QMS ISO 9000 principles and KPIs variables. The results show that these two variables have a positive correlation, so a higher value of the QMS principle appears to increase the value of KPI (Coffey, et al., 2011).

A study conducted in Malaysia also found that there is a positive correlation between the implementation of management responsibilities and the business performance of Malaysian contractors. This also means that better implementation of management responsibilities under the ISO 9000: 2000 quality management system will be a better business performance for contractors. At this point, it must be emphasized that despite attempts to establish a link

between management responsibility and company performance, the study was unable to establish this link at all due to the insufficient number of ISO 9000 certified companies in the totality. This research has a fundamental contribution to scientific and practical significance. As a theoretical contribution, it reinforces previous knowledge about how the role of management responsibility can improve company business performance. On the other hand, this research also contributes to the practical aspect, i.e. In other words, provide contractors with in-depth understanding of the implementation of better senior management roles and provide tools to measure their business performance (Said et al., 2006).

The results of the research conducted in Malaysia indicate that the quality management of construction projects in Malaysia needs to be strengthened, and the problems existing in the implementation of quality management need to be paid attention to and further studied. ISO certification is a trend in most industries today, including the construction industry. The application of ISO standards has received extensive attention from researchers (Keng & Abdul-Rahman, 2011). Tan & Abdul-Rahman (2011), believe that the ISO 9000 series of standards can and have formed the basis of an efficient and beneficial quality management system in the construction industry.

Research conducted in Malaysia shows that ISO registration is used for marketing purposes; Implementation of quality management is strongly regarded as a mean to fulfilling contractual obligations rather than satisfying customer needs; in terms of quality management tools and techniques, construction companies often use experiments and inspections and other traditional methods. Depending on the company's individual practices or the needs of customers/consultants, other methods may be used; the leadership and participation of top management of construction companies must be strengthened in quality management; the financial and human resources for problems in the implementation of quality management must be further increased configuration; most of the quality management implementation problems encountered elsewhere are related to the local context and require attention (Keng & Abdul-Rahman, 2011).

2.9 Research Gaps

The Quality Management System (QMS) which is applied in the construction business describes quality planning, quality control as well as quality assurance. The QMS can help achieve compliance as well as objectives of the construction companies. It is to guarantee that construction projects are successfully conducted and, in the constraints, provided, like, specified period and at a least price. Projects are anticipated to find a sense of balance between price, time as well as quality (Aura, 2019).

A study done by Samsudin, et al. (2012), concluded that construction companies had discovered the benefits of Quality Management System (QMS) in the construction industry. And that contractors have taken the initiatives being certified with ISO 9001. Nevertheless, Samsudin, et al. (2012) as cited in Teklebrhan (2014), the approval of the criteria of all the industry is not as broad as in other industries. This is because of the common view that ISO certification would implicate extra financial burden to the organization like the obstacles which look throughout the implementation of QMS.

QMSs applied by contractors and implemented based on ISO 9001, are now becoming very important to customers who have for some time been seeking qualified and professional construction firms capable of meeting their requirements and providing satisfactory and successful outcomes in project delivery (Willar, et al., 2015).

In contrast to various other stakeholders, the contractor plays a significant role in the task delivery procedure, which is the reason this research is limited to the contractor's practice to assess the implementation of QMS. As previous studies show contractors fail to understand the saving or even added value which may be produced by implementing QMS (Samsudin, et al., 2012). Selamawit (2019), concluded in her study that the construction industry in Ethiopia in implementing QMS is in infant stage, in which her study was focused on consultants practice. Therefore, this study will examine the benefits of effective QMS implementation and identify the major challenges on the practice of QMS on contractors.

QMS practices, and the performance of contractors implementing such QMS, there are no key studies that are particularly relevant to the Ethiopian situation. Given that Ethiopian contractors

are already using ISO 9001 certified QMS, the lack of research intentions in this area is particularly surprising. More attention is required to the construction companies to improve Ethiopian QMS. This is the purpose of this paper, especially because Ethiopian construction industry faces challenges in its internal organization and working environment to achieve the effective implementation of QMS (Kidan, 2014). It is also important to check the current implementation of QMS ISO 9001 by contractors and their performance during the implementation of QMS , because information in these areas will affect the Ethiopian construction companies effectiveness, when passed to verify its quality and profitability, performance and effectiveness; the outlook of the industry; in an environment where construction requirements increase and economic framework conditions are constantly changing, the industry faces challenges and uncertainties.

Recent studies such as (Tigestu, 2019; Kidan, 2014; Beide, 2018) have conducted research on the construction industry with Ethiopian ISO certified consultants and contractors. However, these studies are not sufficient to clearly understand the current practice of the Ethiopian construction companies QMS. Although the knowledge gained from previous research will help in to find ways to determine the practice, benefits, and challenges of implementing QMS.

To fill these research gaps, the research on which this work is based aims to study the practice of construction companies in implementing the QMS ISO 9001 standard. The results of the thesis will become the basis for improving the practice of the QMS in the construction companies.

2.10 Summary of the Literature Review

Various documents and journals are reviewed as part of meeting the requirements of this thesis objectives. This chapter defines quality and related terms, such as quality planning; quality assurance; quality control and quality management systems. This chapter also briefly discusses ISO principles and elements, the advantages, and challenges of QMS implementation.

The Quality Management System (QMS) in construction industry refers to quality planning, quality assurance, quality control. The main goal of construction industry is to ensure that construction projects are successfully completed within the constraints of best quality, stated

period and at minimum cost. The research based on QMS recommended that construction companies should create a flexible and conducive organizational atmosphere which encourages the development of quality management system in all aspects of their work (Nitesh, 2014).

The primary goal in implementing quality management system is enhancing product quality and constantly enhance a service. Quality Management System is among the key managements in construction industry (Shaari, et al., 2017). However, there are still questions regarding the effectiveness of this system in construction industry. ISO 9001:2015 outlines a framework for improving satisfactory of expertise for any organization trying to offer products and services that constantly meet the necessities and expectancies of clients and other relevant interested parties. The QMS is the combination of all the strategies, resources, assets, and cultural values that guide the purpose of purchaser satisfaction and organizational efficiency (ISO, 2019). Even though the ISO 9001:2015 quality management system is widely used by organizations to gain operational and market benefits, studies on the impact of ISO 9001 by Manders (2015), shows that these objectives are not always achieved (Manders, 2015).

In general, from the overview it can be summed up that a large body of literature reports positive impacts on the implementation of QMS (Coffey, et al., 2011; Moatazed-Keivani, et al., 1999; Kumaraswamy & Dissanayaka, 2000; Lau & Tang, 2009; Ahmed, et al., 2005; Keng & Abdul-Rahman, 2011; Tan & Abdul-Rahman, 2011; Chini & Valdez, 2003). However, Kumaraswamy and Dissanayaka (2000) studies reveal negative results which is more paperwork and more management time.

Based on the literature review and identified research gaps, the research aims to assess the current practice, benefits, and challenges of Quality Management System (QMS) implementation on ISO 900:2015 Certified construction companies in Ethiopia.

CHAPTER 3 Methodology

3.1 Introduction

This chapter describes the overall design for data collection method, sample size, data analysis and methods for fulfilling objectives of the research stated in Chapter1.

3.2 Research Approach

The research overall approach is a desk study of archival documents and literatures. The study approach for the survey is through questionnaire and interviews of ISO 9001:2015 certified construction companies. Interviews are used when the researcher intends to support his or her arguments by an in-depth analysis of a person, a group of persons, an organization, or a particular project (Naoum, 2007). The interviews are conducted because of this research to allow for the questionnaire survey. this method is utilized to give flexibility to the interviewee and the researcher during the interview session. The reasons for conducting interviews for this research are to investigate details the benefits achieved, problems encountered, and the strategies used by ISO certified contractors in overcoming the implementation problems. Interviews allow researcher to answer the ‘why’ and ‘how’ questions when the respondents are required to provide justifications on the selected matter.

Apart from primary data, secondary data were also used to conduct the study. Documents review and analysis of secondary data from various sources were used as useful source of information for the study. Relevant books, journals, organization’s past and current research on the relevant issues were used.

3.3 Sample Size

This research used purposive sampling, also known as judgement sampling, involves the researcher to select a sample that is most useful to the purposes of the research. which is often used in qualitative research, where the researcher wants to gain detailed knowledge where the population is very small and specific.

Thus, the ISO 9001:2015 certified construction companies are few in numbers in Addis Ababa. Therefore, purposive sampling technique is used. The researcher has gathered the name and number of the construction companies that are certified from Ethiopian Conformity Assessment Enterprise (ECAE), DQS Management Services PLC Ethiopia (Germany based company) and Alcumus ISO QAR Ethiopia (UK based company) with the total of fifteen ISO 9001:2015 certified contractors. This mentioned organizations are the only ISO certified company in Ethiopia and surveyed all the ISO 9001:2015 certified construction companies and distributed questionnaire to all of them. The sample size is small, so the researcher tried to cover the all the certified construction companies instead of representative sample.

Since the sample size is limited, all the companies were interviewed to get more information on the practice, benefits, and challenges for the implementation of ISO 9001:2015 QMS. Most of the interviewees are the experts involved in the internal auditee committee to get a better clarification on ISO 9001:2015 implementation and for the reason of confidentiality, the names of the respondents and the construction company are kept anonymous.

3.4 Data Collection Methods

Data for this study was derived from both primary and secondary sources and collected using literature reviews, questionnaires, and interviews. According to Kothari, (1985) questionnaires, interviews and direct observations are the most important means of data collection tools. Therefore, in this study, both closed questionnaires and interviews were employed as a primary data collection. The secondary data that is relevant to the study was established through literature review, journals, and periodicals. The questionnaire was created by referring various literatures and modifying based on the objectives of this study. The questionnaire had eleven parts which enabled to collect information on quality management system practice in construction companies.

A total of fifteen questionnaires have been prepared in hard copy and were distributed to the twelve construction companies that are ISO certified. Out of the fifteen questionnaires twelve completed questionnaire were returned because two companies are closed currently, and the

other company was not willing to cooperate. The summary of the methodology used to achieve the research objective is shown in Figure 6 below.

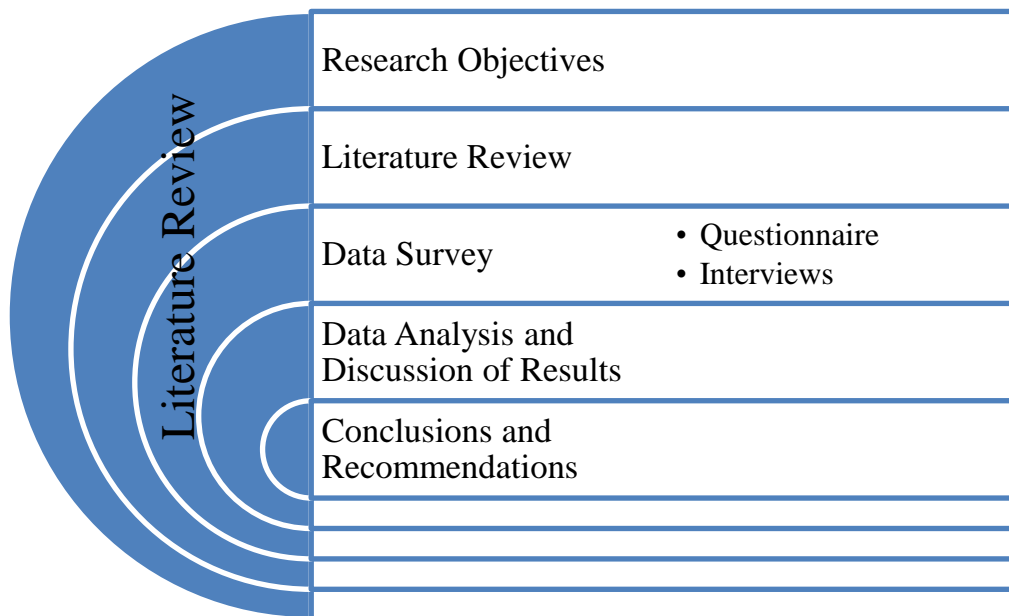


Figure 7 Summary of methodology used for the study

3.4.1 Questionnaire Design

This analysis relies on a closed finished questionnaire to obtain data. This is helpful as it implies both qualitative and quantitative details might be obtained. A structured questionnaire was developed following recommended guidelines by various scholars that include Saunders & Thornhill (2009); Kothari (1985). The selection of these instruments was guided by the nature of data collected, the time available and the objectives of the study. The questions were structured in such a way as to provide relevant information on the extent of QMS on construction companies, in general there are eleven parts in the questionnaire.

- **Part 1:** consists of questions which are related to the company and the personal details of the respondents which include name of company, position, category, year of ISO certification, project completed and major clients of the construction firms.
- **Part 2:** The questions in this section are related to the principles of ISO 9001:2015

- **Part 3:** This section is related to the practice of ISO 9001 elements within the company
- **Part 4:** Questions related reasons for implementing QMS ISO 9001:2015
- **Part 5,6,7 and 8:** are questions related to the level of effectiveness of QMS in construction regarding project quality, time, cost, and customer satisfaction, respectively.
- **Part 9:** Related to the benefits achieved by implementing the ISO 9001-2015 QMS.
- **Part 10:** Related to problems that the companies mostly faced in relation to effective implementation of QMS.
- **Part 11:** Related to remedies to overcome difficulties when implementing QMS.

The questionnaire, along with the cover letter were distributed to twelve constructions from the fifteen construction companies in hard copies in their head offices. Physical visits and intensive telephone conversation were made to the respondents too. The purpose of the communication was to locate the companies, clarify some of the points vague to the respondents in the questionnaires, to follow up responses and to collect filled questionnaires. For the reliability of the data, the questionnaires were distributed to these companies by physical visit of the researcher. All the respondents are all grade one contractors at organization level. Cronbach’s alpha was used to evaluate the reliability and accuracy of the questionnaire using SPSS version 21.0. Cronbach’s alpha value for each part of the questionnaire was calculated, the results of reliability test for the study are presented in that table 5 as follows:

Table 6 Questionnaire Validity

Questionnaire Part	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11
Cronbach’s alpha value	0.71	0.86	0.70	0.86	0.95	0.86	0.91	0.74	0.72	0.73

According to the rule of George and Mallery, (2003) >0.9(Excellent), >0.8(Good), >0.7(Acceptable), >0.6(Questionable), >0.5 (Poor) and <0.5 (unacceptable). The calculated

Cronbach's alpha of the questionnaire for a total of 76 questions was 0.8 which excluded the profile of contractors; this value indicates that the tool is in the range of good, internally consistent and was considered dependable. Then the main study was conducted.

3.4.2 Interviews

To substantiate the questionnaire survey, in depth interviews were provided to find out what the respondents opinion. The form of the interview used was semi-structured which uses a combination of open and close-ended questions. This technique is used to give flexibility to the researcher and interviewee during the interview session. The researchers have conducted the interview on all thirteen ISO 9001:2015 construction companies to justify the reliability of the data collected through questionnaire. The reasons are also to investigate details of the organizations culture influencing the quality management system practice, implementation, benefits achieved, and challenges encountered while implementing the QMS. During the interview documents were reviewed that the organizations use to implement the quality management system like procedure plans for all the departments, checklists, corrective action plans, corrective action clearance, risk planning and internal audits.

3.5 Data Analysis

The data gathered were analyzed through descriptive statics using SPSS (Version 21). After organizing, coding, and defining variables, responses of the cases were entered into the software. Relative Importance Index (RII) Analysis is also calculated because it is a helpful method to compute the relative importance of independent variables when independent variables are correlated to each other. The Relative Importance Index was used to rank the relative importance index of the QMS principles, practice, benefits, challenges, and remedies. These ranking makes it possible to cross compare the relative importance of the independent variables as perceived by the group of respondents.

CHAPTER 4 Data Analysis and Summary of Findings

4.1 Introduction

The data analysis is categorized in to two major parts. The first category focuses on the result obtained from the questionnaire. The second category focuses on the discussion from the interview. Summary of finding of the study is also included in this chapter.

The ISO 9001:2015 certified construction companies are few in Addis Ababa. The researcher has tried to find out the total number of certified construction companies through physical visit in different organizations, after which the data was obtained from Ethiopian Conformity Assessment Enterprise which is part of Ethiopian Standard Agency that certifies in ISO 9001- Quality Management System, ISO 14001- Environmental management system and ISO 22000- Food safety management system, Alcumus ISOQAR LTD Ethiopia which is Manchester, United Kingdom(UK) based company and DQS Management Services PLC that is based in Frankfurt, Germany.

From the information gathered there are a total of 264 ISO certified companies in all sectors, from which 126 companies are certified with ISO 9001:2015 and from the 126 companies the researcher was able to get only fifteen certified contractors which are currently active and have the renewed ISO 9001:2015 certification. Table 6 presents the total number companies that are ISO certified in all sectors and the number of ISO 9001:2015 certified companies including in construction industry.

Table 7 No. of ISO Certified in Ethiopia Companies (ECAE, DQS and ISO QAR)

Company Name	Total Certification in all sectors	Total No. of certificate in ISO 9001:2015	Total No. of ISO 9001:2015 certified contractors (renewed)
ECAE	39	31	5
DQS	75	40	3
ISO QAR	150	55	7
Total	264	126	15

Since the scope of this thesis is limited to only certified construction companies, the contractors who are in the process of renewal and those in the process of getting certified for the first time are not included. Getting the list of certified contractors was difficult because the certificate was given by different certifying bodies. It should be noted that the number of certified companies to date may be greater than fifteen but as per the effort made, only fifteen contractors were found.

Therefore, the researcher has delivered the questionnaires to fifteen ISO 9001 certified contractors. However, regardless of the effort made, one contractor could not compile the questionnaire and return the questionnaire. And the other two contractors are not currently active in the industry. As a result, twelve of the fifteen questionnaires were returned. Hence, responses from the twelve contractors were used in analyzing this survey. The data from this survey have been analyzed using SPSS (Statistical Package for the Social Sciences) software computer program. Descriptive statistics such as frequency tables and percentages were used in the data analysis and results. Relative Importance Index (RII), reliability analysis and mean are also basic instruments for analysis.

To guarantee the validity and reliability of the data obtained in survey is critical as compared with other data gathering methods such as interview and case study approach; surveys are prone to bias and misunderstanding and thus overall, the validity is doubtful. To re-test the validity of the survey and accommodate additional ideas, interview was used based on the same questionnaire. Accordingly, little response bias was found on the questionnaires when comparing the result with the interview response and corrected in this analysis and discussion. The interview also helped to get additional information which are not covered in the questionnaire, like the driving force in implementing the QMS, current challenges in effectively implementing QMS, how to assess and measure customer satisfaction, how often the company conduct internal and external audits etc. In fact, to control the impact of respondent bias, the researcher has delivered the Questionnaire in person to the construction companies offices and explained the importance of accurate data for the research and to the respondents and has collected in person. The researcher was willing to make explanations on unclear questions in the questionnaire, if raised by respondents. Therefore, the summary of the questionnaire prepared and distributed are shown in the table 7.

Table 8 Summary of distribution of questionnaires

Questionnaires Prepared (N)	Questionnaires Distributed (N)	Questionnaires Return(N)	Questionnaire Rejected N (%)	Questionnaire used for analysis N (%)
15	13	12	1(7.69%)	12(92.3%)

4.2 Questionnaire analysis

The questionnaire analysis part is categorized into eleven major parts as follows.

4.2.1 Profile of the Contractors

This section is about the general information of the certified construction companies, including the year they have been certified and how long they have been operating in the construction industry including the position of the respondents that participated in the questionnaire survey.

The position of the respondents that participated in the survey are management representative, design and procurement head and office engineers that are working in the head office of the construction companies. In general, half of the respondents that participated in the survey are management representative, which oversea the implementation of the quality management system within the company, while 33.3% of the respondents were office engineers with more than 5 years of experience.

Table 8 shows that, in terms of category 91.7% of the ISO certified respondents are general contractors (GC-1) while the remaining 8.3% is building contractor (BC-1). 66.7 % of the construction companies have been ISO 9001:2015 certified in 2019 while 16.7% were certified in the year 2020. And 8.3% in the year 2021. However, one of the construction companies (8.3%) was certified in 2015 in the same year in which, ISO 9001:2015 was published. The response of the respondents is summarized as shown in table 8

Table 9 Descriptive Summary of the respondent's

	Position in the Company	Grade	Year of ISO certified	Company operating in years	Projects executed in last five years	Major clients
A	Project Management Team	GC-1	2020	More than 20	More than 20	Gov't
B	Office Engineer	GC-1	2019	10 years and above	Less than 10	Private
C	Office Engineer	GC-1	2021	5 to 10 years	Less than 10	Gov't
D	Department Manager	GC-1	2019	5 to 10 years	11 to 20	Gov't
E	Management Representative	GC-1	2019	10 years and above	Less than 10	Gov't
F	Management Representative	GC-1	2020	More than 20	Less than 10	Gov't
G	Office Engineer	GC-1	2019	10 years and above	Less than 10	Gov't
H	Management Representative	BC-1	2019	10 years and above	More than 20	All
I	Office Engineer	GC-1	2019	10 years and above	11 to 20	Gov't
J	Design & Procurement Head	GC-1	2019	5 to 10 years	Less than 10	Gov't
K	Management Representative	GC-1	2019	10 years and above	More than 20	Private
L	Management Representative	GC-1	2015	10 years and above	Less than 10	Gov't

According to the survey the respondents have been operating in the construction industry for more than 10 years. Three of the construction companies have been operating 5 to 10 years in the industry. While Company A & F have been in the industry for more than 20 years. In addition, the respondents' major clients are government and public bodies apart from company B and K in which, their major clients are private stakeholders.

4.2.2 The practice of QMS ISO 9001:2015 principles

There are seven principles of ISO 9001:2015 quality management system stated in ISO 9001:2015 manual which are described in the literature review. In this research one of the research objectives is to evaluate the practice and awareness of QMS, to do so, these principles were listed, and the contractors were asked if they have fully implemented these seven QMS principles within their organizations.

To achieve this, the seven QMS principles were presented to the respondents. The respondents were requested to indicate the level of implementation of these principles on a Likert scale of 'fully implemented,' 'implemented,' 'partially implemented' and 'not implemented.' The

mean, standard deviation, relative Importance Index (RII) were analyzed and ranked. The data in table 9 summarizes the ranks, mean scores, and relative importance index indicating that all the seven ISO 9001 principles were at a level of implementation. Therefore, the perception of respondents on the level of implementation of the principles is shown in table 9.

Table 10 Descriptive summary of respondents on level of practice on QMS principles

No.	QMS Principles	Level of implementation scale in				M	SD	RII	R
		Frequency (percent)							
		4	3	2	1				
1	Customer Focus	2(16.7)	7(58.3)	3(25)	0(0)	2.92	0.67	0.73	1 st
2	Improvement	1(8.3)	7(58.3)	3(25.0)	1(8.3)	2.67	0.78	0.67	2 nd
3	Evidence-based decision making	0(0)	7(58.3)	5(41.7)	0(0)	2.58	0.58	0.65	3 rd
4	Leadership	0(0)	7(58.3)	5(41.7)	0(0)	2.58	0.51	0.65	3 rd
5	Process Approach	0(0)	7(58.3)	4(33.3)	1(8.3)	2.50	0.67	0.63	4 th
6	Relationship Management	0(0)	6(50)	6(50)	0(0)	2.50	0.52	0.63	4 th
7	Engagement of People	1(8.3)	5(41.7)	4(33.3)	2(16.7)	2.42	0.90	0.60	5 th

Notes: M-Mean, SD- Standard Deviation, RII-Relative Importance Index, R-Rank; Likert Scale: 1-Not implemented(mean<1.50), 2-Partially implemented (1.51-2.50), 3- Implemented (2.51-3.00) and 4- Fully implemented (3.51-4.00)

As shown in the table above, the mean scores for the level of implementation which ranged from 2.42 to 2.92 reflecting that the standard deviations (SDs) were small, indicating that the data points were close to the means. These results also reflect that the mean is an appropriate statistical metric for summarizing the current implementation level of ISO 9001 principles (Willar, et al., 2015).

The highest implemented principles than the rest is customer focus (understand the needs of customer, align organizational objectives with customer needs and expectations, measure customer satisfaction) with a relative important index of 0.73. This result is in full agreement with the study of (Kumaraswamy & Dissanayaka, 2000).The bar chart in figure 7 provides a visual description of this distribution. This graph has clearly demonstrated that the most

frequent number of respondents indicates that the principle of customers focus is implemented within its organization.

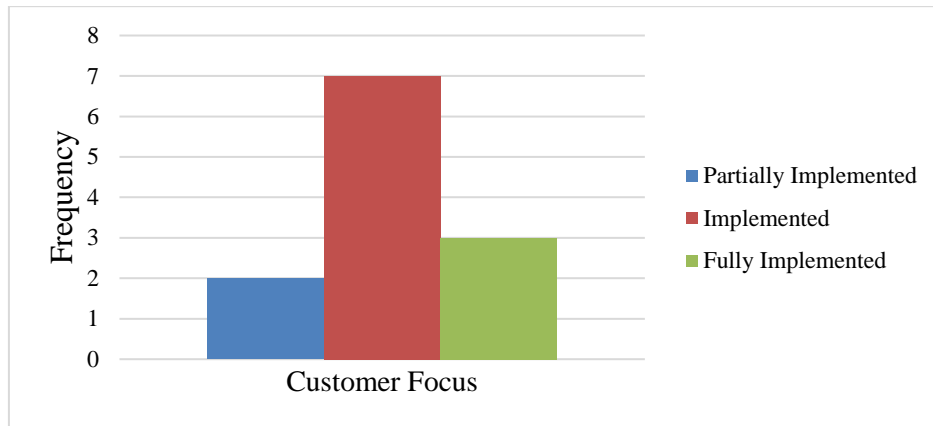


Figure 8 Frequency distribution on customer focus

The second principle classified according to the value RII of 0.67 is improvement (continually monitoring, reviewing, and defining opportunities for improvement). The bar chart in figure 8 provides a visual representation of this distribution. In which this chart clearly shows that the most frequent number of respondents indicated that this principle is implemented, which shows that 58.3% the organizations have a continuous approach to improvement. However, only one company has not implemented this principle based on respondents.

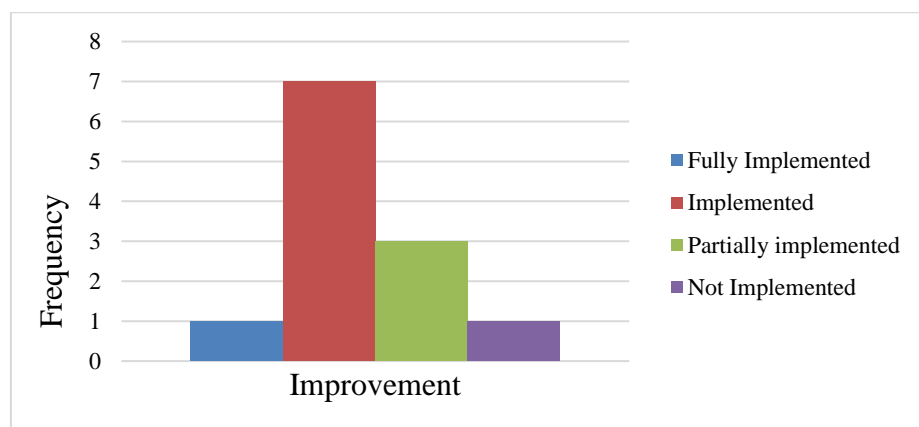


Figure 9 Frequency distribution on continuous improvement

The third ranked principle according to the RII value of 0.65 are evidence-based decision making or factual approach to decision making and leadership (setting objectives; considering the risk; implementing quality policy; and ensuring the standards are met). The bar chart in

figure 9 provides a visual representation of these distributions, respectively. Thus, the graph shows that the most frequent number of respondents indicated that these two principles are implemented, which shows 58.3% of the respondents replied that decisions based on the analysis and data evaluation and information is more likely to produce desired results. As 58.3% also replied that leaders at all levels establish the unity of purpose and direction and create conditions in which people participate in achieving quality goals of the organizations.

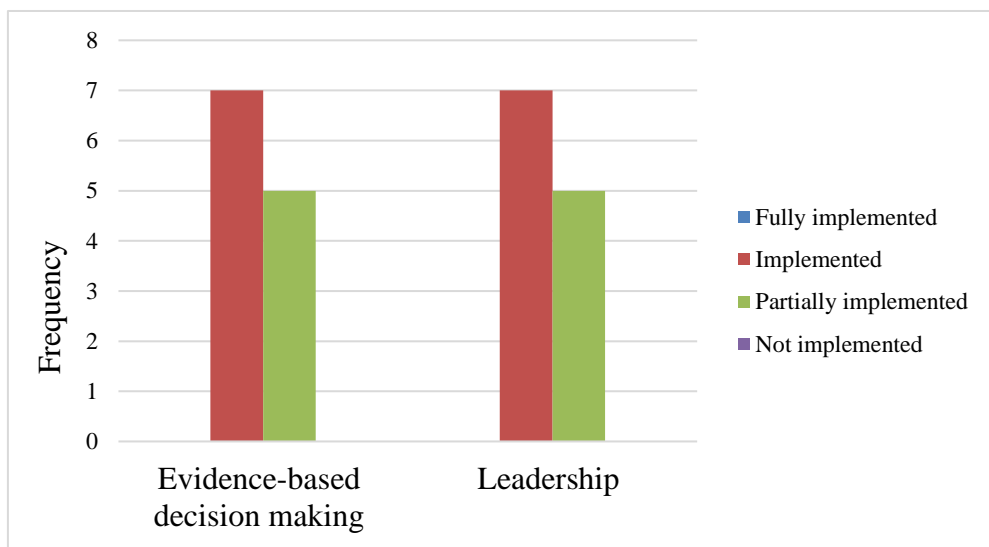


Figure 10 Frequency distribution on evidence-based decision making and leadership

The fourth ranked principle with a RII value of 0.63 are process approach (implements the PDCA (Plan-Do-Check and Act) principle) and relationship management (controlling the ways in which each process interacts). The bar chart in figure 10 provides a visual representation of this distributions. In which both graphs clearly shows that the most frequent number of respondents indicated that this two principles are not so fully implement, which shows 58.3% of the respondents responded that consistent and predictable results are achieved more effectively and efficiently when activities are understood and managed as interrelated processes that function as a coherent system and 50% of the respondents replied that for sustained success, an organization manages its relationships with interested parties, such as suppliers.

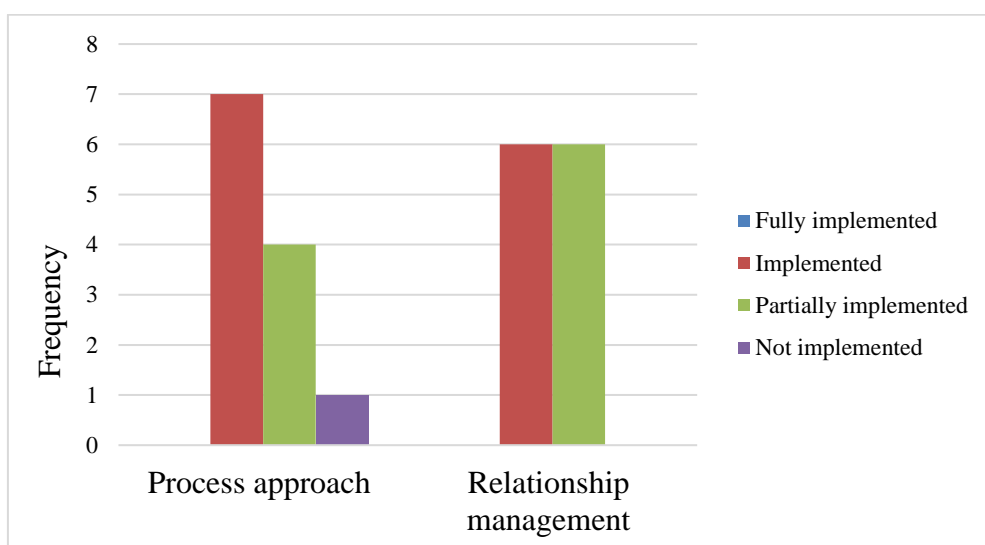


Figure 11 Frequency distribution on process approach and relationship management

The contractors also mentioned that the interdependent relationship between the suppliers and the contractors is mutually beneficial, but more focus is given to the international suppliers than the local ones because it is harder to maintain relationship with the foreign companies than the domestic ones, therefore these principles are not so fully implemented meaning a strategy is required in an organization to maintain an ongoing level of engagement.

The least implemented principle according to the data gathered is engagement of people (training and ensuring there is effective communications), which is ranked in fifth place with a RII value of 0.60 and a mean value of 2.42. The bar chart in figure 11 provides a visual representation of this distribution. In which this graph clearly shows that the most frequent number of respondents indicated that this principle is implemented, but one company (8.3%) of the responded indicated that competent, empowered and engaged people at all levels throughout the organization are essential to enhance its capability to create and deliver value. Therefore, figure 11 shows the frequency distribution on involvement of people.

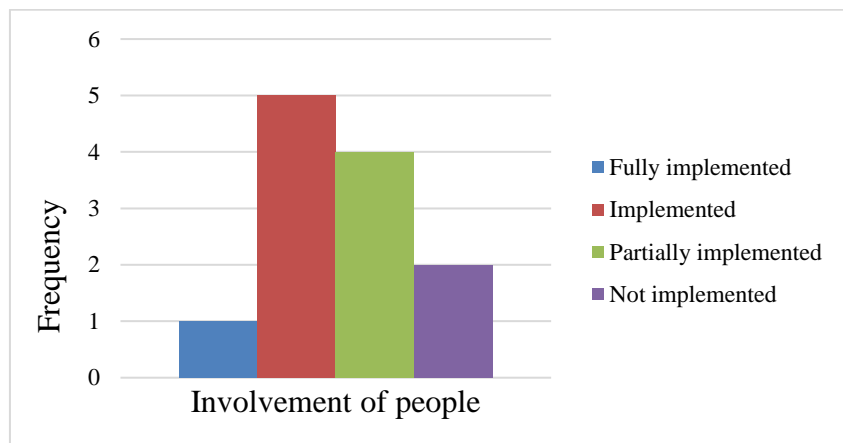


Figure 12 Frequency distribution on engagement of people

They have explained that although all the seven principles are important, however, they said that running the construction projects is primarily based on the customer focus principle. In addition, they mentioned that customer focus is the goal in their construction endeavors. The contractors keep in consideration the needs of the customer to be fulfilled by continuous improvement through customer survey.

4.2.3 The practice of QMS Elements

Based on the literature review, there are nine core elements of QMS. Therefore, the elements were listed in detail for the contractors to indicate the level of implementation within the organization. The responses from the construction companies regarding the levels of implementation for each element of the QMS, in their own companies is presented in table 10 with frequency(percentage), mean value, standard deviation, relative importance index and the rank of the level of implementation on the ISO 9001 elements within the construction company.

Table 11 Descriptive summary of elements of QMS implementation

No.	Elements of QMS	Level of implementation scale in frequency (percent)				M	SD	RII	R
		4	3	2	1				
1	Quality objectives	8(66.7)	3(25)	1(8.3)	0(0)	3.58	0.67	0.90	1 st
2	Quality instruments	8(66.7)	3(25)	1(8.3)	0(0)	3.58	0.67	0.90	1 st
3	Data management	3(25)	8(66.7)	1(8.3)	0(0)	3.17	0.58	0.79	2 nd
4	Quality manual	5(41.7)	5(41.7)	0(0)	2(16.7)	3.08	1.08	0.77	3 rd
5	Customer satisfaction with product quality	3(25)	7(58.3)	2(16.7)	0(0)	3.08	0.67	0.77	3 rd
6	Document control	3(25)	3(25)	4(33.3)	2(16.7)	2.58	1.08	0.65	4 th
7	Continuous improvement	3(25)	6(50)	1(8.3)	2(16.7)	2.83	1.03	0.54	5 th
8	Processes	3(25)	5(41.7)	4(33.3)	0(0)	2.92	0.79	0.52	6 th
9	Organizational structure and responsibilities	6(50)	4(33.3)	0(0)	2(16.7)	3.17	1.11	0.46	7 th

Notes: M-Mean, SD- Standard Deviation, RII-Relative Importance Index, R-Rank; Likert Scale: 1-Not implemented(mean<1.50), 2-Partially implemented (1.51-2.50), 3- Implemented (2.51-3.00) and 4- Fully implemented (3.51-4.00)

The survey findings indicate that, for a significant percentage of companies surveyed, six elements were at level of “implemented”: mean scores ranging from 2.84 to 3.17. The bar chart in figure 12 provides a graphic representation of quality objectives (management defines quality policy with a strategic goal) and quality instruments (test and inspection records are retained and preserved as part of the quality documentation system).

In addition, this graph clearly shows that the most frequent number of respondents indicated that these two elements (quality objectives and quality instruments) are fully implemented and ranked in the first place with a RII of 0.90 according to 66.7% of the respondents. Figure 12 shows that 8.3% are partially implemented, 25% are implemented while the majority shows that its fully implemented within the construction companies.

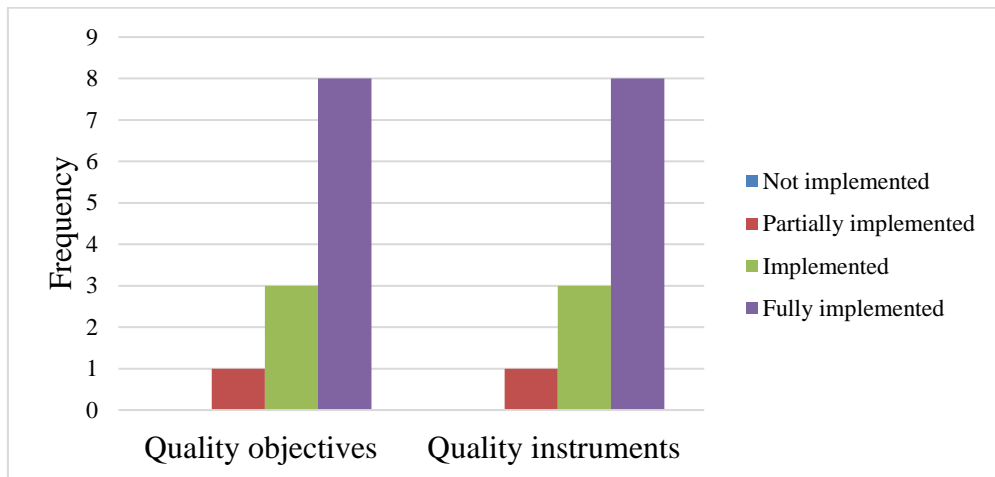


Figure 13 Frequency distribution on quality objectives and quality instruments

The bar chart in figure 13 provides a visual representation of quality management (consistent product quality, operating efficiencies, compliance risks, customer satisfaction, and profitability) distribution. In which this graph clearly shows that the most frequent number of respondents indicated that this element is implemented and ranked in the second place with a RII of 0.79 according to 66.7% of the respondents. While 25% of the respondents fully implement, one of the companies also mentioned that ineffective data management practices can experience inconsistent product quality, operating inefficiencies, compliance risks, poor customer satisfaction, and low profitability.

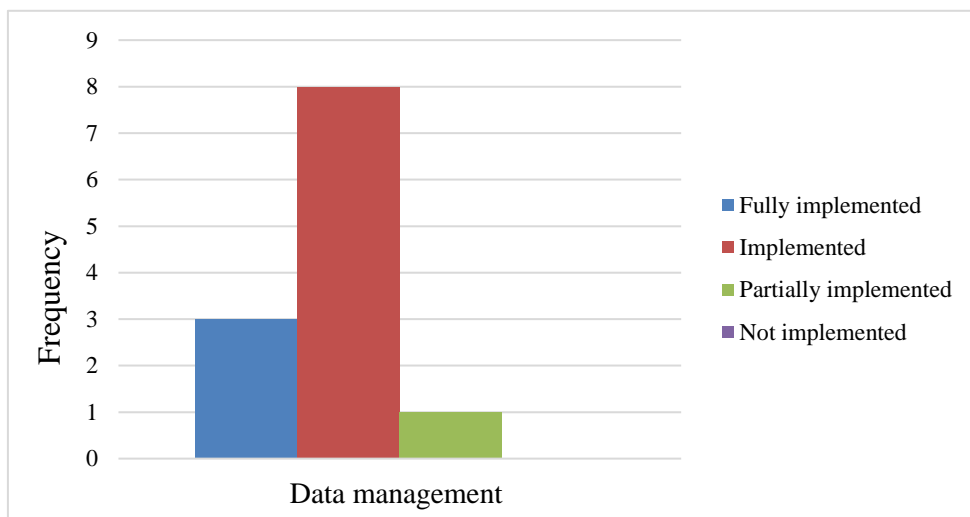


Figure 14 Frequency distribution on data management

The RII value of 0.77 with a mean value of 1.08 and 0.67 for quality manual (document that describes the quality management system of an organization) and customer satisfaction with product quality respectively, these elements are ranked in third place. The bar chart in figure 14 provides clear picture of these two elements. In which this graph clearly shows that customer satisfaction is not so fully implemented compared to quality manual which shows that it has equal percentage for fully implemented (41.7%) and not so fully implemented (41.7%). However, two respondents (16.7%) indicated that quality manual has not yet been implemented.

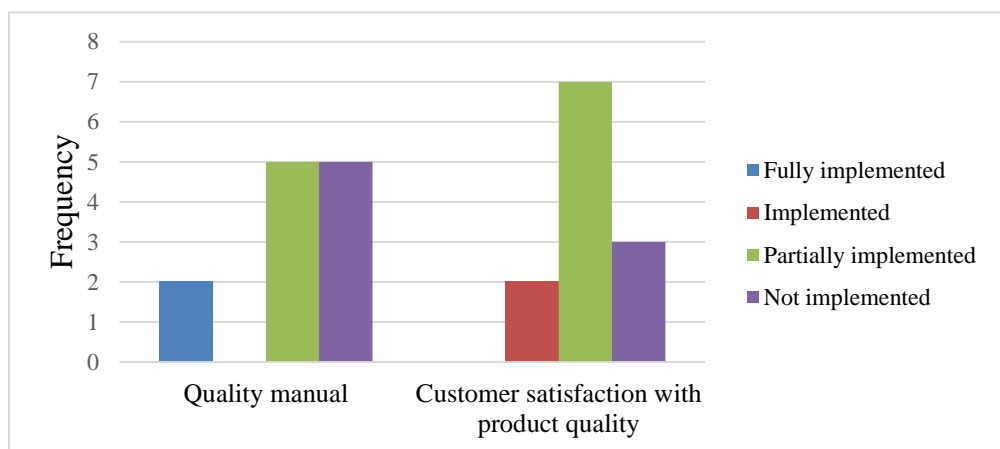


Figure 15 Frequency distribution on quality manual and customer satisfaction with product quality

Document control (a way to ensure that information remains relevant, up-to-date, accessible and aligned to the strategy) is ranked in the fourth place with a RII and mean value of 0.65 and 1.08, respectively. The bar chart in figure sss15 provides a visual representation this element. In which this graph clearly shows equal number of respondents full implemented (25%) and implemented (25%) that document control charts, graphs and other method of analysis determine on how well a process is working and facilitates continuous improvement. 33.3% of the companies partially implemented this element while 16.7% has not implemented it.

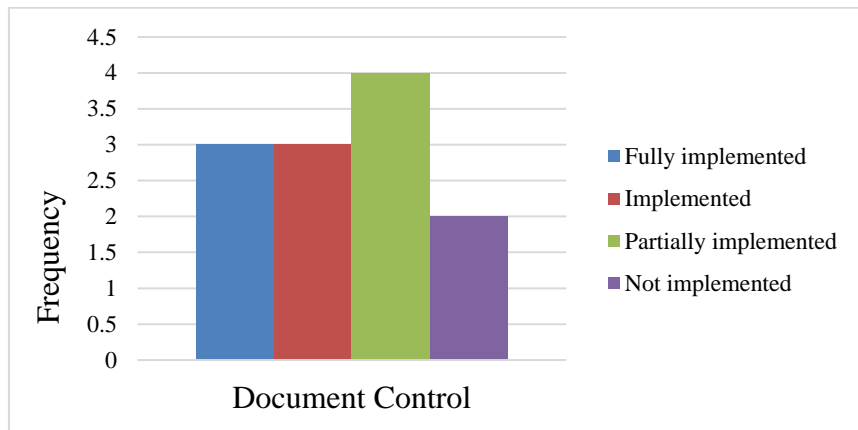


Figure 16 Frequency distribution on document control

Continuous improvement (an ongoing effort to improve organization product/service) is ranked in the fifth place with a RII and mean value of 0.54 and 1.03, respectively. The bar chart in figure 16 provides clear picture of this element. In which this graph clearly shows the number of frequencies in which 50% are not so fully implementing, twenty-five% of them are fully implementing it, also mentioned that continuous improvement and adaptation are necessary for organizations to drive benefits with the QMS and maintain customer satisfaction. Company E mentioned that QMS dictate that continual improvement is an organization-wide responsibility. However, ISO 9001 is clear that leadership should play a primary role in implementing a quality driven culture as in the literature review by (Kelderman, 2020). In addition, Clause 5.1.1 states "top management shall demonstrate leadership and commitment with respect to the quality management system by taking accountability for effectiveness." on the other hand 16.7% are not implemented this element within their organization.

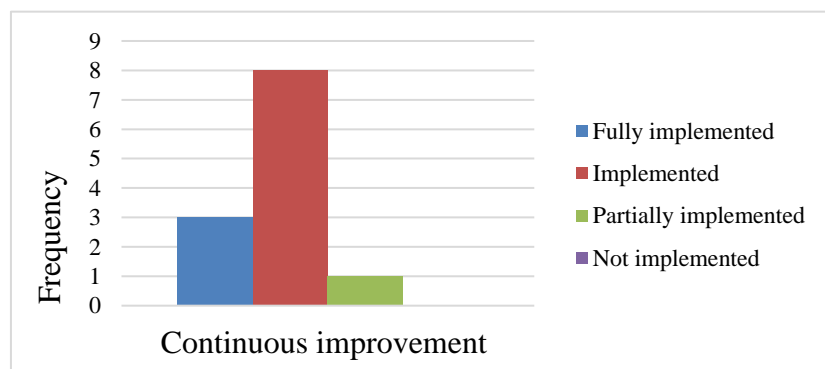


Figure 17 Frequency distribution on continuous improvement

QMS are inherently process driven approaches to assurance and quality control. Standards for quality control need organizations to determine as well as define all organizational tasks which make use of resource to change inputs into outputs. Every duty in the organization could be linked with a procedure, which includes purchasing. Which is one of the core elements of QMS, in which processes (creation and modification of any quality documentation is strictly controlled by established procedures) is ranked in sixth place with a RII and mean value of 0.52 and 0.79, respectively. Figure 17 shows the processes distribution. In which this graph clearly shows that the most frequent number of respondents indicated that this element is not so fully implement, which shows that the organization’s creation and modification of any quality documentation is strictly controlled by established procedures an ongoing focus on improvement. However, 33.3% of the construction companies partially implemented it. Therefore figure 17 shows the frequency distribution on processes.

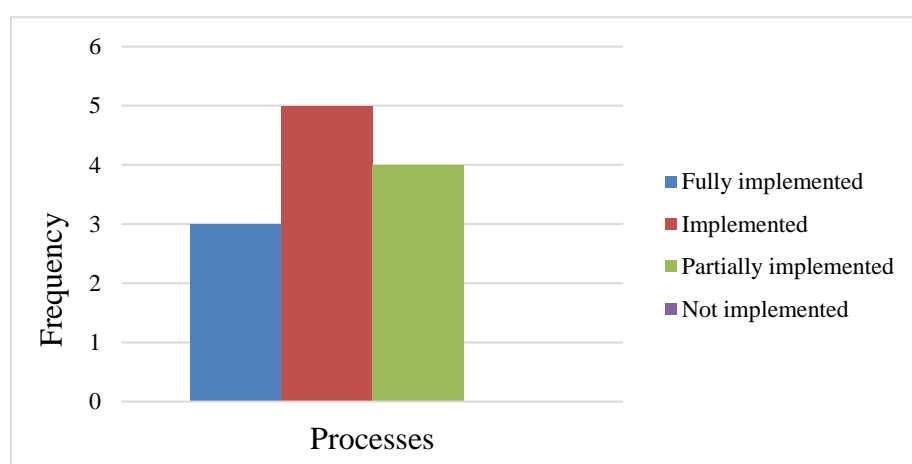


Figure 18 Frequency distribution on processes

Organizational structure and responsibilities (Clear and updated model of the organization's structure and responsibilities of all individuals within the organization), which is clear and updated model of the organization’s structure and responsibilities of all individuals within the organization was ranked last in seven places with RII equal to 0.46 and mean value of 1.11. However, 50% of the companies fully implemented it whereas 16.7 % has not implemented as shown in figure 18.

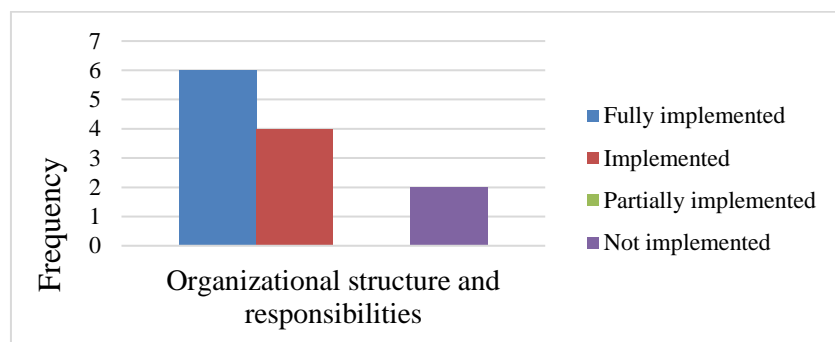


Figure 19 Frequency distribution on organizations structure and responsibilities

4.2.4 Reason for Implementing ISO 9001:2015 QMS

The descriptive analysis of the reasons for implementing QMS indicates the following findings as shown in table 11.

Table 12 Descriptive summary of QMS implementation reason

No.	Reason of Implementing QMS	Reason scale in Frequency (Percent)			M	SD	RII	R
		No	Mild	Yes				
1	Dissatisfaction with the previous mode of operation and its results	-	6(50)	6(50)	2.50	0.52	0.83	5 th
2	Customer requirements	2(16.7)	0(0)	10(83.3)	2.67	0.78	0.89	3 rd
3	For marketing purposes and to enhance the reputation of your company	1(8.3)	3(25)	8(66.7)	2.58	0.67	0.86	4 th
4	To compete with international construction companies where ISO certification is mandatory for tendering	-	3(25)	9(75)	2.75	0.45	0.92	2 nd
5	To increase employee motivation and participation	3(25)	1(8.3)	8(66.7)	2.42	0.90	0.81	6 th
6	To ensure higher productivity	-	2(16.7)	10(83.3)	2.83	0.39	0.94	1 st
7	Lack of corporate commitment and inconsistency of management action and decision making.	3(25)	7(58.3)	2(16.7)	1.92	0.67	0.64	7 th

Notes: M-Mean, SD- Standard Deviation, RII-Relative Importance Index, R-Rank

The results of this study showed that the companies' reasons, in implementing QMS in the first instance, were encouraged by positive intentions to ensure high productivity with RII equal to 0.94 and ranked first. However, the studies in Hong Kong, USA and UK shows that customer drive is the main motivation for certification (Ahmed , et al., 2005; Lau & Tang, 2009; Moatazed-Keivani, et al., 1999). On the other hand, the study from Malaysia by Keng and Abdul-Rahman (2011), showed that ISO registration is used for marketing purposes; Implementation of quality management is strongly regarded as a mean to fulfilling contractual obligations rather than satisfying customer needs as discussed in the literature review. The survey results also revealed that, the second motive for ISO 9001 certification was to compete with international construction companies where ISO certification is mandatory for tendering with RII value of 0.92. As indicated in table 11, the third ranked motive is to meet customer requirements as part of the bidding process with a value of RII equal to 0.89.

The survey shows that, the least motive that drives the construction companies to apply for ISO 9001 certification, is lack of corporate commitment and inconsistency of management action and decision making. Another least motive is to increase employee motivation and participation. The other reason which was ranked in 4th and 5th place was for marketing purposes and to enhance the reputation of the company and dissatisfaction with the previous mode of operation and its results with a RII value of 0.86 and 0.83, respectively.

4.2.5 Effectiveness of QMS Implementation for Project Quality

To analyze the effectiveness of QMS on project quality, few measures for effectiveness were derived from literature review. In the questionnaire, the respondents were asked whether the measures listed were effective or not in relation to QMS implementation, based on their experience, using a rating of 5 being "strongly agree," 4 as being "agree", 3 as being "neutral", 2 as being disagree and 1 as being Strongly disagree.

The result is in contrast with Rediet (2011), study, which the finding was that QMS has not been effective for construction companies in terms of matching the project scope with the project proposal and complying with contract specification. However, this study shows that

QMS has improved the products and services of construction companies as summarized in table 12 as shown below.

Table 13 Descriptive summary of QMS in relation to project quality

No	Level of effectiveness of QMS on quality	Likert scale in Frequency (Percent)					M	SD	RII	R
		5	4	3	2	1				
1	Project scope can match with the project proposal and compliance with contract specifications	6(50)	2(16.7)	1(8.3)	6(50)	0(0)	3.92	1.31	0.78	3 rd
2	Quality assessment and control framework	2(16.7)	6(50)	1(8.3)	0(0)	3(25)	3.33	1.50	0.67	5 th
3	Product defect rate decreases	3(25)	4(33.3)	4(33.3)	1(8.3)	0(0)	3.75	0.96	0.75	4 th
4	Product and service quality improvement	4(33.3)	6(50)	2(16.7)	0(0)	0(0)	4.17	0.72	0.83	1 st
5	Quality incentive system; motivation for quality improvement	5(41.7)	4(33.3)	2(16.7)	1(8.3)	0(0)	4.08	0.99	0.82	2 nd
6	Quality training/ meetings	4(33.3)	6(50)	0(0)	1(8.3)	1(8.3)	3.92	1.24	0.78	3 rd

Notes: M-Mean, SD- Standard Deviation, RII-Relative Importance Index, R-Rank; Likert Scale: 1-Strongly disagree (mean<1.50), 2-Disagree (1.51-2.50), 3- Neutral (2.51-3.50), 4- Agree (3.51-4.50) and 5- Strongly agree (4.51-5)

The data in table 12 show that the effectiveness measures for quality of a construction project fall mainly into two categories, level 4 “agree” (3.51-4.5) for all six measures except quality assessment and control framework which is at a level of 3 “neutral” with a mean value of 3.33, which is in the range of 2.51-3.5 for level 3 and ranked in 5th place with RII value of 0.67. Product and service quality improvement, quality incentive system; motivation for quality improvement, quality training/ meetings, project scope can match with the project proposal and compliance with contract specifications and product defect rate decreases are ranked in 1st, 2nd, 3rd, 3rd, and 4th place with a RII value of 0.82, 0.78, 0.78 and 0.75, respectively. Thus, the

mean rating of the level of effectiveness of QMS on quality shows that the most considered effectiveness in relation to quality is product and service quality improvement.

4.2.6 Effectiveness of QMS Implementation in Project Completion Time

This part of the QMS questionnaire evaluates the effectiveness of QMS in relation to project completion time. To analyze the effectiveness of QMS on project quality, few measures for effectiveness were derived from literature review. In the questionnaire, the respondents were asked whether the measures listed were effective or not in relation to QMS implementation, based on their experience, using a rating of five being “strongly agree,” 4 as being “agree”, 3 as being “neutral”, 2 as being disagree and 1 as being Strongly disagree.

Table 13 show that the effectiveness measures for time of a construction project fall mainly into two categories, level 4 “agree” (3.51-4.5) for all six measures except meeting proposed implementation timeliness with actual timeliness of the project completion which is at a level of 3 “neutral” with a mean value of 3.42, which is in the range of 2.51-3.5 for level 3 and ranked in 5th place with RII value of 0.68.

Documented procedures are easier for the employees to follow toward reduction time , more reliable construction project scheduling and delivery , reduction of delay as a result of errors and change of scope by owners , Improved project delivery time , reduction of delay as a result of turn over and rework and ability to help and solve problems of the project completion are ranked in 1st, 2nd, 3rd , 3rd and 4th place with a RII value of 0.82, 0.82, 0.78, 0.73, 0.73 and 0.73 respectively.

Hence, the mean rating of the level of effectiveness of QMS on time shows that the most considered effectiveness in relation to time is more reliable construction project scheduling and delivery and reducing duration of projects due to easier documentation procedures for the employees to follow. Table 13 presents the means, standard deviations, relative importance index and rank the seven measures as shown below.

Table 14 Descriptive summary of QMS in relation to project completion time

No.	Level of Effectiveness of QMS on Time	Likert scale in frequency (Percent)					M	SD	RII	R
		5	4	3	2	1				
1	Meeting proposed implementation timeliness with actual timeliness of the project completion	2(16.7)	6(50)	0(0)	3(25)	1(8.3)	3.42	1.31	0.68	5 th
2	Improved project delivery time	2(16.7)	7(58.3)	1(8.3)	1(8.3)	1(8.3)	3.67	1.15	0.73	3 rd
3	Ability to help and solve problems of the project completion	2(16.7)	6(50)	2(16.7)	1(8.3)	1(8.3)	3.58	1.16	0.72	4 th
4	Reduction of delay because of turn over and rework	2(16.7)	5(41.7)	4(33.7)	1(8.3)	0(0)	3.67	0.89	0.73	3 rd
5	Reduction of delay because of errors and change of scope by owners	3(25)	6(50)	2(16.7)	1(8.3)	0(0)	3.92	0.90	0.78	2 nd
6	More reliable construction project scheduling and delivery	2(16.7)	9(75)	1(8.3)	0(0)	0(0)	4.08	0.51	0.82	1 st
7	Documented procedures are easier for the employees to follow toward reduction time	2(16.7)	9(75)	1(8.3)	0(0)	0(0)	4.08	0.67	0.82	1 st

Notes: M-Mean, SD- Standard Deviation, RII-Relative Importance Index, R-Rank; Likert Scale: 1-Strongly disagree (mean<1.50), 2-Disagree (1.51-2.50), 3- Neutral (2.51-3.50), 4- Agree (3.51-4.50) and 5- Strongly agree (4.51-5)

4.2.7 Effectiveness of QMS Implementation in Project Cost

Like the effectiveness measures for time of project, the respondents were asked questions regarding the effectiveness of QMS for the cost of project. These measures were retrieved from reviewing literatures by different scholars which are commonly agreed on. In the questionnaire, the respondents were asked whether the measures listed were effective or not in relation to QMS implementation, based on their experience, using a rating of five being “strongly agree,” 4 as being “agree”, 3 as being “neutral”, 2 as being disagree and 1 as being Strongly disagree.

Respondents said that their company's QMS measures are the most effective. QMS reduces the cost of efficient process management and resources by optimizing performance, and QMS reduces costs through good supply chain management. Table 14 presents the summary of the

respondents including the means, standard deviations, relative importance index and rank the six measures as shown below.

Table 15 Descriptive summary of QMS in relation to project cost

No.	Level of Effectiveness of QMS on Cost	Likert scale in frequency (Percent)					M	SD	RII	R
		5	4	3	2	1				
1	Budget and cash flow management	3(25)	7(58.3)	1(8.3)	1(8.3)	0(0)	4.0	0.85	0.80	3 rd
2	Reduce cost of rework	3(25)	6(50)	3(25)	0(0)	0(0)	4.0	0.74	0.80	3 rd
3	Increased return on investment (ROI) and profit can be caused by reduction of cost	2(16.7)	9(75)	1(8.3)	0(0)	0(0)	4.08	0.51	0.82	2 nd
4	Improved resources consumption	1(8.3)	9(75)	2(16.7)	0(0)	0(0)	3.92	0.51	0.78	4 th
5	Optimizing performance can reduce expenses by efficient process management and resources	2(16.7)	7(58.3)	3(25)	0(0)	0(0)	3.92	0.67	0.78	4 th
6	Lower production costs	3(25)	7(58.3)	1(8.3)	1(8.3)	0(0)	4.0	0.83	0.80	3 rd
7	A well-managed supply chain can reduce expenses	8(66.7)	3(25)	1(8.3)	0(0)	0(0)	4.58	0.67	0.92	1 st

Notes: M-Mean, SD- Standard Deviation, RII-Relative Importance Index, R-Rank; Likert Scale: 1-Strongly disagree (mean<1.50), 2-Disagree (1.51-2.50), 3- Neutral (2.51-3.50), 4- Agree (3.51-4.50) and 5- Strongly agree (4.51-5)

4.2.8 Effectiveness of QMS Implementation in Customer Satisfaction

As mentioned on the literature review, customer satisfaction is one of the main goals and mission of construction companies. It is also one of the seven ISO 9001:2015 principles of QMS implementation. And the respondents give a great emphasis to customer satisfaction. They were asked how effective QMS is on customer satisfaction of their construction projects. Like the other three parameters, time, cost, and quality, effectiveness measures for customer satisfaction are retrieved from reviewing different scholarly literature. In the questionnaire, the respondents were asked whether the measures listed were effective or not in relation to QMS implementation, based on their experience, using a rating of five being “strongly agree,” 4 as being “agree”, 3 as being “neutral”, 2 as being disagree and 1 as being Strongly disagree.

According to the survey result, Table 15 presents the means, standard deviations, relative importance index and rank the five measures as described in the table below.

Table 16 Descriptive summary of QMS in relation to customer satisfaction

No.	Level of Effectiveness of QMS on Customer Satisfaction	Likert scale in frequency (Percent)					M	SD	RII	R
		5	4	3	2	1				
1	Number of disputes/claims has been reduced	6(50)	5(41.7)	1(8.3)	0(0)	0(0)	4.42	0.67	0.88	1 st
2	Number of reworks has been reduced	5(41.7)	7(58.3)	0(0)	0(0)	0(0)	4.42	0.51	0.88	1 st
3	Less number of defects	4(33.3)	8(66.7)	0(0)	0(0)	0(0)	4.33	0.49	0.87	2 nd
4	Information coordination; improved customers relationship, communication, and reporting	4(33.3)	6(50)	2(16.7)	0(0)	0(0)	4.17	0.72	0.83	3 rd
5	Improved quality of product	5(41.7)	6(50)	1(8.3)	0(0)	0(0)	4.33	0.65	0.87	2 nd

Notes: M-Mean, SD- Standard Deviation, RII-Relative Importance Index, R-Rank; Likert Scale: 1-Strongly disagree (mean<1.50), 2-Disagree (1.51-2.50), 3- Neutral (2.51-3.50), 4- Agree (3.51-4.50) and 5- Strongly agree (4.51-5)

Table 15 shows that the effectiveness measures for customer satisfaction of a construction project fall into one category, level 4 “agree” (3.51-4.5) for all five measures. The respondent’s 1st ranked that it would reduce the number of disputes/claims and number of reworks with RII=0.88 and mean=4.42. While information coordination; improved customers relationship, communication, and reporting; and improved quality of product is ranked second and third place with relative importance index of 0.87 and 0.83. Thus, the mean rating of the level of effectiveness of QMS on customer satisfaction is the fact that it reduces the number of disputes/claims and number of reworks.

4.2.9 The benefits attained by Contractors in implementing QMS

Since all the responding companies had achieved ISO 9001:2015 certification and implemented the system for a certain period, they were asked about the benefits achieved because of implementing the QMS. 66.7% of the respondents agreed on all the described benefits of QMS implementation. From the listed benefits, one of the benefits which all the respondents held the most advantage for their companies was better documentation control. This result is in full

agreement with the findings of Rediet (2018), which was that QMS leads to better quality and improves documentation and traceability. The result of this survey is summarized in the table 16.

Table 17 Descriptive summary of benefits achieved by Implementing QMS

No.	Benefits Achieved by Implementing QMS	Likert scale in frequency (Percent)			M	SD	RII	R
		No	Mild	Yes				
1	Increased Customer satisfaction	0(0)	3(25)	9(75)	2.75	0.45	0.92	2 nd
2	Improved company's management & work efficiency (Clear job description)	0(0)	6(50)	6(50)	2.5	0.52	0.83	4 th
3	Improved communication	0(0)	3(25)	9(75)	2.75	0.45	0.92	2 nd
4	Better documentation control	0(0)	0(0)	12(100)	3.0	0	1.00	1 st
5	Enhanced company's corporate image	0(0)	4(33.3)	8(66.7)	2.67	0.49	0.89	3 rd
6	Improved quality of work done (reduce wastage and less defects)	0(0)	6(50)	6(50)	2.50	0.52	0.83	4 th
7	On time project completion	3(25)	6(50)	3(25)	2.00	0.74	0.67	6 th
8	Increased number of projects undertaken	1(8.3)	4(33.3)	7(58.3)	2.50	0.67	0.83	4 th
9	Increase process efficiency which will also increase profits	0(0)	4(33.3)	8(66.7)	2.67	0.49	0.89	3 rd
10	Continuous improvement of the organization's overall performance.	0(0)	4(33.3)	8(66.7)	2.67	0.49	0.89	3 rd
11	Cost and time saving through avoidance of mistakes and reworks	2(16.7)	3(25)	7(58.3)	2.42	0.79	0.81	5 th

Notes: M-Mean, SD- Standard Deviation, RII-Relative Importance Index, R-Rank

As shown in the table above list of eleven possible benefits of implementing QMS were recaptured from literature review and the data shows the level of benefits achieved in the process of implementing QMS fall mainly into the two categories, level '1' yes (mean = 2.51 – 3.00) ranked 1st to 3rd with RII value of 1,0.92 and 0.89 respectively and level '2' mild/somewhat (1.51 – 2.50) is ranked 4th to 6th place with RII value of 0.83,0.81 and 0.67 respectively. Hence, the mean rating of the benefits of implementing QMS shows the system improved better documentation control and communication within the certified construction companies.

4.2.10 Challenges of QMS Implementation by Contractors

According to Teklebrhan (2014), findings the main challenges was resistance to change by staff especially engineers i.e., unwillingness to implement and maintain the QMS. Similarly, this study results shows that the main challenges face by the construction companies is lack of awareness and lack of employees' commitment and inconsistency of management action and decision making as shown in the table 17.

Table 18 Descriptive summary of challenges in Implementing QMS

No.	Difficulties in the process of implementing QMS	Likert scale in frequency (Percent)				M	SD	RII	R
		4	3	2	1				
1	Lack of awareness	6(50)	5(41.7)	1(8.3)	0(0)	3.42	0.67	0.85	1 st
2	Lack of employees' commitment and inconsistency of management action and decision making.	7(58.3)	1(8.3)	1(8.3)	3(25)	3.00	1.35	0.75	2 nd
3	Insufficient of human resources to implement	2(16.7)	1(8.3)	2(16.7)	7(58.3)	1.83	1.19	0.46	5 th
4	Difficulty in understanding ISO 9001 terminology to integrate fully into company's operating procedures.	3(25)	2(16.7)	5(41.7)	2(16.7)	2.5	1.09	0.63	4 th
5	Management and staff complete their activity reports "at the last minute," prior to the conduction of an internal/external audit.	3(25)	4(33.3)	2(16.7)	3(25)	2.58	1.16	0.65	3 rd
6	Lack of participation from client and consultant	1(8.3)	1(8.3)	3(25)	7(58.3)	1.67	0.98	0.42	6 th
7	Lack of co-operation from sub-contractor	0(0)	1(8.3)	5(41.7)	6(50)	1.58	0.67	0.40	7 th
8	Lack of identified funding in the company for implementing QMS.	0(0)	0(0)	3(25)	9(75)	1.25	0.45	0.31	8 th
9	Poor planning of the system	3(25)	4(33.3)	1(8.3)	4(33.3)	2.5	1.24	0.63	4 th

Notes: M-Mean, SD- Standard Deviation, RII-Relative Importance Index, R-Rank; Likert Scale: 1- Not experienced (mean<1.50), 2- Very seldom experienced (1.51-2.50), 3- Sometimes experienced (2.51-3.50), 4- Often experienced (3.51-4)

To assess the main challenges faced during implementation of QMS in the construction companies, nine items of difficulties were assumed in the questionnaire which were drawn from literature review and the opinions from the respondents were sought. The data in Table 18 show that the level of difficulties in the process of implementing QMS fall into the three

categories, level ‘3’ sometimes experienced (mean = 2.51 – 3.00) ranked 1st to 3rd, level ‘2’ very seldom experienced (1.51 – 2.50) is ranked 4th to 7th and level ‘1’ not experienced ranked in 8th place. Meanwhile, the mean rating of the problems shows that the most considered challenges in QMS implementation were lack of awareness.

4.2.11 Remedies for Effective QMS Implementation by Contractors

The last part of the QMS questionnaire survey was designed to evaluate the remedies taken by the contractors when faced with challenges. A list of the most common strategies used related to QMSs in the construction industry was sourced from literature review. In the questionnaire, the respondents were asked to identify the remedies that the company adopted to overcome the problems in relation to QMS implementation, based on their experience, using a rating of yes, somewhat and no. Table 18 shows the summary of the response from the respondent’s.

Table 19 Descriptive summary of remedies to effectively implement QMS

No	Remedies for effective QMS implementation	Scale in frequency (%)			Mean	SD	RII	R
		No	Mild	Yes				
1	Giving training	1(8.3)	3(25)	8(66.7)	2.58	0.75	0.86	3 rd
2	High participation of top management	3(25)	4(33.3)	5(41.7)	2.17	0.83	0.72	7 th
3	Internal and external audit	0(0)	2(16.7)	10(83.3)	2.83	0.43	0.94	1 st
4	Strict supervision on site	0(0)	5(41.7)	7(58.3)	2.58	0.52	0.86	3 rd
5	Establish feedback system	0(0)	4(33.3)	8(66.7)	2.67	0.49	0.89	2 nd
6	Frequent direction-finding committee meeting	4(33.3)	3(25)	5(41.7)	2.08	0.98	0.69	8 th
7	Team-working approach	2(16.7)	2(16.7)	8(66.7)	2.5	0.75	0.83	4 th
8	Involvement of all employees in the documentation process.	3(25)	3(25)	6(50)	2.25	0.90	0.75	6 th
9	Launch quality campaign	2(16.7)	4(33.3)	6(50)	2.33	0.79	0.78	5 th

Notes: SD- Standard Deviation, RII-Relative Importance Index, R-Rank.

The data in table 18 shows the level of remedies fall into a mean value of (2.51-3.00) ranked from 1 to 3rd with a RII of 0.94,0.89 and 0.83 respectively and respondents with a mean value of (1.51-2.50) ranked from 4th to 8th.with RII 0.83,0.78, 0.75,0.72 and 0.69, respectively. Meanwhile, the mean shows that extensive internal and external audit, establishing feedback

system, giving training and strict supervision on site are the most recommended remedies in overcoming a challenge in implementing QMS.

4.3 Analysis of the Interview

In this research in addition to collecting data using quantitative approach, qualitative data were collected to identify the driving force to implement QMS, the challenges encountered, to assess how the companies measure customer satisfaction and to assess how often the internal and external audit is being conducted in the construction companies. The major motive for construction companies to establish and implement ISO 9001 based QMSs is identified as being to control project activities effectively and efficiently.

The respondents who are in top management explained in the interview that they lead by example and that they work towards creating a convenient internal environment for the employees, but the survey says otherwise. They have also explained that using a systematic approach to management is the other prioritized principle since it helps them in managing the interrelated processes within their construction company. They further explained that the implementation of this principle is necessary since there are different departments and subdivisions within each department in the organization, such as human resource, engineering, finance, procurement, store. Hence, the need for following this principle to run the construction process systematically using the QMS standards. The respondents have also mentioned that the fourth principle, process approach, is similarly followed as the system approach because the two principles are integrated actions as activities and resources are managed as a process.

Since a construction process has its procedure in the process approach like receive work order, review and evaluate work order, ensure availability of work methodology, prepare master plan schedule, review and adjust the master plan, communicate approved master plan to consultant, request construction materials and other resources, organize site, mobilization of construction materials and other resources, perform construction works, monitoring and inspection of works and reports, review work progress reports, take corrective actions, finalize construction work, review final construction works, approval, provisional handover of the work, final handover of the works and retain documented records.

The benefits mentioned in the interview by the contractors in implementing QMS like enhancing team spirit, instill discipline staff, reduce staff conflict, enhance job satisfaction, provide confidence to clients, reduce customer complaints, lower rejection rates and improved workmanship.

The major challenges mentioned by all construction companies was lack of awareness and employee's commitment: All construction companies agreed that awareness is the most critical problem encountered during the implementation of ISO 9001:2015 QMS. There are reasons mentioned by the respondents on why this problem occurred during interview. And the reasons are that most employees do not know what ISO all is about and it is hard for them to accept the concept, employees think that it is difficult to adapt to the recent changes caused by ISO. For example, following the working procedures mentioned in the Quality Manuals and Project Quality Plan (PQP) and employees think that extra work is a burden to them since they are already busy with their existing work and have not time to cope with extra work to implement the QMS. And the other employees are aware of how ISO works and benefits that comes with it but lacks commitment. They said that they know and implement it, but they did not follow all the procedures mentioned in the Quality Manual and Project Quality Plan (PQP). Except company E & F the rest of contractors said they have lack of resources especially company A, I and L often experienced insufficient of human resources in implementing ISO especially during the documentation preparation. While the rest of the contractors said they very seldom experience insufficient human resource in the process of implementing QMS.

Difficulty in understanding ISO 9001 terminology to integrate fully into company's operating procedures which also brought resistance from the staff and affected the performance of the QMS is another challenge mentioned by the respondents. Site staff are used to working under supervision rather than quality procedures and it required time to change their habit. The required quality documentation control and records have generated extra workload for them, and half of the respondents agreed that this is a difficulty yet to be overcome.

Company K often encounter problems in lack of cooperation from client, consultant and/or sub-contractor, who did not give full cooperation towards them even though they know that the contractors are implementing ISO. The client and consultants that they are working with

tend to do the works their own way. In contrast, the rest of contractors mentioned that they get full cooperation from their client, consultant and managed their subcontractors while few agreed, they have problems with their sub-contractor who failed in meeting the ISO requirements such as recorded transaction made in buying materials.

All the contractors mentioned during the interview that change in culture, low priority on quality, complexity and variability of construction process, ineffectiveness of quality policy, expensive to develop and implement the scheme and substantial documents and verifications are also the obstacles faced by the whole construction industry while adopting the QMS. Thus, training is either conducted by the ISO consultant hired by the company or other external bodies. Apart from that, the team working approach mentioned by the construction companies in performing task is a wise strategy whereby employees can share their knowledge, interests, and experiences to solve problems, and this is effective to increase their commitment towards the job.

Even though Internal and external audit was not included in the questionnaire all companies that have been interviewed conduct internal and external audit to ensure that the system implemented are working effectively. And when problems are encountered corrective action plan is prepared and issues corrective action clearance report once the problem is resolved in implementing the system. The frequency of internal audit and management review conducted is found to be the same and ranges from every 3 months to every year. On the other hand, respondents have said that they are externally audited at every year by external party who issued the certificate. However, the certificate is valid for three years.

4.4 Summary of Findings

The research attempted to study the construction practices related to quality management system among 12 ISO 9001:2015 certified contractors in Addis Ababa. According to the data collected by questionnaire survey, using SPSS software for analysis, the summary is as follows:

- Among the seven principles of the ISO 9001:2015 respondents mostly considered "customer satisfaction" to be of the utmost importance. While engagement of people is partially implemented from the rest of the principles which are process approach,

continual improvement, Evidence-based decision making and relationship management.

- All respondents ranked "management commitment" as the most essential element. Consequently, it could be concluded the achievements of any quality management system depends significantly on the strong commitment of top managements and on exactly how customers are valued. To establish the usefulness of quality management system, quantifying quality improvement is important. Various instruments are out there for measuring quality improvement of construction processes. And such measurements constitute just the initial step towards the never-ending cycles of continual process improvement. The goal is using the outcomes obtained from such dimensions to attain continuous improvement and consequently satisfy the customers' ever-changing needs & requirements.
- The motives of implementing the QMS is to ensure higher productivity within the organization and to compete with international construction companies where ISO certification is mandatory to participate in tender.
- In terms of the level of effectiveness in relation to quality, time, cost, and customer satisfaction it can be concluded that product and service quality of a construction can be improved by effective implementation of QMS. more reliable construction project scheduling and delivery, and reduction of time by preparing documented procedures that be easier to follow by employers. A well-managed supply chain will reduce the expense in relation to cost of project.
- The construction companies measure the customer satisfaction in different methods like verbal communication with clients in the project sites, by proper review of customer compliant and customer survey but the main problem is after assessing the problem remedies/corrective action plans are not implemented within the corrective action plan time.
- The study findings additionally suggests that enhanced company's management & work efficiency as the most important advantage from the implementation of the system while lack of awareness on the system among staff members is regarded as the

significant issue. It is suggested audit and training (external and internal) need to be increased to get over those implementation problems

- There is lack of intensive internal audit in all the construction companies, the surveillance audit conducted by the external auditors is inadequate in identifying the gaps on the system because the files for the audit are last minute fabricated documents.
- The QMS has improved the overall organization performance but somehow there is a limitation on the sustainability of the system on the effectiveness of the implementation in relation to the project quality, cost, time, and customer satisfaction.

CHAPTER 5 Conclusions and Recommendations

This chapter summarizes the conclusions of the research study in relation to the research objectives. It then presents the contributions of the study by providing recommendations and direction for further research.

5.1 Conclusions

The objective of the study was to evaluate the current practices of QMS, benefits, and challenges in implementing quality management system (QMS) on ISO 900:2015 licensed construction companies in Ethiopia. This goal was attained from the collection and analysis of data, with the incorporation of extant literature to address the problems concerning the effectiveness of quality management system implementation.

The following conclusions are derived in line with the objective of this research.

1. Regarding the effectiveness in terms of quality, time, cost, and customer satisfaction, it can be concluded that product and services quality of a construction can be improved through effective implementation of QMS.
2. It can be concluded that the effectiveness of QMS implementation for customer satisfaction is higher than the other QMS principles in construction companies.
3. All the certified construction companies have benefited from ISO 9001:2015 certification. Especially in documentation control, customer satisfaction and improvement in the internal communication.
4. The major challenge faced by the construction companies is lack of awareness among the employers and lack of commitment among the top management as well as the employees.
5. Intensive internal and external audits and the establishment of a feedback system will make a significant contribution to overcoming the challenges of implementing QMS.

5.2 Recommendations

Based on the discussion and major findings of the study the following recommendations were forwarded

- The construction companies should establish a feedback system to collect feedbacks and act on the gap identified regarding the system and give training among the staff in all level management, especially fresh staff should be trained before deploying in the work environment to avoid the lack of awareness problem which is the main challenges in implementing effective and integrated quality management system.
- The top management must closely monitor and control the status of the employees QMS implementation according to the company plan and objectives. Team working approach needs to be improved and top managers should involve all employees in the documentation process.
- Intensive management review meetings should often be conducted take place to close the gaps and take corrective actions where there is nonconformity, and it will also smooth the document control and the external audit process.
- The Government bodies should enforce a law to encourage contractors to be ISO 9001:2015 certified and implement the QMS, ISO certification must be a mandatory requirement to participate in any kind of tender.
- Contractors should give great attention on the factors that affect quality, cost, time, and customer satisfaction.
- Civil engineering as well as Construction and Technology Management students and all graduate engineers must be qualified to develop a quality culture to easily grasp the concept of Quality Management System (QMS). The courses of civil engineering undergraduate classes must consist of quality components after which the graduate engineers might provide themselves with quality expertise in conducting their tasks.

5.3 Future Research Recommendations

- Research can be conducted on identifying a framework to improve the sustainability of the QMS in the construction sector.

References

- [1] Aba, E. K. & Badar, M. A., 2013. A Review of the Impact of ISO 9000 and ISO 14000 certifications. *The Journal of Technology Studies*, Vol.39 No.1, pp. 42-50.
- [2] Aba, E.K, Badar, M. & Hayden, M.A., 2015. Impact of ISO 9001 Certification on Firms Financial Operating Performance. *International Journal of Quality & Reliability Management*, Vol.33 No.1, pp. 78-89.
- [3] Abdul Hakim Mohammed, Maizan Baba, L.Jawahar-Nesan & Norhanim Zakaria, 2006. ISO Quality Management System: A Lesson from Klia, Malaysia: Intensification of Research in Priority Areas.
- [4] Abdullah, M. N. b., 2006. A Case Study on Quality Management System in Construction Project, Malaysia Technology University, Skudai: Msc Thesis, Faculty of Civil Engineering, Department in Construction Management.
- [5] Ahmad, M., Mohd Yusof, S. & Mohd Yusof, N., 2012. Comparative Study of Quality Practices Between Japanese and Non-Japanese Based Electrical and Electronics Companies in Malaysia: A Survey. *Journal Technology*, Vol.47 No.1, pp. 75-89.
- [6] Ahmed, S.M., Aoieong, R.T., Tang, S.L. & Zheng, D.X.M., 2005. A Comparison of Quality Management System in the Construction Management Industries of Hong Kong and the USA. *International Journal of Quality & Reliability Management*, pp. Vol.22 No.2, pp. 149-161.
- [7] Ali, M. C., 2014. Exploring The Potential of Integration Quality Assessment System in Construction (QLASSIC) With ISO 9001 Quality Management System (QMS). *International Journal of Quality Research*, Vol. 8 No.1, pp. 73-86.
- [8] Anup W. S., Arun Kumar H., Saqhi S., 2015. Study of Quality Management System in Construction. *International Research Journal of Engineering and Technology (IRJET)*, Vol.02 No.2, pp. 462-467.
- [9] APB Consultant, 2021. ISO 9001:2008-Quality Management System. Available at: <http://isoconsultantpune.com/iso-90012008-quality-management-system/iso-90002005/fundamentals-of-quality-management-systems-as-per-iso-9000/> [Retrieved date:21/06/2021], Time: 10:50 AM
- [10] ASQ, 2021. Learn About Quality. Available at: <https://asq.org/quality-resources/quality-management-system> [Retrieved date:21/06/2021], Time: 1:30 AM
- [11] Aura, 2019. QMS Quality First. Available at: <http://www.auraqualitymanagement.com/blog/importance-quality-management-systems-construction-industry/> [Retrieved date: 05/07 / 2021], Time: 11:55 PM

- [12] Biniyam Asefa, 2018. Assessment of Quality Management Practices of Ethiopian Contractors Focused on Building Construction Projects, Addis Ababa, Ethiopia: MSc Thesis, Addis Ababa Institute of Technology, School of Civil and Environmental Engineering, Department of Construction Technology and Management.
- [13] Birhanu, B., 2011. Quality Management and Engineering Practice and Challenges in Ethiopia, Addis Ababa, Ethiopia: Doctor of Philosophy in Industrial Engineering, Addis Ababa Institute of Technology, Department of Mechanical Engineering.
- [14] Birhanu, B. & Daniel, K., 2014. Quality management practice in Ethiopia. African Journal of Business Management, Volume 8(17), pp. 689-699.
- [15] Birhanu, B. & Daniel, K., 2014. Quality management practice in Ethiopia. African Journal of Business Management, Volume 8(17), pp. 689-699.
- [16] Chini, A. R. & Valdez, H. E., 2003. ISO 9000 and the U.S. Construction Industry. Journal of Management in Engineering, 019(002).
- [17] Christopher, S. M., 2018. PECB Insights, ISO 9001:2015 Quality Management Systems-Requirements. Available at: <https://insights.pecb.com/already-implemented-iso-9001-company-align-project-qms/> [Retrieved date: 20/08/2021], Time: 11:55PM
- [18] Coffey, et al., 2011. Quality Management System and Construction Performance. Bangkok, Thailand, In Proceedings of:2011 IEEE International Conference on Quality and Reliability.
- [19] Daniel, K. & Fasika, B., 2003. Quality Management: Efforts & Problems in Ethiopian Manufacturing Industries. Journal of EEA, Volume 20, pp. 56-74.
- [20] David, B., 2019. Master Control. Available at: <https://www.mastercontrol.com/gxp-lifeline/what-is-a-quality-control-system-and-how-can-an-eqms-give-it-a-boost/>[Retrieved date : 20/09/2021], Time: 01:50 PM
- [21] Daw, A., Aslihan, K. & Muteb, A., 2016. Application of Quality Management Systems (QMS) in Construction Industry. Detroit, Michigan, USA, Proceedings of the 2016 International Conference on Industrial Engineering and Operations Management, September 23-25.
- [22] Ekpenyong, E. E., 2016. Assessment of Quality Management Practices of Construction Companies in Akwa-Ibom State, Akwa Ibom State, Nigeria: MSc Thesis, Uyo University Faculty of Environmental Studies School of Postgraduate Department of Construction Management
- [23] Fekade Selassie, G., 2020. Quality Control and Quality Assurance Practices in Selected Finishing Works: The Case of Public Building Construction Projects in Addis Ababa, Addis

- Ababa, Ethiopia: MSc Thesis, Addis Ababa Institute of Technology, School of Graduate Studies, Department of Construction Technology and Management.
- [24] George, D. & Mallery, P., 2003. SPSS for Window step by step: A simple guide and reference. 4th ed. Boston: Allyn & Bacon.
- [25] Harris, F. & McCaffer, R., 2001. Modern Construction Management. 5th ed, London: Blackwell publishing.
- [26] ISO 9000:2005, 2005. Quality management systems — Fundamentals and vocabulary. Available at: <https://www.iso.org/obp/ui/#iso:std:iso:9000:ed-3:v1:en> [Retrieved date: 20/09/2021], Time: 08:50 PM
- [27] ISO 9000:2015, 2021. ISO 9000:2015 Quality management systems — Fundamentals and vocabulary, Requirements. Available at: <https://www.iso.org/standard/45481.html> [Retrieved date: 20/09/2021], Time: 11:50 PM
- [28] ISO 9001:2008, 2021. APB Consultant. Available at: <http://isoconsultantpune.com/iso-90012008-quality-management-system/iso-90002005/fundamentals-of-quality-management-systems-as-per-iso-9000/> [Retrieved date: 12/08/2021], Time: 10:50 AM
- [29] ISO 9001:2015, 2021. Standards Stores since. Available at: <https://the9000store.com/iso-9001-2015-requirements/what-is-iso-9001-quality-management-system/> [Retrieved date: 12/08/2021], Time: 10:05 AM
- [30] ISO, 2015. Quality Management Principles, Geneva, Switzerland: International Organization for Standardization.
- [31] ISO, 2019. Quality Magazine. Available at: <https://www.qualitymag.com/articles/95235-what-is-iso-90012015-and-why-is-it-important> [Retrieved date: 12/09/2021], Time: 11:05 AM
- [32] ISO, 2021. ISO 9000 Family Quality Management. Available at: <https://www.iso.org/iso-9001-quality-management.html> [Retrieved date: 08/08/2021], Time: 10:50 AM
- [33] Kelderman, E., 2020. Quality and Compliance Hub. Available at: <https://www.qualio.com/blog/the-9-core-elements-of-a-quality-management-system> [Retrieved date: 10/09/2021], Time: 1:05 AM
- [34] Keng, C. T. & Kamal, Z. S., 2016. Implementation of ISO Quality Management System in Construction Companies of Malaysia. 03(No 01).
- [35] Keng, T. C. & Abdul-Rahman, H., 2011. Study of Quality Management in Construction Projects. 10(7).
- [36] Kothari, C., 1985. Research Methodology, Methods and Techniques, New Delhi: Wiley Eastern Limited.

- [37] Kumaraswamy, M. M. & Dissanayaka, S. M., 2000. ISO 9000 and beyond: from a Hong Kong construction perspective. *Construction Management and Economics*, 18(7), pp. 783-796.
- [38] Lance, S. & Coleman, B., 2021. Quality Assurance and Quality Control. In: ASQ, ed. *The ASQ Certified Quality Auditor Handbook 5th ed*: ASQ Quality Press.
- [39] Lau, A. & Tang, S., 2009. A survey on the advancement of QA (quality assurance) to TQM (total quality management) for construction contractors in Hong Kong. *International Journal of Quality & Reliability Management*, 26(5), pp. 410-425.
- [40] Lawson, J., 2021. *An Introduction to Acceptance Sampling and SPC with R*. 1st ed.: Chapman and Hall/CRC Press.
- [41] Leong, T., Zakuan, N. & Saman, M., 2014. Review of Quality Management System Research in Construction Industry. *International Journal of Productivity and Quality Management*, Vol. 1, No. 1, pp. 105-123.
- [42] Sui Pheng, L. and Yeo, H. K. C., 1997. ISO Quality Assurance in Singapore's Construction Industry an update. *Structural Survey*, 3(15), pp. 113-117
- [43] Malkawi, A., 2016. *Understanding & Implementing QMS in accordance to ISO 9001:2008*, Amman-Jordan: Global Matrix Consultation Co.
- [44] Manders, B., 2015. *Implementation and Impact of ISO 9001*(No. EPS-2014-337-LIS). ERIM Ph.D. Series Research in Management. Erasmus Research Institute of Management.
- [45] Mane, P.P. & Patil, J.R., 2015. Quality Management System at Construction Projects: A Questionnaire Survey, *International Journal of Engineering Research Applications*,5(3), pp. 126-130
- [46] Meretu, T., 2021. *The Impact of ISO 9001 Certification on Organizational Performance: The Case of Adam Spinning Factory.*, Addis Ababa, Ethiopia: Addis Ababa University, School of Graduate Studies in Quality Management and Organizational Excellence.
- [47] Mitra, A., 2016. *Fundamentals of Quality Control and Improvement*. Fourth ed. New Jersey and Canada: John Wiley & Sons.
- [48] Moatazed-Keivani, R., Ghanbari-Parsa, A. & Kagaya, S., 1999. ISO 9000 standards: Perceptions and experiences in the UK construction industry. . *Construction Management and Economics*, Volume 17, pp. 107-119.
- [49] Naoum, S., 2007. *Dissertation Research and Writing for Construction Students*. 2nd ed. UK: Butterworth-Heinemann: Oxford.
- [50] Neyestani, B. & Juanzon, J. B., 2017. Impact of ISO 9001 Standard on the Quality Cost of Construction Projects in the Philippines. *Proceedings of 2017 Manila International Conference*

- on “Trends in Engineering and Technology” (MTET-17) Jan. 23-24, 2017, Manila (Philippines).
- [51] Neyestani, B., 2016. Effectiveness of Quality Management System (QMS) on Construction Projects. De La Salle University, Department of Civil Engineering
- [52] Nitesh, S., 2014. Impact of Quality Management in Construction Projects, Riga, Latvian: Riga Technical University, Faculty of Engineering Economics and Management, The Student of Master Study Program in Civil Construction and Real Estate Management.
- [53] Owino, A., 2013. ISO 9001 Quality Management System Audit as an Organizational Effectiveness Evaluation Tool. International Journal of Information Technology and Business Management, 20(1), pp. 15-29.
- [54] Patel, C. S. & Pitroda, J., 2021. Quality Management System in Construction: A Review. Reliability: Theory & Applications, 60(1(60)), pp. 121-131.
- [55] Prado-roman, C., Del Castillo-Peces, C., Mercado-Idoeta, C. & Del Castillo-Peces, J., 2018. The effects of implementing ISO 9001 in the Spanish construction industry. Cuadernos de Gestion, 18(1), pp. 149-172.
- [56] Priya, T. A. & Anu, V. V., 2018. Remodeling the Quality Management System to Calculate the Quality Cost in Building Construction. International Research Journal of Engineering and Technology (IRJET), 05(11), pp. 812-815.
- [57] Purushothama, B., 2015. Implementing ISO 9001:2015. New Delhi, India: Woodhead Publishing India Pvt Ltd.
- [58] Quality Magazine, 2019. Quality Magazine. Available at: <https://www.qualitymag.com/articles/95235-what-is-iso-90012015-and-why-is-it-important>
[Retrieved date: 20/07/2021], Time: 8:05 AM
- [59] Rabiae, S. & Aziz, S., 2018. Applying Six Sigma in Smart Factory: Limits and Problems. ARPN Journal of Engineering and Applied Sciences, 13(20), pp. 8316-8325.
- [60] Rauzana, A., 2017. Implementation of Quality Management System in Construction. 6(12), pp. 173-179
- [61] Rediet, B. G., 2018. The Role of QMS Implementation on Construction Project Performance: The case of Grade One General Contractors in Addis Ababa, Addis Ababa, Ethiopia: Addis Ababa University, School of Commerce College of Business and Economics.
- [62] Rene, S.-G., Faton, A., Eric, L. & Pierre, D., 2020. ISO 22301 Societal Security Business Continuity Management Systems, Whitepaper, New York: PECB - Professional Evaluation and Certification Board.
- [63] Rumane, A. R., 2017. Quality Management in Construction Projects. 2nd ed. CRC Press.

- [64] Said, I., Zainul, A. & Mohd Shafiei, M. W., 2006. Management Responsibility and Business Performance Between ISO 9000 and Non-ISO 9000 Certified Contractors in Malaysia, in: International Conference on Construction Industry 2006: Toward Innovative Approach in Construction and Property Development
- [65] Said, I., Ayub, . A. R., Abd Razaki, A. & Tee, K. K., 2009. Factors Affecting Construction Organization Quality Management System in the Malaysian Construction Industry.
- [66] Samsudin, N. S., Ayob, S. M., Sahab, S., & Ismail, Z., 2012. The Advantages of Quality Management System in Construction Project. In Humanities, Science and Engineering (CHUSER),2012 IEEE Colloquium on pp. 38-41.
- [67] Samsudin, N. S., Ayop, S. M., Sahab, S., & Ismail, Z., 2012. Problems and Issues on the implementation of Quality Management System in construction projects. In Business, Engineering and Industrial Applications (ISBEIA),2012 IEEE Symposium on pp. 684-689.
- [68] Saunders, M. & Thornhill, A., 2009. Research methods for business students. 5th ed. London: Pitman Publishing imprint.
- [69] Selamawit, T., 2019. Effectiveness of Quality Management System (ISO 9001-2008) Implementation in Ethiopian Construction Consultants, Addis Ababa, Ethiopia: MSc Thesis, Addis Ababa Institute of Technology, Department of Civil and Environmental Engineering.
- [70] Sepani, S. & Thushangi, J., 2012. Quality Planning Process of Construction Contractors: Case Studies in Sri Lanka. *Journal of Construction in Developing Countries*, 17(1), pp. 101-114.
- [71] Shaari, N., Abdullah, M. N., Sheng, Z. S. & Afiq Lokman, M. A., 2017. Quality Management System in Contractor Organizations: An Empirical Study on Costs and Benefits of ISO 9001:2008 Implementation. *International Journal of Real Estate Studies*, 11(5).
- [72] Shamma-Toma, M., Seymour, D. E. & Clark, L., 1996. The effectiveness of formal quality management systems in achieving the required cover in reinforced concrete. *Construction Management and Economics*, 14(4), pp. 353-364.
- [73] Sharabi, M., 2015. Customer Focus. *Encyclopedia of Quality and the Service Economy*, pp. 114-118.
- [74] Souki, G. & Cid, G., 2008. Perceived Quality, Satisfaction and Customer Loyalty: An Empirical Study in the Mobile Phones Sector in Brazil. *International Journal of Internet and Enterprise Management*, 10 October, 5(4), pp. 298-314.
- [75] Spedan, 2018. A short history of ISO 9001 quality management. [Online] Available at: <https://spedan.co.uk/blog/iso-9001-quality/a-short-history-of-iso-9001-quality-management> [Retrieved date: 20/10/2021], Time: 8:05 AM

- [76] Stanton, K., 2020. Quality & Compliance Hub, the 5 Noticeable Benefits of Implementing a Quality Management System in 2021. Available at: <https://www.google.com/amp/s/www.qualio.com/blog/the-5noticeable-benefits-of-implementing-a-quality-management-system%3fhs> [Retrieved date: 07/08/2021], Time: 8:05 PM
- [77] Tan, C.-K. & Abdul-Rahman, H., 2011. Study of Quality Management in Construction Projects. *Chinese Business Review*, 10(7), pp. 542-552.
- [78] Tang, S. & Kam, C., 1999. A survey of ISO 9001 implementation in engineering consultancies in Hong Kong. *International Journal of Quality & Reliability Management*, 16(6), pp. 562-574.
- [79] Tang, S., Syed M. Ahmed, Raymond T. Aoieong & S.W. Poon, 2005. *Construction Quality Management*. Hong Kong, China: Hong Kong University Press.
- [80] Team, C. N., 2020. List of Registered Construction Companies in Ethiopia. Available at: <https://cconlinenews.com/2020/07/22/list-of-registered-construction-companies-in-ethiopia-2/> [Retrieved date: 20/07/2021], Time: 10:55 PM
- [81] Teklebrhan, K., 2014. *Assessment of Impact of ISO 9001 Certification on Ethiopian Construction Companies*, Addis Ababa, Ethiopia: Addis Ababa Institute of Technology, School of Civil and Environmental Engineering.
- [82] UN Centre for Regional Development, A. O., 2000. *Project planning, implementation, and evaluation: a training manual*. UNCRD textbook and training material series, UNCRD (05)/UN22/No.8(ISBN/ISSN 490623674X), pp. xi, 238 p.
- [83] Veitch, C., 2018. *The Construction Industry in Ethiopia*. Available at: <https://www.whoownswhom.co.za> [Retrieved date: 2/08/2021], Time: 12:55 PM
- [84] Wang, B.-B. S., 2001. *ISO 9001:2000 Standard Quality System Manual*, California: California State University, Dominguez Hills. ProQuest Dissertations Publishing.
- [85] Watson, P. & Howarth, T., 2011. *Construction Quality Management Principles and Practice*. 1st ed. New York: Spon Press.
- [86] Wieland Brookes, 2020. Wieland Brookes. Available at: <https://www.wieland-brookes.com/en/company/about-us> [Retrieved date: 01/09/2021], Time: 2:45 PM
- [87] Willar, D., 2012. *Improving Quality Management System Implementation in Indonesian Construction Companies*. PhD Thesis. Queensland University of Technology, Indonesia
- [88] Willar, D., Coffey, V. & Trigunarsyah, B., 2015. Examining the Implementation of ISO 9001 in Indonesian Construction Companies. *TQM Journal*, 27(1), pp. 94-107.

- [89] Xiao, H. & Proverbs, D., 2002. The performance of contractors in Japan, the UK and the USA: An evaluation of construction quality. *International Journal of Quality & Reliability Management*, 19(6), pp. 672-687.
- [90] Yohannes Kefyalew, 2020. *Quality Management Practices in Building Construction Companies in Ethiopia in The City of Addis Ababa*, Addis Ababa, Ethiopia: MSc Thesis, Addis Ababa University College of Business and Economics, School of Graduate Program, Department of Quality Management and Organizational Excellence

Appendix-A Steps in QMS Implementation Process

STEP 1: Evaluate the organization's objectives and targets for implementing ISO 9001

The need for a QMS may arise from repeated customer complaints, frequent warranty returns, delayed deliveries, too high inventories, frequent production hold-ups or a high level of rework or rejection of products or services. Also it could be that the need for implementing ISO 9001 comes from the market, that is demanding a certified QMS, or otherwise it is impossible to operate in this market, or supply this dominant customer. Strong technological driven markets such as the aircraft and automotive business put this demand on their contractors and subcontractors for cost reasons but also for safety and liability reasons. This third party certification demonstrates the abilities of the organization to the potential customer. At this stage, identify the goals and objectives which should be achieved through a QMS, such as an improved company structure, greater efficiency, better profitability, reliable supplier etc. Introduce the Eight Quality Management principles to top management and get them motivated and committed to apply to these principles.

Checklist at this stage:

1. Check that the management has adopted the 8 leadership principles and is motivated and committed to apply them.
2. Communicate the objectives and targets for the implementation of the QMS with all the staff.

STEP 2: Obtain knowledge about the ISO 9000 family and appoint a management representative

Decide on the responsibilities of the person who will be involved in developing and documenting the QMS, including the appointment of a management representative who will oversee the implementation of the QMS. The person made responsible for the process of implementing the QMS should understand the requirements of ISO 9000 and 9001 and read the contents of ISO 9004.

Checklist at this stage:

1. Check to see that the management representative should have been appointed at this stage.
2. Check that the contents and the philosophy of ISO 9000 and 9001 have been made clear and have been accepted.

STEP 3: Organize the resources

Decide on the responsibilities of the person who will be involved in developing a documenting the QMS, including the appointment of a management representative who will oversee the implementation of the QMS. Establishing a project or ISO-team may also prove to be useful to oversee progress and in providing resources wherever required. The ISO team should consist of involved employees from different levels. Some authority can be given by top management to speed up the process. If within the organization no adequate competence is available, or no resources such as time and knowledge can be made available, then a consultant should be appointed. Before doing so, it is good to realize that with subcontracting a part of the implementation process, a part of the knowledge and the commitment is lost. An organization can learn more and better from its mistakes and own developments, than from just doing what a consultant is recommending. Prepare a cost estimate and procure and allocate the resources for this project. Raise commitment from the top management.

Checklist at this stage:

1. Check that the management has decided upon the individual who will develop the QMS and about its authority.
2. At this stage, check that the supporting ISO-team is established and the objectives for the team should have been made clear.
3. Check if commitment has been made at this stage to the implementation process, if not, it should be stopped here.
4. Don't continue if there is no support group such as an ISO-team or a similar solution.
5. Check that the needed resources such as manpower, money and time have been made available to the Management Representative and the ISO-team.

STEP 4: Raise awareness and provide training:

Raise awareness about QMS requirements amongst all personnel performing activities and tasks that affect quality. Plan for and provide specific training on how to develop quality manual, procedures and work instructions. Besides that, it is important to instruct people how to identify and implement improvement processes and how to audit compliance with the QMS. Appoint a certain number of people to be the internal auditors and provide sufficient training. The ISO-team and/or the consultant should be resources for assistance during the training.

Checklist at this stage:

1. Check that training has been provided to the people involved in the writing of procedures and work instructions. Make sure that the written documents reflect the actual situation and not the desired situation.
2. Check if a number of people have been selected as internal auditors and that the internal auditor training has been provided.
3. Check that the ISO-team assist in providing insight into the QMS to the other employees by means of presentations, newsletters and other ways of communication.
4. Develop forms that can replace difficult status reporting and provide instruction on how to use them.

STEP 5: Gap Analysis

Evaluate the gaps between the existing QMS and the requirements of ISO 9001:2008. Prepare how to bridge these gaps, including the planning for any additional resources required. Gap analysis may be carried out through self-assessment, by the ISO-team or by an external consultant.

Checklist at this stage:

1. Check that the gap analysis has been carried out and study the outcome.
2. With this analysis it should be possible to identify the gaps when it is compared with the ISO 9001 QMS

3. Check that a plan has been developed to bridge the found gaps. Make sure that the plan also contains a time schedule and that the actions are realistic and can be finished in time.
4. Check that the results of the gap analysis and the actions to bridge the gaps have been reported to top management and that management is also committed.

STEP 6: Product realization processes

Review clause 7 of ISO 9000:2008 relating to Product Realization to determine how the requirements apply or do not apply to the company's QMS. The processes covered by this clause include:

- Customer related processes.
- Design and development.
- Production and service provision.
- Control of measuring and monitoring devices.

Note that if the company is not responsible for preparing the design of the product, it can exclude the requirement for design and development from the QMS, as long as the reasoning is mentioned in the quality manual.

Flow chart each process in detail and discuss these flowcharts with the experts, in other words, the people that work with these processes. Draft the framework of the quality management system and identify the supporting documents. Then develop the QMS documentation.

Checklist at this stage:

1. Check to see that all the processes have been properly documented.
2. Have this documentation done by the experts, the people that are responsible for these processes.
3. Check on the requirements of the standard and exclude the elements that are not applicable to the organization.
4. Get the approval from top management for these exclusions

STEP 7: Planning and time frame

In this stage the allocation of the resources for the QMS project should be defined. Prepare a complete plan including the plan to close the gaps identified in the Gap Analysis, to develop the QMS processes. In the plan, include activities to be performed, resources required, responsibilities and an estimated completion time for each activity. Build in check point to assure in time completion. Clause 4.1 and 7.1 of ISO 9000:2008 provide information that should be used when developing the plan. The total time required for each phase (planning, documentation, implementation and evaluation) depends on the extent of the gaps in the existing QMS. Communicate the master plan to all staff, but especially the ISO-team and the people involved.

Checklist at this stage:

1. Check that the plan is complete, including the actions to bridge the gaps, a time schedule and the allocation of the resources such as manpower, money and time.
2. Check that enough effort has been made to communicate the plan and the result of it to all staff. If needed provide extra information to key people and the ISO-team.

STEP 8: Draft a Quality manual and develop a Quality Policy

Draft the quality policy for the organization. Get the policy committed by top management. Make sure that the policy is a strong statement, original and applies to the organization. In the quality manual:

- Include how the QMS applies to the products, processes, locations and departments of the organization.
- Exclude any requirement with justification if applicable.
- Refer to or include documented procedures (if available already) for QMS.
- Describe the interaction between the processes of the QMS, e.g. the interaction between product realization processes and other management, measurement and improvement processes.

Checklist at this stage:

1. Check that there is an adequate policy developed, that top management is committed and it is a strong statement. Do not continue without this policy statement.
2. Check that everybody in the organization has seen it, understands it and can repeat it in his/her own words.
3. Check that the QMS manual is ready. Don't continue without an approved manual.
4. Check that the requirements from the standards are fulfilled and that reference is made to at least six procedures, but no more than that are needed.
5. Keep it simple.
6. If there is still not sufficient commitment from top management, don't continue.

STEP 9: Draft the Documentation, design the QMS and implement it

The implementation has two parts. The implementation of the QMS, and that of the supporting paperwork. The implementation of the QMS is another way of working. Define the structure and get the people involved committed to work accordingly. Introduce the quality manual to the top management. Explain the document structure and how it fits in the QMS. After top management introduction, middle management should be made aware of the document structure. Top management should be showing that they are working according to the leadership principles.

After companywide commitment, procedures have to be written. ISO 9000 outlines clearly what has to be documented. What is not needed can be decided by the organization. In principle the employees that work with the documents must write these procedures. The procedures should reflect the actual situation, not the desired one. After the completion and implementation of the procedures, the next level will be the work instructions. Here the same system applies. Get the experts to describe their work and activities.

Finally a complete documentation set should be available. It should be noted that only six procedures are required by the standard. Key is that the people involved, work according to these documents. Maintain the QMS for three months before internal auditing should take place. Correct the QMS where needed.

Checklist at this stage:

1. Check that the elements of the standards are implemented in the organization.
2. Elements such as continual improvement, leadership principles and customer orientation.
3. Check that all the needed procedures have been developed and that the work instructions have been written.
4. Check that the process owners are involved in the development of the work instructions.

STEP 10: Carry out internal audits

During the phase of implementation of some three to six months after the documentation has been written, the trained auditors should carry out one or two internal audits covering all activities for the QMS, and concerned management should take corrective action on the audit findings without delay. Wherever required, revise the manuals, procedures and objectives. After each internal audit, the top management should review the effectiveness of the system and provide resources for corrective actions and improvements.

Checklist at this stage:

1. Check that the responsible people have been trained for the internal auditor function.
2. Record their training results and data.
3. Check that internal auditors do not audit their own department or work area.
4. Check that the results of the internal audits are fed back into the system and lead to improvement of the QMS, the processes and the documents.
5. Check that the results of the internal audits are reviewed on top management level and that appropriate action has been taken.
6. Check that there is a time schedule for internal audits and that it is maintained.

STEP 11: Conduct a Management Review

It is important in this stage to have a formal management review that shows the commitment of all levels. The recommendations from this review have to be carried out. Use the Management Review procedure developed for the organization.

Checklist at this stage:

1. Check that the result of the management review is functioning well and that all people involved know what is expected from them. Check the involvement and commitment of the top management.
2. Check that actions are taken and decisions are made.
3. Check that the main focus is on the customer s satisfaction.
4. Check that the decision makers are present.

STEP 12: Pre-assessment. Apply for certification

Carry out a pre-assessment. Correct the QMS and the documentation where needed. Re-assessment can be done with the help of an external certification body, but also by local consultants or by consultants from the branch organization. On satisfactory completion of the previous step, and if the company decided to obtain third party certification, an application for certification should be made to an certification body.

Checklist at this stage:

1. Carry out a pre-assessment to win trust and confidence among the people involved in the certification process.
2. Check that actions are taken and decisions are made based on the results of the pre-assessment.
3. Check that the right partner has been found to carry out the pre-assessment.
4. Check that a certification body has been approached for the final assessment.

STEP 13: Conduct periodic evaluations and initiate corrective and preventive actions

After certification, the organization should periodically conduct internal audits to review the effectiveness of the QMS and see how it can be continually improved. The organization should evaluate periodically if the purpose and goals for which the QMS was developed are being achieved, including its continual improvement.

It is needed to look at the organization's overall systems performance and then decide when and where the most effective improvements can be realized. Then objectives have to be set for those improvements and a periodic evaluation has to be conducted to monitor achievements. Improvements could be the reduction of cycle time within a process or the reduction of contamination in a manufacturing process.

Checklist at this stage:

1. Check that periodically internal audits are planned and conducted.
2. Check that the non-conformities from the final assessment will be solved as soon as possible.
3. Check that the organization will review its goals and objectives on a regular basis.
4. Check that management reviews are planned and conducted periodically

STEP 14: Evaluation

The certification is certainly not the last phase. The people involved need to measure the success of the implementation of the QMS during the implementation process and by the conclusion of the process. Measurements should be made against the original aims and goals and the key indicators of an effective QMS as stated below:

Checklist at this stage:

1. Check that senior management is fully committed to the QMS and owns the appropriate processes.
2. Check that the QMS is designed around business processes and not around ISO 9001 or any other standard.
3. Check that staff knows how to access the QMS documentation.
4. Check that visibility of processes and the clarity of the instructions in the QMS documentation set are clear, concise, readable and understandable. The people involved maintain their own documents
5. Check that the organizational culture is a culture of opportunities, focused around continual improvement rather than a person-to-blame culture.

6. Check that the quality management representative is a key organization person rather than a sideline person.
7. Check that internal auditing is seen as adding value and part of the continual improvement of the QMS.
8. Ensure that there is Continual improvement in system.
9. Keep up with regular internal audits and Management Reviews. (Consultant, 2021)

Appendix-B List of ISO 9001:2015 Certified Contractors in Ethiopia Until August 25, 2021

No.	Name of Company
1	Aser Construction
2	Anchor Foundation Specialist PLC
3	Bamacon Construction
4	Ethiopian Construction Works Corporation
5	Gemeshu Beyene Construction PLC
6	Giga Construction
7	Gutema Firisa Construction
8	Kushladder Construction
9	Markan Construction
10	Mesay Oli Construction
11	Tekleberhan Ambaye Construction Plc
12	Tesfaye Legesse Construction
13	TNT Construction & Trading
14	Rama Construction PLC
15	Zamra Construction PLC

Appendix-C Questionnaire

ADDIS ABABA UNIVERSITY
School of Civil and Environmental Engineering
Addis Ababa Institute of Technology

August, 2021

Dear Respondents,

I am a post-graduate student in Construction Technology and Management at Addis Ababa Institute of Technology. I am presently engaged in primary and secondary data collection to assess Quality Management System (QMS) practice on ISO 9001:2015 Certified construction companies in Addis Ababa.

As part of my primary data collection, I have designed this questionnaire to seek your response.

The aim of this research is:

- To assess the practice and awareness of QMS on ISO 9001:2015 certified construction companies in Addis Ababa.
- To identify the effectiveness of QMS implementation in relation to customer satisfaction in Addis Ababa construction companies.
- To assess the major challenges and find remedies on the practice of QMS in Addis Ababa construction projects

Confidentiality:

I can assure you all information provided in this survey will be confidential, no name of companies or individuals will be identified in any subsequent research report, and all information collected will be used only for the purposes of academic research. If you have any questions regarding this survey, please do not hesitate to contact: Mahlet Kebede, on Phone No. +251-910-18-43-29 or Email: mahi.abeine@gmail.com.

Thank you for your interest in participating in the research!!!

Sincerely yours,

Mahlet Kebede, Graduate Student at Addis Ababa institute of Technology (AAiT)

Part 1: Questions Related to the Company

Please kindly respond to the following questions by ticking (✓) the appropriate box or writing your answer in the space provided.

1.1 Name of company (Optional) _____

1.2 Your position in the company _____

1.3 Number of projects executed in the last five years

Less than 10 11 to 20 more than 20

1.4 The firm's major clients

Public Private Cooperative

Others (please specify): _____

Part 2: Questions Related to the practice of ISO 9001 principles

Based on your experience, please tick (✓) the appropriate box which indicates the level of implementation of each major principle of ISO 9001 standard in your company.

4=Fully implemented 3= Minimally implemented 2= Yet to be implemented 1= Not Implemented

The eight major ISO 9001 Principles		4	3	2	1
2.1	Focuses on customer requirements and expectations.				
2.2	The leaders establish unity of purpose and direction and create conditions in which people are engaged in achieving the organization's quality objectives.				
2.3	Employees are fully involved and their abilities are empowered for the company's benefit.				
2.4	The company identifies, understands, and manages interrelated processes as a system.				
2.5	The company has a strategic objective for permanent and continuous improvement of overall performance.				

2.6	Decision-making is based on an analysis of relevant data and information.				
2.7	The company and its suppliers have a mutually beneficial relationship.				

Part 3: Questions Related to the practice of ISO 9001 elements

Based on your experience, please tick (√) the appropriate box which indicates the level of implementation of ISO 9001 elements in your company.

4=Fully implemented 3= Minimally implemented 2= Yet to be implemented 1= Not Implemented

The ISO 9001 elements		4	3	2	1
3.1	Management defines quality policy with a strategic goal				
3.2	A quality manual and supporting procedures have been created and are maintained.				
3.3	Clear and updated model of the organization’s structure and responsibilities of all individuals within the organization.				
3.4	Consistent product quality, operating efficiencies, compliance risks, customer satisfaction, and profitability.				
3.5	Creation and modification of any quality documentation is strictly controlled by established procedures.				
3.6	Customer satisfaction with product quality				
3.7	Work instructions, quality plans and workmanships standards, verify that each job is being done correctly.				
3.8	Test and inspection records are retained and preserved as part of the quality documentation system.				
3.9	Control charts, graphs and other method of analysis determine how well a process is working and facilitate continuous improvement.				

Part 4: Questions Related to QMS ISO 9001:2015 Implementation

The followings are related to the reason why your company was interested in implementing ISO 9001. please choose and mark “yes” if you agree with the statement, “somewhat” if you are neutral about it and “No” if you disagree

Why your company Implemented ISO 9001 QMS		Yes	Some what	No
4.1	Dissatisfaction with the previous mode of operation and its results			
4.2	Customer requirements			
4.3	For marketing purposes and to enhance the reputation of your company			
4.4	To compete with international construction companies where ISO certification is mandatory for tendering			
4.5	To increase employee motivation and participation			
4.6	To ensure higher productivity			
4.7	Lack of corporate commitment and inconsistency of management action and decision making.			

Part 5: Questions related to the effectiveness of QMS implementation in project quality

The following are related to the level of the effectiveness of QMS in construction projects quality. Please choose and mark and Based on your experience, please tick (√) the appropriate box which indicates the level of effectiveness in implementation of ISO 9001:2015 QMS in your company project quality/scope.

Please choose and mark “yes” if you agree with the statement, “somewhat” if you are neutral about it and “No” if you disagree.

Level of Effectiveness of QMS on quality		Yes	Some what	No
5.1	Project scope can match with the project proposal and compliance with contract specifications			
5.2	Quality assessment and control framework			
5.3	Product defect rate decreases			
5.4	Product and service quality improvement			
5.5	Quality incentive system; motivation for quality improvement			
5.6	Quality training/ meetings			

Part 6: Questions related to the effectiveness of QMS implementation in project time

The following are related to the level of the effectiveness of QMS in construction projects time. Please choose and mark and Based on your experience, please tick (√) the appropriate box which indicates the level of effectiveness in implementation of ISO 9001:2015 QMS in your company project time.

Please choose and mark “yes” if you agree with the statement, “somewhat” if you are neutral about it and “No” if you disagree

Level of Effectiveness of QMS on Time		Yes	Some what	No
6.1	Meeting proposed implementation timeliness with actual timeliness of the project completion			
6.2	Improved project delivery time			
6.3	Ability to help and solve problems of the project completion			
6.4	Reduction of delay as a result of turn over and rework			
6.5	Reduction of delay as a result of errors and change of scope by owners			
6.6	More reliable construction project scheduling and delivery			
6.7	Documented procedures are easier for the employees to follow toward reduction time			

Part 7: Questions related to the effectiveness of QMS implementation in project cost

The following are related to the level of the effectiveness of QMS in construction projects time. Please choose and mark and Based on your experience, please tick (√) the appropriate box which indicates the level of effectiveness in implementation of ISO 9001:2015 QMS in your company project cost.

Please choose and mark “yes” if you agree with the statement, “somewhat” if you are neutral about it and “No” if you disagree.

Level of Effectiveness of QMS on Cost		Yes	Some what	No
7.1	Budget and cashflow management			
7.2	Reduce cost of rework			
7.3	Increased return on investment (ROI) and profit can be caused by reduction of cost			
7.4	Improved resources consumption			
7.5	Optimizing performance can reduce expenses by efficient process management and resources			
7.6	Lower production costs			
7.7	A well-managed supply chain can reduce expenses			

Part 8: Questions related to the effectiveness of QMS implementation in customer satisfaction

The following are related to the level of the effectiveness of QMS in construction projects customer satisfaction. Please choose and mark and Based on your experience, please tick (√) the appropriate box which indicates the level of effectiveness in implementation of ISO 9001:2015 QMS in your company customer satisfaction.

Please choose and mark “yes” if you agree with the statement, “somewhat” if you are neutral about it and “No” if you disagree.

Level of Effectiveness of QMS on Customer Satisfaction		Yes	Some what	No
8.1	Number of disputes/claims has been reduced			
8.2	Number of reworks has been reduced			
8.3	Less number of defects			
8.4	Information coordination; improved customers relationship, communication, and reporting			
8.5	Improved quality of product			

Part 9: Questions related to Benefits of QMS implementation

The following are related to the benefit your company achieved by implementing the ISO 9001:2015 QMS. Please choose and mark “yes” if you agree with the statement, “somewhat” if you are neutral about it and “No” if you disagree.

Benefits Achieved by Implementing QMS		Yes	Some what	No
9.1	Increased Customer satisfaction			
9.2	Improved company's management & work efficiency (Clear job description)			
9.3	Improved communication			
9.4	Better documentation control			
9.5	Enhanced company's corporate image			
9.6	Improved quality of work done (reduce wastage and less defects)			
9.7	On time project completion			
9.8	Increased number of projects undertaken			
9.9	Increase process efficiency which will also increase profits			
9.10	Continuous improvement of the organization's overall performance.			
9.11	Cost and time saving through avoidance of mistakes and reworks			

Part 10: Questions related to the challenges of QMS implementation

The following statements are related to problems that companies mostly faces in relation to effective ISO 9001 implementation. please tick (√) the appropriate box which indicates whether your company has also experienced these problems.

4=Often experienced 3=Sometimes experienced 2=Very seldom experienced 1=Not experienced

Difficulties in the process of implementing QMS		4	3	2	1
10.1	Lack of awareness				
10.2	Lack of employees' commitment and inconsistency of management action and decision making.				
10.3	Insufficient of human resources to implement				
10.4	Difficulty in understanding ISO 9001 terminology in order to integrate fully into company's operating procedures.				
10.5	Management and staff complete their activity reports "at the last minute", prior to the conduction of an internal/external audit.				
10.6	Lack of participation from client and consultant				
10.7	Lack of co-operation from sub-contractor				
10.8	Lack of identified funding in the company for implementing QMS.				
10.9	Poor planning of the system				

Part 11: Questions Related to Remedies to Effective QMS Implementation

What strategies has your company adopted to overcome/minimize the problems that come across while implementing the QMS?

Please choose “yes” if you implemented, “somewhat” if you are neutral about it and “No” if you have not implemented.

Remedies		Yes	Some what	No
11.1	Giving training			
11.2	High participation of top management			
11.3	Internal and external audit			
11.4	Strict supervision on site			
11.5	Establish feedback system			
11.6	Frequent direction-finding committee meeting			
11.7	Team-working approach			
11.8	Involvement of all employees in the documentation process.			
11.9	Launch quality campaign			

*****Thank you very much for your participation in this survey*****

Appendix-D Interview

Guide for Interview

1. What was the driving force to implement Quality Management System by your company?
2. What Challenges has your company encountered when implementing the ISO 9001:2015 QMS?
3. In your opinion, is your company effectively implementation the QMS regarding customer satisfaction?
4. How do you assess and measure customer satisfaction?
5. How often do you conduct internal and external audit?
6. In what ways can QMS practice be further improved?
7. What is your opinion regarding the need for a QMS framework as a guideline to assist your company in implementing ISO 9001 effectively?

*****Thank you very much for your participation in this survey*****