The Role of QMS Implementation on Construction Project Performance: The case of Grade One General Contractors in Addis Ababa

By:

Rediet Beide Getachew

A Project Submitted to the School of Graduate Studies

Presented in Partial Fulfillment of the Requirements for the Degree of Master of Arts

In

Project Management

ADDIS ABABA UNIVERSITY, SCHOOL OF COMMERCE

COLLEGE OF BUSINESS AND ECONOMICS

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Addis Ababa, Ethiopia

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DECLARATION

I, the undersigned, declare that this project work titled '**The Role of QMS Implementation on Construction Project Performance: The case of Grade One General Contractors in Addis Ababa'** is my original work performed under the supervision of my research advisor Dr. Abdurezak M. and has not been presented elsewhere for assessment and for a degree in any other university. All sources of materials used for this thesis have also been duly acknowledged.

Signature: _____

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Place of Undertaking: Addis Ababa, Ethiopia

Date: December 2018

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ABSTRACT

The construction industry plays a significant role in the economy of developing countries although it is struggling from different challenges. The Ethiopian construction industry shares many of the problems and challenges the industry is facing in other developing countries. One of the many challenges of the industry is quality management as stated by different scholars. Quality is the most significant factor in the success of construction projects. Contractors are one of the key players in the industry and previous studies indicate that they have received benefits of quality and increased their productivity after implementing a Quality Management System (QMS). Therefore, there arose the need to know whether it is able to improve project performance so that the benefit and effectiveness of the QMS can be measured with project management theory. This research is conducted to assess the role of QMS implementation on the performance of construction projects by Grade One General Contractors in Addis Ababa. It is descriptive and qualitative in kind. Interview is used as an instrument of data collection. The research analysis shows how effective a QMS is on the project time, cost, quality, and customer satisfaction parameters of construction projects of Grade One General Contractors. Qualitative analysis is used to describe the benefits of implementing QMS, the fulfillment of the eight principles of QMS, and its effectiveness on time, cost, quality, and customer satisfaction parameters of the contractors' projects. The finding of the research elaborates that QMS is more effective on external factors (customer satisfaction) than on internal factors (time, cost, quality) of the contractors' construction projects. It is found that International Organization for Standardization (ISO) certification can enhance the reputation of an organization and image of quality to attract customers, and that QMS implementation is an effective technique to achieve documentation and traceability for GCI construction companies. The finding also revealed that QMS is not implemented to its fullest potential by the contractors once after they have been certified. The contractors could achieve maximum benefits by fully implementing the eight major QMS principles and also ensure continuous improvement.

Keywords: Construction projects, Customer satisfaction, Grade one general contractors, Project performance, Project cost, Project time, Project quality, Quality Management System

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List of Abbreviations and Acronyms

BC	Building Contractor
COQ	Certification of Qualification
CSF	Critical Success Factors
EFQM	European Foundation for Quality Management
EQA	Ethiopian Quality Award
GC	General Contractor
GDP	Gross Domestic Product
ISO	International Organization for Standardization
KPI	Key performance Indicator
MOUD	Ministry of Urban Development
NETVAR	Net Variation
PDCA	Plan-Do-Check-Act
PMBOK	Project Management Body of Knowledge
QA	Quality Assurance
QC	Quality Control
QI	Quality Improvement
QM	Quality Management
QMS	Quality Management System
RC	Road Contractor
SC	Special Contractor
TQM	Total Quality Management

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CHAPTER ONE

INTRODUCTION

This chapter entails about the implementation of ISO 9001 Quality Management System (QMS) on construction projects of Grade one general contractors (GCI) in Addis Ababa. It consists of Background of the study, Statement of the problem, Research objectives, Research questions, Significance of the study, Scope of the study, Limitation of the study, and Organization of the study.

1.1. Background of the study

Quality is the most significant factor in the success of construction projects. Quality of construction projects is a general philosophy by which processes are carried in a total quality infrastructure (Chong, 2011). The total quality infrastructure consists of several key pieces. The first and one of the most important is the quality system as a business management tool (Juran & Godfrey, 1999). In 1987, the first edition of the quality system was introduced by the International Organization for Standardization (ISO) to aim quality and customer's satisfaction improvement.

Five different versions of ISO 9001 have been published by ISO until now; 1987, 1994, 2000, 2008, and 2015 versions. Essentially the layout of the ISO 9001:2015 standard is similar to the previous ISO 9001:2008 standard in the way that it follows the Plan, Do, Check, Act cycle in a process-based approach, but is now further encouraging this to have risk-based thinking. ISO 9001:2008, the fourth version, is basically the same as the previous one. It aims to explain the existing requirements in a clearer way. ISO 9001:2008 promotes the adoption of a process approach when developing, implementing and improving the effectiveness of a quality management system, to meet customer requirements and enhance customer satisfaction.

Quality can have an effect on cost and time length of projects' completion, in order to satisfy customers in construction firms (Ali & Rahmat, 2010). Therefore, quality management should provide an appropriate environment with suitable tools, techniques, and procedures for implementing construction project successfully (Mane & Patil, 2015). Although there are many

studies indicating that some organizations have received benefits of quality and also increased their productivity after implementing a quality management system, there is a need to know whether QMS is able to improve project performance so that the benefit and effectiveness of QMS can be measured with project management theory.

Effectiveness is the degree to which objectives are achieved and the extent to which targeted problems are solved. Effectiveness measures are used to judge project performance and project success. Baccarini (1999) defined effectiveness as the degree of achievement of objectives. Projects are formed to accomplish objectives and success is measured in terms of how well these objectives have been met. Criteria such as meeting project time, budget, technical specification and mission to be performed are the top priorities of project objectives (Baccarini, 1999). Effectiveness measures refer to the achievement of project objectives, user satisfaction and the use of the project (Pinto & Slevin, 1988). To measure the effectiveness of QMS on construction projects, the objectives of QMS shall be known. The goals and objectives a company defines under a quality management system have to be clear, achievable and measurable. One of the key goals of any quality management system is to improve quality of products or services the company provides. Quality in such a system has three components. High quality means high accuracy, compliance with applicable standards, and high customer satisfaction. The specific objectives of Quality management may vary depending on the QMS implementing organization, but the general objective of QMS is to measure each component and achieve improvements. The ten possible indicators for effectiveness measures identified by Pinto & Slevin (1988) and Davies (2002) are; client satisfaction on service, user satisfaction with product, project effectiveness, project functionality, free from defects, value for money, profitability, absence of any legal claims and proceedings, learning and exploitation and generate positive reputation. Therefore; in this particular research to measure the effectiveness of QMS on the performance of the construction projects, it is focused on four of the ten effectiveness indicators; client satisfaction on service, free from defects (quality of project), value for money (time of project), and profitability (cost of project).

1.2. Statement of the Problem

Numerous reports have criticized the construction industry, especially in terms of productivity, quality and quality system (Ali & Rahmat, 2010), and the majority of project managers focus on the cost and time instead of quality for construction projects, but the scholars emphasize more attention should be towards quality (Mane & Patil, 2015). Large construction projects have been known for their cost overrun and late completion time (Touran & Lopez, 2006). Most construction companies face many challenges, such as workmanship defects, project delay, and cost overrun in completing their projects. Since over the past three decades, the globalization and competition have been increasing (Neyestani & Juanzon, 2016). Thus, the globalization and competition are the most important reasons that each construction company needs to improve and correct its system for achieving its objectives by management tools.

The construction industry plays significant role in the economy of developing countries. For example, in many developing countries, major construction activities account for about 80% of the total capital assets, 10% of their Gross Domestic Product (GDP), and more than 50% of the wealth invested in fixed assets. In addition, the industry provides high employment opportunity, probably next after agriculture (Jekale, 2004). As Idoko (2008) noted, many projects in developing countries encounter considerable time and cost overruns, fail to realize their intended benefit or even totally terminated and abandoned before or after their completion. Moreover, the development of the construction industry in developing countries generally lags far behind from other industries in those countries and their counter parts in developed nations. The construction industry in developing countries failed to meet expectations of governments, clients and society as a whole as Jekale (2004) generally concluded.

Poor managerial capability of contractors is one of the critical problems of the construction industry in developing countries as Adams (1997), Long, et. al. (2004) and others indicated in their researches. Thus, improving the managerial capability of contractors needs to be one of the priority considerations for improvement of capability of contractors in developing countries. Researches by Dlungwana & Rwelamila (2004), and others have also strongly emphasized the importance of improving the management skills of contractors. As most of the works of contractors is managed as a project, improving the contractors' project management capability

can significantly contribute to the overall improvement of contractors' capability to deliver successful projects. As the results of studies in 776 projects across seven industries in different countries have shown, construction and engineering companies successfully achieve their goals because of being subject to particularly thorough planning, analysis, and control by project management (Zwikael & Smyrk, 2011). Successful project management can be defined as having achieved the project objectives as on time, within cost, and quality (scope) to meet client's requirement (Kerzner, 2010). The total quality infrastructure consists of several key pieces. The first, and one of the most important is the quality system (Juran & Godfrey, 1999) as a business management tool.

The Ethiopian construction industry shares many of the problems and challenges the industry is facing in other developing countries, perhaps with greater severity. Given the critical role the construction industry plays in Ethiopia and other developing countries, and the poor level of performance of the industry in those countries, improving the performance of the industry ought to be a priority action (Yimam, 2011). As contractors are one of the key players in the industry and the makers of the final product, any development and improvement initiatives in the industry has to consider ways of improving the capacity and capability of the contractors. The construction industry is growing in Ethiopia at a very fast pace and it brings a great deal of development to the country and to the city specifically, but it is also undeniable that there are various quality problems arising with it as well. The construction industry in Ethiopia is challenged by several problems which tend to confront the sector and thus making efforts at developing the construction industry very difficult and complex (Jekale, 2004)

On a study of condominium housing projects in Addis Ababa Dires (2016) stated that the rate of construction project accomplishment is weak because of the rapid increasing rate of major defects in building as a result of poor workmanship and poor-quality materials which have been identified as the major cause of defects in the Ethiopian construction industry. It is also very clear that not only the low-cost projects, but also the private owned projects are usually not free of construction defects. The city roads are under maintenance almost throughout the year if not always. This experience results in the compromising of the overall project success and the poor rating of customer satisfaction. Quality management plays an important role in the quality of the

deliverable of construction projects. But prior studies on Ethiopian contractors found that there is a very low rate of quality management practice in their project executions. And there is a need to know what the contractors have benefited from implementing QMS but practicing it at a very low rate. Also, how effective QMS is on the main elements of construction projects; time, cost, and quality, to sustain customer satisfaction with minimum implementation rate. Having stated the aforementioned issues, this study assesses the role of QMS implementation on the performance of the construction projects of Grade one general contractors in Addis Ababa. And it's effectiveness on the main elements of the selected GCI construction projects; cost, time, quality/scope, and also customer satisfaction for the overall project success.

1.3. Research Questions

- What are the benefits of implementing QMS on construction projects by GCI?
- What is the role of QMS implementation for project performance regarding the time of project delivery, the project budget, and the desired quality of GCI construction projects?
- What is the contribution of QMS implementation for customer satisfaction of GCI clients?
- To what degree (extent) are the quality management principles being fulfilled for continuous improvement of QMS implementation of GCI contractors?

1.4. Research Objectives

1.4.1. General Research Objectives

- The general objective of this research is to assess the role of QMS implementation on the project performance of construction projects of GCI contractors in Addis Ababa

1.4.2. Specific Research Objectives

- Examine the effectiveness of QMS implementation on the main elements of construction projects (construction quality, the time length of the project, and cost of the project) in relation to customer satisfaction within projects of selected GCI in Addis Ababa
- Explore the remedies to minimize workmanship defects, project delay, and cost overrun of construction projects for continuous improvements of the effective implementation of QMS in GCI in Addis Ababa

1.5. Significance of the study

The findings of this study will benefit the Ethiopian construction industry considering that QMS plays an important role in the quality of construction works, cost-minimizing, and time-saving aspect of construction project management. GCI contractors who have not implemented QMS in Addis Ababa will understand the importance of applying QMS, and GCI contractors who have implemented QMS will understand the importance of maintaining the practice for continuous improvement with this study. By assessing the benefits in QMS implementation this study will leave room for improvement on future QMS implementation endeavors.

1.6. Scope of the Study

The scope of the study is focused on assessing and analyzing QMS implementation of construction projects of GCI who have implemented QMS and are located in the city of Addis Ababa. The study is focused on the quality management practices of selected GCI contractors who have implemented QMS in the execution and post-delivery period or after the planning, design, and award of projects. It is mainly concerned with the quality, time, and cost parameters of the quality management system. And it includes the customer satisfaction parameter in relation to the three main management practices.

The time, cost and quality elements are given major emphasis because those are the key elements that contribute to project success and customer satisfaction. Success is measured by product and project quality, timeliness, budget compliance, and degree of customer satisfaction (Project Management Institute, 2013). The QMS practices in this study will be referred to the ISO 9001:2008 and ISO 9001:2015 versions since those are the latest versions. The objectives of this study shall be achieved by analyzing primary data which will be gathered through semi-structured interview by the selected GCI who have implemented ISO 9001 Quality Management System in Addis Ababa.

1.7. Limitations of the Study

Although the construction sector is very wide, due to constraints of time, this study will only be based on the organizational level. The focus will be on execution (delivery) and post-delivery phase of the construction projects to outline the practices of QMS implementation of GCI in

Addis Ababa. And factors that are related to the planning phase of the QMS implementation will be recognized as inputs for the project delivery and post-delivery phase. During the assessment of the QMS implementation of the sampled contractors, parameters such as scope, risk, communication, procurement, human resource etc. will not be studied.

1.8. Organization of the Study

This paper has five major chapters. The first chapter is an introduction to the importance of the study. It consists of a short background to the problem and its approaches, research questions, research objectives, the scopes, and limitations. The second chapter discusses relevant theories to the study on QMS implementation. It covers an in-depth and elaborative look at relevant previous studies which relate to the effectiveness of construction quality management practices. The nature of the required data is elaborated along with the methods (interview, desk study) of collecting them in the third chapter. This chapter also outlines strategies for achieving the planned objectives and answering the research questions. Research methodology and data presentation from the studied field are included in the third chapter. The methods that are specified in the third chapter are further discussed and implemented on the set of data gathered and presented in the fourth chapter of this research. The fourth chapter is the analysis and discussion of a case study based on the previously presented theory and the main findings are also presented. The last and fifth chapter includes conclusions, recommendations, references used and appendixes. Besides the remedies and proposals, the research briefly points out areas of concern for future study as observed from the viewpoint of this research's findings.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

The theoretical background is based on literature survey to assess the experiences concerning the study areas on QMS implementation on construction projects from around the world and in Ethiopia. Also, to identify the effectiveness of QMS on major project elements on construction projects to design a questionnaire based on the information gathered. The literatures are available from electronic media, journal articles and books.

2.2. Understanding Quality Management System

As mentioned in the previous chapter, successful project management is defined by Kerzner (2010) as having achieved the project objectives as on time, within cost, and quality to meet client's requirement and that quality is the most significant factor in the success of construction projects. Quality management system (QMS) provides generic guidance and requirements for establishing an appropriate quality management procedure, in order to lower cost, increase productivity, customer's satisfaction, and market share in the organizations. In construction industry, it can assist the companies to achieve successfully their objectives, and ensure that all phases of construction project consistently meet client's requirements or need (Neyestani & Juanzon, 2016).

2.2.1. ISO certification

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). Quality system was introduced by ISO on 15th, March 1987. ISO is compatible with proprietary approaches to quality management which are recommended by scholars such as Deming, Juran, Crosby, and non- proprietary approaches such as Total Quality Management (TQM), Lean Six Sigma, European Foundation for Quality Management Excellence Model (EFQM), Certification of Qualification (COQ), and other continuous improvement techniques (PMI, 2008). Successful implementation of QMS is to take it as a strategic decision for the organization. The purpose of quality management system can be namely such as reducing possible errors at all phases of projects by proper control, finding faults

or errors soon, measuring to avoid repeated mistakes, and determining and initiating corrective action or preventive measures (Aized, 2012).

Since its inception in 1987 the ISO 9000 series of standards has been adopted worldwide across all types of business sectors as a means of certifying a QMS. By the end of 2008 there were 982,832 ISO 9000 certified companies worldwide, representing an increase of 31,346 (3%) since 2007 (The ISO Survey, 2010). According to the latest survey of The ISO Survey (2014) 1,609,294 ISO certificates were issued, and the majority of them belonged to QMS standard or 1,138,155 ISO 9001 certificates issued that met the requirements of QMS under external audit of third-party or Certification Body (UNIDO, 2012). Although the number of certifications seemed to grow around the above time frame, the report from ISO shows a different story on the current survey. The number of certificates on 2016 resulted in 1,576,538, which is a drop in number from 2014 and prior. And as of August 2017, the number dropped even further to 1,558,127 (The ISO Survey, 2017). For all countries, the majority of the data comes from the same certification bodies as previous year. There were a small number of bodies that failed to participate, having a slight impact on the total, however these were only those that provide relatively small amounts of data (The ISO Survey, 2017).

2.2.2. Organizational outlook on QMS

According to various authors, quality improvement and management has become a subject of great importance in organizations. Quality Management (QM) focuses on the overall process of a system rather than just concentrating on results, it is the determination and implementation of the quality policy with regard to the organization. Many organizations throughout the world have started to realize the potential it holds for them and have therefore adopted new philosophies focused on quality management rather than just being focused on the end results.

On a study done on Slovenian organizations, some organizations already implementing the ISO 9001 QMS are wondering is it worth maintaining and what significance does it hold for the company? Empirical studies have shown that Quality Management does indeed have a positive effect on the various business functions (Piskar & Dollinsek, 2006) and therefore calls for a deeper look. The empirical studies were undertaken through questionnaires during 2002 in

Slovenia. 212 Companies that were already implementing the ISO 9001 system were asked to participate in this study. The results obtained from this study were analyzed and compared by the various authors. In conclusion all the authors were in favor of the QMS (Piskar & Dollinsek, 2006).

A QMS guarantees that all activities regarding to quality are planned. It's a management system whose matter is organizing elements to achieve a specific goal. A QMS consists basically of an organizational structure, responsibilities, procedures, processes and resources for implementing quality management. The objective of a QMS is for the continuous improvement of quality in an organization and therefore it is implied that QMS reaches all parts of an organization, it is not just isolated to one area of the business.

The level of detail to which a particular practice should be documented depends on the practice itself. A quality policy forms part of a QMS and is usually the main focus around which the rest of the QMS is formed. Prior to certification, audits are performed on the QMS to ensure that implementation is satisfactory and that it complies with the contracted requirements. A QMS has several uses such as; a means to communicate the vision, values, mission, policies and objectives of the organization, a means of showing how the system has been designed, a means of showing linkages between processes, a means of showing who is responsible for what, an aid to training new people, a tool in the analysis of potential improvements and a means of demonstrating compliance with external standards and regulations.

2.2.3. Quality Management Principles

Quality Management principles are a set of fundamental beliefs, norms, rules and values that are accepted as true and can be used as a basis for quality management (ISO, 2015c). It is a framework to guide organizations towards improved performance. Based on Deming, Juran, Crosby and other scholars' common ideas, there are four basic tenets of quality management: customers' satisfaction, continuous improvement, and process focus and management commitment. And from these tenets, the ISO 9000 series of standards developed eight major quality management principles. These principles can be used by organizations as a framework to improve performance (ISO, 2012a).

The general part of the ISO 9001:2008 international standard recognizes that the quality management principles stated in ISO 9000 and ISO 9004 have been taken into consideration during the development of the Standard. The eight quality management principles are the bases of ISO 9001:2008, ISO 9001:2015 QMS requirements. The quality management principles can be used by senior management as a framework to guide their organizations towards improved performance. These principles are not elements against which the organization can be directly assessed but their influence can be seen throughout the standard. They should be considered by any organization wishing to comply with the spirit, as well as the text of ISO 9001.

Table 2.1. The Eight Quality Management Principles

Customer focus	Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations
Leadership	Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives
Involvement of people	People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit
Process approach	A desired result is achieved more efficiently when activities and related resources are managed as a process
System approach to management	Identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives
Continual improvement	Continual improvement of the organization's overall performance should be a permanent objective of the organization
Factual approach to decision making	Effective decisions are based on the analysis of data and information
Mutually beneficial supplier relationships	An organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value

Source: ISO 9001:2008

Customer focus is the first principle, and it covers both customer needs and customer service. This principle stresses that a business should understand its customers, what they need and when. While trying to meet, but preferably, exceed customers' expectations. As the business's ability to spot new customer opportunities and satisfy them improves; customer loyalty increases, revenue rises and waste is then reduced. More effective processes result in improved customer satisfaction overall (ISO 9001:2008). Leadership is concerned with the direction of the organization. The business should have clear goals and objectives, and ensure its employees are actively involved in achieving those targets. The benefits are higher levels of employee engagement and increased motivation to satisfy customer needs. Research shows, if employees are kept 'in the loop' and understand the business vision, they'll be more productive. This principle seeks to rectify employees' complaints about lack of communication (ISO 9001:2008).

Well-managed processes reduce costs, improve consistency, eliminate waste and promote continuous improvement. By becoming a more efficient organization, confidence is built in stakeholders by optimizing performance (ISO 9001:2008). Processes are managed by making responsibilities clear and ensuring resources are used in the best way. The process approach is all about efficiency and effectiveness. It's also about consistency and understanding that good processes also speed up activities. Great processes reduce cost, improve consistency, eliminate waste, and promote continuous improvement (ISO 9001:2008). ISO defines Systematic approach to management as "identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives." A business focuses its efforts on the key processes as well as aligning complementary processes to get better efficiency. This means that multiple processes are managed together as a system which should lead to greater efficiency.

The continual improvement principle is very straightforward. Continual improvement should be an active business objective. The benefits of this are clear; increased ability to embrace new opportunities, organizational flexibility, and improved performance. Especially in difficult economic times, the businesses that thrive are those that can adapt to new market situations (ISO 9001:2008). The factual approach to decision making principle states, a logical approach based on data and analysis, is good business sense. Unfortunately, in a fast-paced workplace, decisions

can often be made rashly, without proper thought. Implementing the Quality Management Principles discussed above will allow decisions to be made with clarity (ISO 9001:2008). Informed decisions lead to improved understanding of the marketplace as data is collated and analyzed, and the ability to defend past decisions (ISO 9001:2008). The last principle deals with supply chains. It promotes the relationship between the company and its suppliers; recognizing it is interdependent. A strong relationship enhances productivity and encourages seamless working practices. The result is optimization of costs and resources, improving and building long-term relationships and the flexibility of joint responses to changing market or customer needs and expectations (ISO 9001:2008).

2.2.4. Effective QMS Implementation in construction projects

Once a QMS is implemented successfully, it is monitored closely and improved over time. This is all part of the continuous improvement process which in turn leads to the other objective of an organization; Total Quality Management (TQM). According to Deming TQM is not possible, since reaching it means that everything is perfect, which will never be the case, it is rather meant as a philosophy to which an organization can employ. Nevertheless, organizations strive for TQM through a philosophy which focuses on customer satisfaction, problem prevention rather than detection, teamwork, leadership, management responsibility, continuous improvement, and control of business processes. QMS and TQM can be combined, but they are not dependent on each other and therefore a company can implement a QMS without adopting the whole TQM philosophy. A full consensus is yet to be reached on the exact content and definition of a Total Quality Management System (Yong & Wilkinson, 2001), although it is agreed that TQM is not possible within an organization without a commitment from the top management (Kelkar, 2008).

The construction process can be complex and often confusing. Given the number of products, players and unique characteristics associated with construction, one can certainly understand how it might be difficult to put together a comprehensive quality management plan. In this competitive environment, successful companies fulfill customer requirements in an effective and efficient manner. For this reason, efforts to control the quality of products have developed over time. This originated in the manufacturing industry, because most manufacturers inspected their

products before shipping them. This subsequently led to quality control and then to the development of quality assurance and quality management (Ethiopian Standards Agency, 2011).

Defects arising in construction are mostly caused by poor management and communication. Consistent quality can only be achieved when such avoidable mistakes are avoided in the first instance. Preventive measures must be taken to minimize the risk of managerial and communication problems. This is the basic concept of quality assurance (Chung, 2002). Consistency only results from a documented QMS which effectively integrates Quality Assurance (QA), Quality Control (QC) and Quality Improvement (QI). Quality Control is focused on fulfilling quality requirements, Quality Assurance is focused on providing confidence that quality requirements will be fulfilled, and Quality Improvement is focused on increasing the ability to fulfill the quality requirements. Outlining the quality management plan requires a twofold approach. One must consider quality first from a "project" perspective and then from a "process" perspective. The two approaches may be categorized as quality control at the project level and quality assurance at the process level (Jackson, 2004). The process approach in ISO 9001:2008 incorporates the PDCA cycle and preventive action-based under the identification and elimination of the root causes of the problems (e.g. errors, defects, lack of adequate process controls) (ISO, 2008).

Table 2.2. The PDCA methodology

Plan	Establish the objectives and processes necessary to deliver results in accordance with customer requirements and the organization's policies.
Do	Implement the processes.
Check	Monitor and measure processes and product against policies, objectives and requirements for the product and report the results.
Act	Take actions to continually improve process performance.

Source: ISO 9001:2008

2.3. Quality Management Systems in Construction

The successful implementation of QMSs requires a total change in organizational focus. It may require an adoption of a new culture that focuses on achieving greater customer satisfaction and improving in operational processes at all levels within construction companies (Willar et. al.,

2010). Different projects or construction firms exhibit unique characteristics, coupled with the changing demands of the industry's stakeholders, combining different investors, clients, contractual arrangements and consulting professions (CIDB, 2016) and (Oyewobi et. al., 2013). Quality management in the construction industry is different from that in the manufacturing or other service industries. This is because the construction industry encompasses not only the quality of products, but also the total management approach needed to meet defined clients' requirements (Rumane, 2011). Lam et. al. (1994), in respect to the construction industry, defined Quality Management as "that aspect of the overall management function that determines and implements the quality policy", and Quality System as "the organizational structure, responsibilities, procedures, processes and resources for implementing quality management".

A quantitative research approach was employed by Willar et.al (2010) to collect the relevant information associated with the QMSs practices within G-7 Indonesian construction companies. The questionnaire was delivered to 118 G-7 construction companies, which are ISO 9001 certified. Those companies mainly engage in building and/or civil engineering works, including roads and bridges, highways and irrigation systems. Nine hundred questionnaire booklets were distributed to Quality Management Representatives, Managers (e.g. Project Managers, Purchasing Managers, Logistic Managers, Maintenance Managers, Finance Managers), and Project/Site Engineers of those companies. These groups of respondents represented the high, middle, and lower management levels in the companies' organizational structure. 77 companies returned the questionnaires, giving a response rate of 65.25%.

The results of the survey showed that the companies' motives in developing and implementing QMS are primarily to successfully operate projects without substantive time delays and cost overruns. This scenario is common for construction organizations that are in the early stages of operating with QMS-ISO 9001. The survey results also revealed that, as also verified in other studies, the main initial motivation for ISO 9001 certification was to have an effective toolkit for improving quality management procedures in companies (Chini & Valdez, 2003) and (Turk, 2006). Some authors have opined that ISO 9001 certification is being pursued both for company marketing reasons and based on customers' requests (Chini & Valdez, 2003) and (Turk, 2006).

2.3.1. Project performance measurement criteria for construction projects

In the construction industry; time, cost and quality have long been defined as the basic criteria and factors of measuring success. However, other several ideas have appeared from different researchers. The study of project success and the critical success factors (CSFs) are considered to be a means to improve the effectiveness of a project (Ramlee, et al., 2015).

There is still a disagreement between project management researchers as to what constitutes project success and how it is to be measured (Klagegg, et al., 2005). Wit (1988) and Pinto & Slevin (1988) mentioned that it is still not clear how to measure project success since project stakeholders perceive success or failure factors differently. They believed that project success should be viewed from different perspectives of the individual owner, developer, contractor, user, and the general public and so on. Wit (1988) explained that the most appropriate criteria for success are the project objectives. The degree to which these objectives have been met determines the success or failure of a project. The criteria for success of the project management effort tends to be restricted to cost, time and quality performance. Although, when measuring project success, one must consider the objectives of all stakeholders throughout the project life cycle and at all levels in the management hierarchy. Therefore, to believe that, with such a multitude of objectives, one can objectively measure the success of a project is somewhat an illusion. Success is measured both objectively (cost and time) and subjectively (quality and satisfaction) (Wit, 1988).

In his book, In Search of Excellence in Project Management, Kerzner (1998) discusses definitions of project success, and provides a list of critical success factors that can affect project performance at different stages of a project life cycle. As he mentioned, the definition of project success has changed over the years. In the 1960s, project success was measured entirely in technical terms: either the product worked or it did not. In the 1980s, the following definition for project success was offered (Kerzner H. , 1998): project success is stated in terms of meeting three objectives: 1) completed on time, 2) completed within budget, and 3) completed at the desired level of quality. The quality of a project was commonly defined as meeting technical specifications. Note that all three of these measures are internal to a project, and do not necessarily indicate the preferences of the end user or the customer. In the late 1980s, after the

introduction of TQM, a project was considered to be a success by not only meeting the internal performance measures of time, cost and technical specifications but also making sure that the project is accepted by the customer; and resulted in customers allowing the contractor to use them as a reference (Kerzner H. , 1998) which is external to the project.

PMBOK (2008) defines a project as a temporary endeavor undertaken to create a unique product, service or result. And for that uniqueness Pinto and Slevin (1988) defined a project as possessing the characteristics of: a defined beginning and end (specified time to completion), a specific, preordained goal or set of goals (performance specifications or desired quality), a series of complex or interrelated activities and a limited budget (specified cost). Wit (1988) also described that during the early phase of the project, schedule is of primary importance, while cost takes second place and quality third. Later in the project, cost becomes the controlling interest, with schedule taking a secondary role. After the project has been completed, schedule and cost problems are easily forgotten and quality becomes the key.

The success criteria for a construction project is not only to evaluate the cost, time and quality as success factors but also to include successful project management, organizational success and the customer satisfaction (Siguroursan, 2009). Reviewing of the relevant literature suggests that different criteria were hypothesized by different researchers (Chan, et al., 2002). These scholars have summarized ten Critical Success Factors (CSFs) of projects through their research. Those CSFs are known as Cost, Time, Quality, Satisfaction, Management, Safety, Technology, Organization, Environment, and Resources (Ramlee, et al., 2015). But this research is bound to only the first four CSFs so emphasis is given to Cost, Time, Quality, and Satisfaction.

The measurement of performance forms the basis for determining success (Wit, 1988). But how does one specify the required level of performance for success? How much cost and time overrun is acceptable for a successful project? Certainly, the lack of acceptable performance variation criteria hampers the measurement of success of a single project. In research, this problem is usually overcome by the measurement of comparative performance of previous projects (Wit, 1988).

Table 2.3. Summary of Success Factors by Previous Researchers

Authors	Critical Success factors (CSFs)			
	Cost	Time	Quality	Satisfaction
Sadeh et al. (2000)	X	X	X	X
Steinfort & Walker (2007)	X	X	X	X
Alzahrani & Emsley (2013)	X	X	X	
Shenhar et al. (2001)	X	X	X	
Lim & Mohamed (1999)	X	X	X	
Rad (2003)	X	X	X	X
Chan et al. (2004)	X	X	X	
Siguroursan (2009)	X	X	X	X

Source: Ramlee *et al*. (2015)

With the above factors in mind, a range of Key Performance Indicators (KPIs) to measure the performance of a construction project is developed, both objectively and subjectively. With reference made to Chan's (1996; 1997) and Naoum's (1994) earlier research, each KPI is discussed and practical approaches to measure these KPIs are introduced. The measures of the KPIs (in this case only the four criteria) are mainly divided into two groups; objective measures (time and cost) and subjective measures (quality and satisfaction). The first group is to use mathematical formula to measure the criteria quantitatively. The other group of criteria is based on subjective opinions and personal judgement. A three to seven-point scale scoring could be applied to measure these KPIs (Chan, 2001).

I. Objective measures

- **Time**

Time is the duration for completing a project. It is scheduled to enable the construction output to be used by the client's future plans (Hatush & Skitmore, 1997). Alarcon and Ashley (1996) raised 'effectiveness' as a success criterion. They defined effectiveness as a measure of how well the project was implemented or the degree to which targets of time and cost from the start-up phase to full production. From Naoum (1994) and Chan (1997), time can be measured in terms of construction time, speed of construction and time overrun. Construction time is the absolute time that is calculated as the number of days or weeks from start on site to practical completion

of the project. Speed of construction is the relative time, which is defined by gross floor area divided by the construction time. Time variation is measured by the percentage of increase or decrease in the estimated project in days/weeks, discounting the Extension of Time (EOT) granted by the client.

- **Cost**

Cost is another important measure. Cost is defined as the degree to which the general conditions promote the completion of a project within the estimated budget (Bubshait & Almohawis, 1994). Cost is not only confined to the tender sum only, it is the overall cost that the project incurs from inception to completion, so it includes any costs that arise from variations, modification during construction period, and the cost created by the legal claims, such as litigation and arbitration. The measure of cost can be in form of unit cost, percentage of net variation over final cost. Unit cost is a measure of relative cost and is defined by the final contract sum divided by the gross floor area. Percentage net variation over final cost (%NETVAR) is the ratio of net variations to final contract sum expressed in percentage term. It gives an indication of cost overrun or cost underrun. Yeong's (1994) approach is used in measuring this term.

II. Subjective measures

- **Quality**

Quality is another basic criterion that is heavily referred to by previous researchers as mentioned above. However, the assessment of quality is rather subjective. In the construction industry quality is defined as the totality of features required by a product or services to satisfy a given need; fitness for purpose (Parfitt & Sanvido, 1993). Nowadays, quality is the guarantee of the products that convince the customers or the end users to purchase or use. Specification is one of the criteria that were advocated by Songer et. al. (1996) and Wateridge (1995). They defined it as the workmanship guidelines provided to contractors by clients at the commencement of project. The measure of technical specification is to what extent the technical requirements specification is achieved.

- **Customer Expectation and Satisfaction**

Users or customers are those who actually use the final products. Ensuring the completed projects to meet the customer's expectation and satisfaction is essential. Liu & Walker (1998)

consider satisfaction an attribute of success. Torbica & Stroh (2001) believe that if customers are satisfied, the project can be considered successfully completed in the long run.

It is learned from the above statements that measuring the success of a project once it's brought to completion is a valuable practice. It provides a learning opportunity for future undertakings, and, the opportunity to assess the true effectiveness of the project. In order to have a holistic view, objective and subjective criteria need to be considered as mentioned previously. A project performance and success is therefore measured by the above measures to state whether or not a project has experienced cost overrun or it is within budget, time overrun or it is within schedule, if it is within technical specification or not, and whether it has satisfied the client or not, depending on the project and the measurer. It is by these measures that a project manager labels the project performance as a success or a failure, and the effectiveness of QMS on the critical factors of the project objectively and subjectively.

2.3.2. QMS implementation in Ethiopian construction

Ethiopia was the 68th member of the international organization for standardization (ISO). The need for quality control in Ethiopia was recognized since 1972 making the establishment of Ethiopian standards institute. At national level, the government of Ethiopia considered quality as a development infrastructure starting from 1940s when agricultural products export began to expand (Beshah, 2011).

QMS certification was a very expensive and tedious process for Ethiopian industries, because there were no system certified organizations which can certify local companies. In February 2009, quality and standard authority of Ethiopia (now called Ethiopian Conformity Assessment Enterprise) obtained system certification and localized the processes. Now the Ethiopian Conformity Assessment Enterprise is giving internationally accepted certificate to not only Ethiopian construction companies but also for any other companies. Ethiopian Quality Standard Agency is also giving training and technical support on QMS (Beshah, 2011).

Through analyses of the Ethiopian Quality Award (EQA) self-assessment report evaluation, generally, quality management practices in Ethiopia was found to be low in all the tenets including leadership, policy and strategy, resources management, process management, customer

satisfaction, business performance, and impact on society (Beshah & Kitaw, 2014). Among these factors, policy and strategy is the most critical problem area despite the least weight given by the EQA. Comparatively, the service industries quality management practice is weaker than that of the manufacturing industries as measured by all the quality parameters. Beshah and Kitaw (2014) also suggested that the quality promoters, particularly the government should give special attention to the service industries quality. However, both manufacturing and service industries should be supported to lay down their day-to-day activity on a long-term strategy and also to improve the root causes for the poor quality management practice.

ISO certification ownership (% of firms) in Ethiopia was reported at 4.3 % in 2015, according to the World Bank collection of development indicators, compiled from officially recognized sources, which is low in number by any measurement. Yimam (2011) in his study of Project Management Maturity in the Construction Industry of Ethiopian GCI contractors identified that about 43% of the contractors perform little or no quality management; the other 24% perform only 2 out of 3 quality management processes that are expected to be performed to achieve the goal of project quality management. The rest 33% of the contractors perform quality management formally or at higher process maturity level (Yimam, 2011).

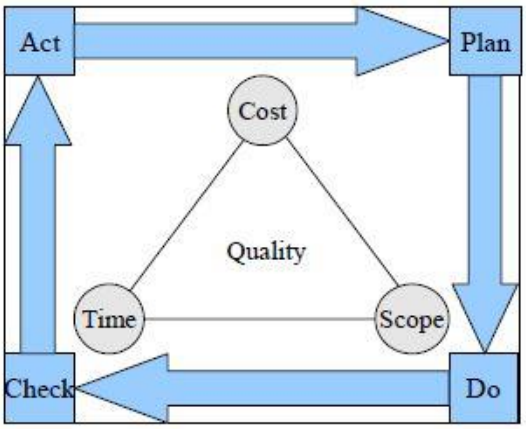
The same study has shown that 20 out of the 21 contractors have awareness about the importance of quality management in their organization. 57% of the surveyed contractors have quality management policies, procedures and guidelines; however, only 24% said they have department or employees specializing in quality management.

2.3.3. Impact of QMS implementation on construction projects

A good Quality Management System can provide the following benefits: greater efficiency, reduced cost, better performance, less unplanned work, fewer disputes, improved visibility, reduced risk, problems show up earlier, better quality, improved customer confidence, portable and reusable products, and better control over contracted products. Some of the advantages in having a documented Quality Management System are: it is reviewable, it can be revisited for improvement, serves as training material, serves as reference material, and it enables repeatability and uniformity across instances or locations.

The QMS is widely used by the organizations for achieving operational and market benefits, it is an optimized standard to upgrade and promote the companies and projects performance. The studies on the impact of QMS reported that these objectives are not always achieved. However, the successful implementation of the ISO 9001 (QMS) standard depends on how the standard is perceived by the companies. As a result, the previous studies on the impact of QMS revealed that the majority of the scholars found the positive effect of QMS on projects (Manders, 2015). For example, a survey by UNIDO (2012) in the Philippines and few countries in Asia, showed that most of the respondents believed QMS can make excellent (57%) and good (22%) influence on the organizations, and only 3% stated the negative impacts of QMS on the firms. Likewise, over 54% had internally motivated reasons (including internal improvement and corporate or top management objective), whilst 39% had externally motivated reasons (customers, markets or governments pressure) to implement QMS in their organizations. Without a doubt, QMS provides the consistency and satisfaction in terms of methods, materials, equipment, etc. in the firms, which can cause them to meet the requirements of their customers, and achieve organizational targets in the projects (Aized, 2012).

Fig 2.1. QMS on Organizational targets of projects and iron triangle



Source: Aized (2012)

2.3.4. Factors that affect QMS implementation

The holding of an ISO 9001 certificate does not mean that a company is implementing an effective QMS; to do that requires a cultural shift. The change from a culture of building to the lowest quality level and then repairing inevitable defective work, to a culture of producing right-first-time output, is required for the demonstration of achievement of successful quality system

application. Corbett et. al. (2000), Irani et. al. (2004), and Koh et. al. (2008) state that there is a definite relationship between corporate culture and quality in construction projects, and in order to support the necessary elements of such a QMS, an appropriate corporate culture is a prerequisite. This relationship is mutually reinforcing and this means that if the corporate culture is good, the quality system will be applied appropriately, with the resulting products and services also being good (Koh et. al., 2008).

A survey conducted by the Building Research Establishment in the United Kingdom showed that 40% of building defects occur during the construction phase (BRE, 1982). In most cases, the defects are found to be the result of (Chung, 2002):

- Misinterpretation of drawings and specifications
- Use of superseded drawings and specifications
- Poor communication with the architect/engineer, subcontractors and material suppliers
- Poor coordination of subcontracted work
- Ambiguous instructions or unqualified operators
- Inadequate supervision and verification on site

Technical knowledge and expertise are of limited value unless they are linked to management expertise. Part of the approach to management expertise is an understanding of the various management systems expected to operate; quality, environment, health and safety and of how these systems apply in different parts of the construction industry. For a firm to be successful it must have people able to and concerned to relate the firm to the needs of its customers (Newman & Choo, 2003).

Studies undertaken in the past showed that poor construction workmanship occurs due to human factors rather than technical factors. Human factors are responsible for defects during construction/management and work procedures, whereas technical factors are responsible for defective materials, design problems and natural disasters (The Effects of ISO Certification on Organization Workmanship Performance, 2012).

2.4. Critical elements within construction projects

The primary objective of the construction management function is the control of three main factors or values. They are time, cost and quality, commonly referred to in the construction industry as the three-legged stool or iron triangle. Kerzner (2010) explained the project can be considered to be any series of activities and tasks that being completed within certain specifications and consuming resources throughout several functional lines for getting specific objectives. One important aspect of project management is analyzing the information related to the optimum balance among the project's objectives (Hajiagha et. al., 2015). These goals should be based on the organization and business objectives to survive in the market and competing with other companies, project management has a significant role to achieve these objectives. As in any other business, construction projects are aiming to achieve success, and the project success depends on its expectations and how they are fulfilled (Proust, 2011), in order to meet the project requirements successfully (PMI, 2008). Extremely, it is essential to identify and focus on construction project objectives as the results of project.

A survey conducted among international organizations in Gaza Strip-Palestine by (Enshassi & Al-Ghuraiz, 2003), revealed that the vital factors cooperate to a successful post-evaluation system in construction projects, and these elements are namely cost, time, quality, project efficiency, owner's satisfaction, project effectiveness, safety, risk, human resource, communication, procurements, and environment. Several authors have researched the subject on project success as critical factors, but the concept of project success still remained ambiguously defined. It seems that the identification of project success is complicated (Neyestani & Juanzon, 2016). Some authors like Kerzner (2010) specified the project's success as the one that assesses both primary and secondary factors (customer's satisfaction). Primary factors include meeting deadlines, budget limit and the level of expected quality (iron triangle) in construction projects (Varajao et al., 2014), these factors to be criteria for real and balanced achievement of construction projects objectives (Golob et. al., 2013).

A total of 112 questionnaires to large and medium sized organizations in Indian construction industry showed that in successful companies, time (89%), cost (79%) and quality (74%) are respectively as most important factors for successful projects (Tabish & Jha, 2012). Therefore,

money (cost), time (delay), and quality (process, performance, products, etc.) are reliable, countable, and controllable notions that managers and practitioners are used to considering as main criteria of project success. These three factors are predominant in the management of usual construction projects (Proust, 2011). Doubtlessly, iron triangle is more significant, due to their significant effect on obtained results for being successful in project management that cost and time of the project is minimized while the project quality is maximized (Hajiagha et. al., 2015). Also, the critical success factors (CSFs) research model explained the success of a project can be affected by: schedule overrun, cost overrun, project performance, and funder's satisfaction (Zwikael & Smyrk, 2011); (Neverauskas & Railaitė, 2013). Accordingly, the vital elements of the projects can be defined as the organization objectives (internal factors), and business objectives (external factors) that are related to client's satisfaction (customer's satisfaction) and market.

Satisfaction has been explained as a function to make comparison between a perception of an outcome by an individual and the expectation of the outcome (Locke, 1970). Client's satisfaction has become challenging issue for the past few decades in construction industry. Usually, clients of construction sector experienced dissatisfaction in many aspects including overspend in project cost, delay of completion, poor quality, and incompetent project teams like subcontractors and consultants. There is a research suggesting that to build up relationship with a new client in construction industry is five times more expensive than to maintain existing one (Ali & Rahmat, 2010). The findings also show that construction companies can increase their profits by 100 percent if they are able to retain five percent or more from the existing clients.

Therefore, clients' satisfaction is one of the key performance indicators for all the participants in construction industry. They must always show improvement in the performance if they want to survive and sustain in the global marketplace. However, quality performance of the products and services which have been received by client within cost and time is always tightly related to the measurement of clients' satisfaction (Parasuraman et. al., 1988).

2.4.1. Time

On the study of the cost benefit analysis of QMS implementation on construction projects in Hong Kong by Thomas et. al. (2012), 112 contractors were chosen for this survey. 36 out of 112 targeted respondents returned the completed questionnaire, representing an effective response rate of around 32%. The results indicate that most contractors (21 out of 33) did not believe the implementation of an ISO9000-based QMS would have any impact on the time overrun. It appears that the main reason was that the contract period of a project in Hong Kong is already very tight. Just a few contractors expressed an increase in time overrun if ISO9000 was not used.

Ali & Rahmat (2010) justified that ISO 9001 cannot affect time length of construction projects because the complexity of construction projects can generate excessive variations during construction. They mentioned that it is seldom for the contractors to complete a project on time without changes to the plans or the construction process. The complexity and uncertainty of construction projects (weather, plan changes, etc.) can cause that ISO 9001 cannot be able to help considerably the construction firms in completing their projects on time (Ali & Rahmat, 2010).

Neyestani, (2016) on his study of QMS on construction projects, found that the highest ranking of the impact of QMS on time length of project completion is; the reduction of delay by improving communication, the reduction of delay by a well-managed supply chain, and the project completion corresponding proposed implementation timeliness.

2.4.2. Cost

Thomas et. al., (2012) study, from the previous sub-article also found that, like time overrun, most contractors (in this case 18 out of 34) confirmed that they expected no change in cost overrun even if an ISO9000-based QMS does not exist. 11 contractors, however, believed that there would be an increase in the cost overrun if not having ISO9000, and the increase could be as much as 25%. Neyestani (2016) in his study found that realizing the defects earlier for correction at a lower cost, optimizing performance, and a well-managed supply chain, as the most important effectiveness factors of QMS impact on construction projects' costs.

It is also worth pointing out that reducing the cost of operations was not conceived by the sampled contractors as a critical issue when they sought initial certification. This may also indirectly indicate that they did not expect the implementation of an ISO9000-based QMS to result in an increase in cost of operations. However, when respondents were asked to indicate their level of satisfaction on the ISO9000-based QMSs in reducing the cost of operation, there is an indication that the level of satisfaction exceeds their original expectation when they first sought ISO9000 certification.

Manders (2015) in her study investigated the financial impacts of ISO 9001 certification using meta-analysis. The findings provide quantitative evidence that, in most of the cases, the companies that implement these standards increase their revenues. However, this effect may be a result of the signaling effect of certification. This effect may differ per region and business sector, and may depend on the length of the period since obtaining the initial certificate. Manders (2015) could not prove that ISO 9001 certification decreases costs. However, she discussed that companies can decrease their costs if they are motivated to implement a well-functioning quality system and if there is a high management commitment. Strategic company goals should also be aligned with the quality policy. Manders (2015) also found that not all companies are able to gain financial benefits from certification, but overall companies are expected to benefit in the long-term. However, the cost of the certification seems to be a setback for achieving short-term benefits (Manders, 2015).

2.4.3 Quality

Construction industry has an important role to reduce unemployment rate, stimulate economic growth, and likewise generate residential, non-residential and infrastructure. Dramatically, over the past three decades, numerous government and business organizations reported that construction industry in many parts of the world suffers from several problems, especially for low quality (Ali & Rahmat, 2010). For a successful project management, cost and time of the project should be minimized while the project quality is maximized as main elements of iron triangle (Hajiagha et. al., 2015) and (Shahu et. al., 2012).

Neyestani (2016) on his study of Impact of ISO 9001 certification on construction firms found that regarding each criterion of project success, regression analysis indicated that the impact of ISO 9001 on construction quality was significant that provided supporting evidence for the view of Khattak & Arshad (2015), who realized the quality of construction projects purely depend on the development of such industry and is associated with the implementation of ISO 9001 (QMS) in this industry. Neyestani (2016) also found that, although construction projects have implemented ISO 9001:2008 at acceptable level in construction projects, the mean score of construction quality was not quite high in descriptive statistics. So, it can be concluded that the construction firms just adopted ISO 9001 certification to become eligible for tendering in government or huge projects, and also achieving its competitive advantages as a marketing tool. This notion causes that the construction firms focus on "short-term" goals for getting a certificate instead of implementing an effective QMS, and obtaining its benefits in project sites for the future (Farooqui & Ahmed, 2009).

On his study of QMS implementation on construction Projects, Neyestani (2016) found quality awareness improvements, enhanced involvement of people in improvement activities, and being effective in quality assurance process as the three most effective measures of QMS on quality/scope in construction projects in selected large-scale construction firms.

2.4.4 Customer Satisfaction

Neyestani's (2016) reports also show that, increasing business benefits, as most significant impact of QMS on the customer's and client's satisfaction. Decrease in client's complaints, improved customer loyalty, improved common understanding of goals and values among interested parties came right next, and improved customers relationship, communication, and reporting also hold great values in effectiveness of QMS implementation on construction projects.

Thomas et. al. (2012) found that when ccontractors were asked to express their perceptions as to the overall satisfaction of their clients that may be attributed to both direct and indirect contributions from their QMSs, more contractors believed that the increase in the overall satisfaction of the client is in the region of 16-20%, which was followed by the 21-25% increase

band. 6 contractors even indicated the overall satisfaction of their client could be beyond a 30% increase. On average, the implementation of an ISO9000-based QMS would increase the overall satisfaction of the client by 18%.

A survey was performed by Thilakarathne & Chitrangani, (2014) for identifying the benefits of implementing QMS in the ISO 9001-certified firms in Sri Lanka, the results of their research indicated that the customer satisfaction, reduces production time increases quality awareness, improves product/service quality, improves employee productivity, and improves employee relations, were respectively, as most important perceived benefits of the QMS implementation within different companies in Sri Lanka. Based on the findings of several empirical studies, most of the aim of QMS standards is to promote the customer's satisfaction, and many studies have shown that it seems QMS is successful for achieving this aim by improving and stimulating the processes of ISO 9001-certified construction projects.

In Malaysian construction companies, the majority of the respondents believed that the functionality and clients' satisfaction are respectively the most influences of QMS implementation into construction projects (Ali & Rahmat, 2010). In addition, (Mane & Patil, 2015) found the 90% of the respondents asserted customer satisfaction and 80% client satisfaction are the most important aspect for maintaining QMS for construction projects in India.

Therefore, this study will assess the Quality management practices of grade one general contractors in Ethiopia to measure the benefits gained from implementing QMS and If it is effective on the project time, project cost, project quality, and customer satisfaction parameters for the overall performance of the construction projects.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter includes the methodology used in this paper. The subsections of this chapter discuss about the research setting, research design, data sources and types of data, sampling techniques, data collection methods and techniques, ethical consideration in research, and data analysis.

3.2. Research Setting

The study area of this research is the capital city of Ethiopia, Addis Ababa. Due to time and cost constraints, it is only focused on Addis Ababa based selected Grade One General contractors who implemented ISO Quality Management System. General contractors include building and road construction so this study is inclusive of various construction types in the industry.

3.3. Research Design

A research study classified as a descriptive study attempts to describe systematically a situation, problem, phenomenon, service or program, or provides information, or describes attitudes towards an issue. The main purpose of such studies is to describe what is prevalent with respect to the issue/problem under study (Kumar, 2011).

Based on the above description, this research design is a descriptive kind with a qualitative approach. Reasons for that classification are:

- ✓ **Descriptive**: It is descriptive for the reason that it is done to provide a clear picture of the quality management system implementation practices in the construction projects of GCI in Addis Ababa with respect to cost, quality and time parameters in relation to customer satisfaction. It also provides an overview of some important recommendations to practice in future research.
- ✓ **Qualitative**: Secondary data was collected by reviewing the studies (literature) for the qualitative information which are related to the main objective of the research. Also a semi-structured interview was conducted with the selected GCI respondents of the

industry professionals (e.g. project managers, contract managers, cost analysts, office engineers, etc.) to investigate the current practices and experiences of the contractors regarding QMS implementation on their construction projects. Qualitative study is also better to describe and analyze small sample units.

As a descriptive study, this research was designed to assess the effectiveness of QMS implementation on the performance of construction projects based on descriptive methods. It assesses QMS's effectiveness construction projects' time, cost and quality of the projects and the perception of customer satisfaction by the GCI contractors for the performance and success of the construction projects. The procedure to assess the QMS implementation practices and examine the time, cost and quality parameters of management practices of GCI in Addis Ababa is-cross-sectional. It is a cross-sectional study that it investigates the current QMS implementation practices of GCI in Addis Ababa at a specific time that the interview was held on the selected contractors. The practice of the company was based on the current management and project quality controlling experience. Thus, the literature review was first carried out to understand the topic, and the concepts of the study, in order to develop an appropriate semi-structured interview guide for obtaining data from the construction projects of the GCIs. The questions were designed on the basis of literature review and preliminary studies. Then the interview was conducted with the respondents working in ISO certified GCI contractors in Addis Ababa.

3.4. Data sources and Types of data

All required data for this study is conducted both from primary and secondary sources. The primary data sources in this research are the respondents from the selected contractors of the research population, ISO certified GCI in Addis Ababa, collected in the form of semi-structured interview questions. Similarly, a thorough review of available published journals and unpublished documents of relevant sources is conducted for the secondary data. The semi-structured interview is used to gather information on the respondents' knowledge of Quality Management System and its implementation practice in their organizations, also their perception of its effectiveness on the project's time, cost, and quality performance and customers' satisfaction of the project for the overall success of projects.

3.5. Research population and Sampling Technique

3.5.1. Population of the Research

This research is conducted by making its population the group of contractors that are situated in Addis Ababa. The population size of this research is the ISO certified contractors that had fallen under the category of Grade One General Contractors. According to MOUD (2005), there are ten grade classifications and four types of contractors which are categorized based on the construction cost of the project that the contractor is seeking to undertake. The classifications of these contractors are General Contractors, Building Contractors, Road Contractors, and Special Contractors and can be categorized in the ten grades based on the criteria specified by MOUD.

Table 3.1. Contractor Grade categorization in Ethiopia

Categories	***Grade***	***Construction cost (in birr)***		
		BC	*RC*	*GC*
GC, RC, BC	1	Above 210,000,000	Above 300,000,000	Above 350,000,000
GC, RC, BC	2	Up to 210,000,000	Up to 300,000,000	Up to 350,000,000
GC, RC, BC	3	Up to 160,000,000	Up to 225,000,000	Up to 270,000,000
GC, RC, BC	4	Up to 110,000,000	Up to 154,000,000	Up to 185,000,000
GC, RC, BC	5	Up to 54,000,000	Up to 76,000,000	Up to 100,000,000
GC, RC, BC	6	Up to 27,000,000	Up to 38,000,000	Up to 45,000,000
GC, RC, BC	7	Up to 11,000,000	Up to 15,000,000	Up to 18,000,000
GC, RC, BC	8	Up to 5,400,000	Up to 7,500,000	Up to 9,000,000
GC, RC, BC	9	Up to 3,000,000	Up to 4,200,000	Up to 5,000,000
GC, RC, BC	10	Up to 1,000,000	Up to 1,500,000	Up to 1,800,000

Source: MOUD (2005)

General Contractors (GC) are contractors who are qualified to undertake a variety of construction works such as buildings, roads, railways, bridges, etc. Building Contractors (BC) are contractors who are qualified to undertake specifically building construction and related works. Road Contractors (RC) are contractors who are qualified to undertake construction of roads specifically and other related civil engineering works. And Specialized Contractors (SC) are contractors who are qualified to undertake construction activities in specialized trades such as electro-mechanical installation works, painting and decorations, sanitary installation works,

wood and metal works and landscaping, and other related activities. The grade classification for Grade one contractors is summarized as 350,000,000 birrs and above for GCI, 300,000,000 birrs and above for RCI, and 210,000,000 birrs for BCI of construction budget value as stated in the above table.

Although there are various types of contractor categories and grades, the target population for this research is chosen from the list of contractors categorized under the GCI classification of Ministry of Urban Development (MOUD) and who have implemented ISO Quality Management System. The population of the study is limited only to Grade One General Contractors due to reasons such as the time limitation of the study. And also since GCI contractors are capable of high budget projects, they have better financial, material, and human resources than the lower grade contractors so it will be a benchmark for further research. The reasons for deciding to limit the scope of the study only to Grade One general contractors are briefly stated below:

- Relatively to the other categories, Grade One contractors (highest level) usually undertake most of the large projects given to local contractors in Ethiopia. Therefore, by assessing the quality management system of these contractors, any knowledge achieved will significantly contribute to the overall improvement of the construction industry performance.
- Only one type of contractor could be assessed because of the time limitation of the study. But since General contractors participate in major building and road construction works in Addis Ababa and they have major stake in governmental projects, so they are chosen as the target population.
- Considering the fact that almost all Grade One contractors are registered in the capital city, sampling is restricted to contractors that are in Addis Ababa and are registered on the list of Ministry of Urban Development.
- Assuming that a study done on higher grade contractors can be a spring for further study of the lower grade contractors, Grade One General contractors are chosen as the study population.
- Grade One contractors also have better financial capability and organizational & human resources than contractors at lower grade levels. Therefore, they can be exemplary to the

lower grades for starting efforts to develop or improve QMS in their construction companies and possibly upgrade to higher grades.

- Although it was thought that it will create difficulty in generalizing the research result, contractors at lower grades were excluded from the study considering the gap between those contractors of Grade One and the lower grade contractors in terms of capacity and project management capability mainly because of the time limitation.

Taking into consideration the above reasons, a more specific population size is drawn. Although there was difficulty in getting the current list of ISO certified GCI contractors from a collated source due to the dispersion of information, the researcher has managed to find 7 GCI contractors who have implemented ISO Quality Management System to choose as the target population. The GCI contractors that took part in the research were selected based on the basis of registration confirmation of Ministry of Construction professionals' company and construction machinery industry development and regulatory bureau on the year 2010 E.C. The reason for the difficulty of getting the list of certified contractors was because the certification was given by different certifying bodies such as British company, German company and Ethiopian conformity assessment enterprise and accumulated data for all could not be found at one place.

3.5.2. Sampling Techniques

The ISO certified construction companies in Ethiopia are few in number. And the researcher was not able to accumulate the actual total number of ISO certified GCI in one place due to unavailability of the list of all ISO certified GCI. The researcher has obtained the sample contractors' list by asking different governmental authorities and non-governmental offices such as Statistics Agency and Ethiopian Standards Agency and through calling Contractors Association directly because organizations like these are expected to hold such information. Therefore, as per the effort made, a total of 7 respondents were selected. Since the population size is small, the sample is a census. A semi-structured interview was conducted on all sampled contractors. Although the sample of this research is only 7 contractors, there is a disclaimer that the GCI contractors who are ISO certified could be more than 7 in Addis Ababa and one shall bear in mind the acclaimed statement while reading this study.

3.6. Data collection Methods and Techniques

Two types of data were collected for this research. Primary data was collected in the form of semi-structured interview questions to the chosen contractors. And the secondary data was found in reference books, journals, and articles that can back up the QMS implementation practices around the world and in Ethiopia.

3.7. Research Instrument

As mentioned above, a semi-structured interview was conducted to use as a research instrument. In the first part of the research data collection process, secondary data were collected from the secondary sources to further complement the information in relation to the Quality Management mechanism of the contractors. For the next part of the research data collection, semi-structured interview was used as a data collection tool. Interview was chosen as a means of data collection because the research has a time limitation and conducting interview questions for the contractors personally was found to be less time-consuming. And the respondents will not be biased when responding to questions that are related to company project performance. Also, this method will reduce the non-response rate and obtain richer data about the QMS implementation practices during the interview session.

The semi-structured interview has three parts. Part one contains questions about the demographic background of the respondent. The second part also consists of questions related to projects executed in the last five years by the company and projects' delivery time, budget, quality, and customer reception from the experiences of the respondents. The third part of the interview was consisting of questions which are related to QMS principles briefed in the ISO manual and the respondents were asked to describe the benefits of QMS implementation their organization has gotten and its effectiveness perceived by the contractors in relation to time, cost, quality, and customers' satisfaction of their projects.

3.8. Validity and Reliability issues

Deliberate judgmental sampling was used to select contractors to cross-check the respondent's response with respect to the interview questions and to further investigate the construction project quality management mechanism used by the contractors based on experience merit. 3

respondents from the sampled GCI contractors were chosen for interview to further investigate and ensure the validity and reliability of the data collected from the interviews. These contractors were chosen purposively considering points such as the company's QMS experience in executing large scale projects, and knowledge level of QMS implementation for the success of projects regarding time, cost, quality, and customer satisfaction.

As Kumar (2011) defined in his study, concurrent validity is comparing the findings of your instrument with those found by another which is a well-accepted instrument. In order to check the validity of the interview questions, the interview was conducted with 3 contractors. The main purpose was to ensure validity, and the interview questions were administered by the researcher through a scheduled semi-structured interview. In the interview, the respondents were required to verify their response with an explanation of supporting practices, construction completion certificate for project duration validity, payment certificates for cost of the projects, contract agreements, and documentation of any kind that was used in the execution of their projects. Further to control the impact of respondent bias, the researcher has conducted most of the interview sessions in person and contacted the rest of the respondent through phone call and explained the importance of accurate information given by the respondents for the successful finding of the research.

3.9. Data Analysis

In this research, narrative analysis is used for the semi-structured interview data. The collected data from the interview questions by the selected contractors are gathered and analyzed by comparing and contrasting the interview stories. Then the connection between the answers and the previous studies are narrowed to easily present the findings. Since it is a qualitative study, all data retrieved through interview may vary in content, but the categorization will help to generalize the findings. Therefore, contractors that are in the highest time overrun, cost overrun, quality problems, and customer complaints were analyzed respectively. Then, a summary of each data is organized from the data collected and presented that show the analysis of the QMS practices implemented by the contractors to have maximum effectiveness on their construction projects are developed.

3.10. Ethical Consideration in Research

Respondents had the consent to participate and were informed that their participation is strictly voluntary and that they can reject it at any time. A notification of disclosure was presented in a letter form to the respondents. The research had kept the anonymity of the respondents' identities and participant data is kept confidential and the answers did not end up in the hands of a third party.

CHAPTER FOUR

RESEARCH ANALYSIS AND FINDINGS

4.1. Introduction

The analysis of this research is primarily done to find an answer to the research questions raised and to discuss the objective stated in the first chapter. For this research, descriptive analysis type is chosen. By using descriptive analysis, the needed objectives are clearly elaborated and it is covered in the upcoming sub-sections.

4.2. Data Analysis and Finding

The ISO certified Ethiopian construction companies are very few in number. This research has tried to cover the total number of certified GCI construction companies through online searching and making direct calls by taking contractors' addresses from Contractors Association and by asking different non-governmental offices such as Ethiopian Standards Agency and Statistics Agency since these offices are expected to provide such information. Through the search to find ISO certified GCI contractors, the researcher was able to find only 7 ISO certified contractors due to the unavailability of the total list in one office because certification bodies are various. Since the scope of this study is limited only to ISO certified GCI, the contractors who are in the process to get certified are not included. It should be noted that the number of certified companies to date may be greater than 7 but as per the effort made, only 7 certified contractors were found.

The collected data from interview sessions with the 7 contractors were interpreted qualitatively. By using this, the level of QMS implementation effectiveness on the construction projects was found. The QMS implementation effectiveness level on projects are presented by using the data gathered from the interview and it includes:

- The degree to how the eight ISO principles are fulfilled for continuous improvement by GCI
- Benefits of implementing QMS on construction projects' performance of GCI
- QMS implementation effectiveness on project delivery time of GCI construction projects

- QMS implementation effectiveness on projects that had the highest number of project time overrun
- QMS implementation effectiveness on budget of GCI construction projects
- QMS implementation effectiveness on projects that had the highest number of project cost overrun
- QMS implementation effectiveness on quality of GCI construction projects
- QMS implementation effectiveness on projects that had the least number of desired project quality
- QMS implementation effectiveness on customer satisfaction of GCI construction projects
- QMS implementation effectiveness on projects that had the most complaint from customers

The research interview questions were conducted with the 7 ISO certified contractors. And all have attended the interview sessions which gives a 100% rate of response. Hence, the responses from the 7 contractors were used in analyzing this survey.

4.2.1. Demographic Background and Construction Experience of respondents

The findings of this study were based on 7 respondents in top, and medium level management (e.g. Project managers, Office engineers, Contract managers, Cost analysts) working in different construction companies, which are classified as Grade one or large-scale in Addis Ababa. Four of the respondents have a moderate knowledge level of QMS while the rest three have high knowledge of QMS. Given their work experience and background, it is expected for them to have at least moderate knowledge if not high, so that they have a high possibility of fair judgement calling in answering the questions.

In general, the majority of the respondents in construction projects are project managers. And only few of them are office engineers such as contract managers, cost and quantity developers. All of the contractors have maintained their certification and even one had upgraded to the latest (ISO 9001:2015) version. Regarding the longevity of QMS implementation in the construction companies, more than half of the respondents (4 of them) belonged to the organizations, which have implemented QMS between 5 and 8 years. The rest belonged to those companies that have

implemented QMS between 1 and 3 years, 3 and 5 years, and one respondent actually implemented for more than 10 years in their firms.

4.2.2. ISO Principles implementation by GCI

There are eight major principles of ISO quality management system as described in previous chapters which are known as Customer focus, Leadership, People involvement, Process approach, Systematic approach to management, Continual improvement, Factual approach to decision making, and Mutually beneficial supplier relations. The finding of this study shows the level of fulfillment of those principles by the respondents and how effectively they are implemented to ensure continuous improvement.

The eight principles stated in the ISO manual are practiced in different contractors in Addis Ababa based on their knowledge of the extent to which they implemented the principles. In this research one of the research question is to find the degree or extent of how the principles are fulfilled for the continuous improvement of Quality Management System implementation. In order to do so, these principles were listed and the contractors were asked to describe how far they have gone in achieving the implementation of the principles by their firms.

The principles that are the most implemented and followed by the majority of the contractors are the second and fifth principles which state that QMS should prioritize leadership, and a systematic approach to management respectively. 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. 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. The implementation of this principle is necessary since there are different departments and sub divisions within each department in the organization, such as engineering, finance, procurement, store, and such, hence the need for following this principle in order 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 project has a

general procedure which is to prepare drawings and specifications, quote, sign contract, mobilize materials on site, construct, and deliver, this process is better executed by following the QMS principles to minimize the unnecessary back and forth communication between office and site parties or within each office and site parties. The majority of the respondents said that these three principles are the highest implemented principles than the rest and that this QMS standard has helped the companies achieve the goals that are set for the construction projects.

The first, sixth, seventh, and eighth principles; customer focus, continual improvement, factual approach to decision making, and mutually beneficial supplier relationship; are mildly implemented by the contractors. They have explained that although these principles are as important as the above mentioned three, they said that running the construction projects is primarily based on the above three principles. Customer focus is the ultimate goal in their construction endeavors. The contractors keep in consideration the needs of the customer to be fulfilled mainly by the process and system approach principles. And the interdependent relationship between the suppliers and the contractors is mutually beneficial but they said that 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 fully implemented and fulfilled including continual improvement since its meaning is that all QMS principles and standards are permanent objectives of the organization. As far as the factual approach to decision making principle is concerned, the respondents explained that although they usually make decisions based on evidential data, sometimes they make decisions based on judgement call by words of affirmation when there is no data to back up an information to not affect the project process. The principle that is the least implemented by the contractors is involvement of people. The respondents said that they try to participate employees at all levels of the organization in decision makings and operations but ultimately the top management has always the final say because even though they have implemented a QMS, they said that they still function in the old fashioned manual way and that the QMS have not fully surged in their companies to completely rely on the system to automatically to let employees at medium and lower levels control and make final decisions.

4.2.3. Perceived Benefits of QMS implementation by GCI

The results of the data interpretation for the benefits of QMS implementation on the performance of construction projects is presented as follows. A list of nine possible benefits of implementing QMS were retrieved from literature review and the interviewees were asked if they agreed on the listed benefits based on the experiences of their corresponding companies' construction projects and to further explain why. The potential benefits of QMS implementation is that QMS reduces cost, reduces risk, leads to better performance, leads to better quality, improves documentation and traceability, improves competitiveness, facilitates accountability of employees, enhances quality inspection, and improves customer satisfaction.

Most of the respondents agreed on almost all of the described benefits of QMS implementation. They emphasized on two of the benefits which harbored the most advantage for their companies. These benefits were that QMS leads to better quality and improves documentation and traceability. The interviewees said that the QMS procedures have helped their companies in organizing and documenting their reports, specifications, and any related documents by sorting among their respective categories, dates and project types which had led them to achieve better qualities in their construction projects. The documentation and traceability have minimized their project delay that is related to losing or misplacing documents on the wrong folders and also naming the documents appropriately according to QMS standards. Also, time that is lost due to communication for sharing files is minimized due to proper use of document sharing. Following this, risks related with cost, time and quality of the projects are reduced. The interviewees mentioned that although risks related with natural occurrences and uncontrollable situations can not be minimized with QMS implementation since they are not preventable, the pro-active approach of QMS has helped them to predict and prepare for possible risk factors other than those that are uncontrollable and they can opt on the related issues to resolve it faster. Costs spent regarding informal communications and careless documentation are reduced and QMS also enhanced the quality inspection of the construction companies, which ultimately improves customer satisfaction collectively.

The respondents did not necessarily agree that QMS benefits the companies regarding improving competitiveness against construction companies locally and regionally. Even though ISO

certification increases face value and creates marketing opportunities, the interviewees said that it does not mean that the competition is any less. They also said that they did not agree that it facilitated the accountability of the employees, this could be the result of failing to implement the 'involvement of people' ISO principle. If people are not involved in the implementation process of the QMS and if they are not practicing the QMS standards such as formats and checklists, the accountability will not be facilitated so long as they are functioning in an old-fashioned office procedure.

4.2.4. Effectiveness of QMS implementation on critical factors of construction projects

The descriptive analysis of the effectiveness of QMS on vital factors of construction projects shows the following findings. Respondents were asked to describe the number of large-scale construction projects they executed in the last five years. And of those projects, how many of them exhibited project delays, cost overruns, lesser quality than desired, and received most complaints from customers.

Table 4.1. Large scale projects executed in the last five years by GCI

Contractors list	*Projects in the last 5 yrs.*	*Time overrun*	*Cost overrun*	*Quality problem*	*Most complaint*
	No	*No*	*No*	*No*	*No*
Contractor A	16	16	16	14	5
Contractor B	12	6	7	11	2
Contractor C	20	5	6	1	1
Contractor D	7	2	1	2	0
Contractor E	4	0	0	0	0
Contractor F	7	2	4	2	2
Contractor G	3	1	0	0	2

Of the 7 contractors, 6 of them had experienced time overrun, 5 of them cost overrun, 5 of them quality problems, and 5 of them client complaints. The contractors that exhibited the most time overrun are Contractor A and Contractor B. The contractors that experienced the highest number of project cost overrun are Contractor A, Contractor B, and Contractor F. The contractors that

had the highest number of project quality defects are Contractor A and Contractor B. And the contractors that had the highest number of customer complaint are almost all of the contractors.

4.2.4.1. QMS Implementation Effectiveness on Time of Project

The interviewees were asked whether they believed or agreed on QMS effectiveness measuring items for time of project that are commonly agreed on by different scholars or not, and to explain why. From the list of items described as effectiveness measures of the time parameter of project performance by QMS implementation derived from the literature review, the respondents have found QMS to be effective on most of the tenets. It is commonly agreed by scholars that implementing QMS reduces project delay as a result of turnover, rework, errors, lack of communication unnecessary inspections, and change of scopes by clients. And when asked, the interviewees responded that implementing QMS has helped their organizations save time by minimizing the relapse time of introducing and familiarizing a new employee with the work procedure when there is turnover because QMS has standards that can easily be adapted. They have also agreed that QMS reduces delay by minimizing rework and errors since the PDCA (plan-do-check-act) cycle of QMS has a positive impact on lessening the errors of deliverables. The lack of communication is also minimized because the companies have developed standard formats to communicate, update, and report to internal and external project parties which in-turn minimized change of scopes by clients that generally results in saving time of project.

As agreed by many scholars, QMS also results in a more reliable construction project scheduling, and delivery, and reducing duration of projects due to easier documentation procedures for the employees to follow. Most of the interviewees also agreed on the above effectiveness measures. As mentioned earlier on the benefits of QMS sub-section, they said that QMS has a great deal of benefit regarding documentation and traceability. So, they agreed that it reduces delay due to easier documentation procedures because the formats of filing and sorting or categorization of documents keeps files from getting lost or misplaced, which saves them some time. Regarding the reliable construction project scheduling and delivery tenet, the interviewees also agreed because they said that QMS promotes a detailed look on all the steps of the construction process so that all activities are included on the project schedule and that there are less surprises mid-way

through project execution. No activity is too small to be included on the master schedule because that helps the contractors to be reliable on their project duration and delivery time.

However, the majority of the interviewees did not necessarily agree that QMS has been effective on their construction projects by reducing delay that is related to shortage and delivery of materials, increasing confidence to anticipate shorter project completion time, and preventing delay due to a well-managed supply chain that provides a stable flow of goods and services. They said that shortage and delivery of materials is usually related with foreign currency shortage and untimely letter of credit (LC) from banks. Although the contractors have good relationship with their international suppliers regarding importing materials, shipping the goods from the supplier country to Ethiopia is somewhat always a time taking process during freight. And regardless of whether they have a good QMS practice or not, implementing QMS could not prevent them from delaying the project as a result of these external issues. This had let them to not anticipate shorter project completion time relatively to previous projects. They said that as much as they tried to follow and prevent delay regarding shortage of materials internally, it is still not promising to anticipate lesser time for project execution due to the mentioned external factors.

The findings of this study show the relationship between QMS implementation effectiveness on time and the contractors that had experienced the highest delay in percentage. It is mentioned above that the contractors that had experienced the most project time overrun are Contractors A and B. Both Contractor A and B are indifferent to most of the effectiveness level measures of project time, in relation to QMS implementation. Contractor A even disagrees that QMS implementation leads to better performance. These contractors said that they have not gained tangible benefits from implementing QMS. And they were asked how many of the ISO principles they have applied for continuous improvement after certification and they said that they have not fully implemented the principles and they have yet to implement most of them. Contractor B has minimally implemented some of the principles but have not gained full benefits regarding reduction of project delay and that the company still suffers from it. This could be the result of not following ISO principles and practicing QMS after implementation. Therefore, the

contractors who exercised the QMS principles generally have effective results on reduction of project delay than those who did not.

4.2.4.2. QMS Implementation Effectiveness on Cost of Project

Similar to the effectiveness measures for time of project, interviewees 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. These measures for effectiveness were that QMS resolves problems of construction projects effectively without changes on the amount of project, tracks and measures business outputs, identifies and eliminates areas of waste and duplication, optimizes cheaper and easier cost on communication and follows up assigned tasks to construction project resources, increases ROI and profit, reduces expenses of efficient process management and resources by optimizing performance, lowers production cost by fewer nonconforming products, less rework, lowered rejection rates, streamlines processes and fewer mistakes, lowers correction cost by realizing the defects earlier, and reduces cost by well-managing the supply chain.

Of the above-mentioned tenets, the respondents said that the QMS measures their companies were most effective on were that QMS reduces expenses of efficient process management and resources by optimizing performance, and that QMS reduces cost by well-managing the supply chain. It is explained in the interview that although they did not agree that well-managing the supply chain was not effective on time of project for the reasons that external factors still affected the time and caused delay, regardless, it was effective on cost of the project because this prevented them from spending unnecessary cost like they did before they implemented QMS because they still controlled the internal activities. They mentioned that they have minimized their cost of operations (e. g. transportation) and cut unnecessary spending by avoiding tools and materials mobilization more than the allotted trip to construction sites, they have been able to predict the mobilization trips since implementing QMS. The respondents have agreed on and believe that QMS is effective in tracking and measuring business outputs, identifying and eliminating areas of waste and duplication. They said that it has helped them save and minimize costs of materials by preventing repetitive mistakes and material wastage through the process and system approach. If such a problem has happened once, it will be reported and archived for

future reference so that it does not happen again. The other thing the respondents have agreed on as mentioned earlier on the above sub-section is that QMS optimizes cheaper and easier cost on communication and follows-up assigned tasks to construction project resources. The respondents agreed that QMS has allowed them to save time and cost on communication by following the standard of documentation and reporting. Although previous studies show that some organizations have increased ROI and profit after implementing QMS, the respondents where somewhat indifferent to it. They said that they have increased profit gradually over the past years but they are not sure as to whether it is because of QMS or not. They said that there is a great deal of construction need in the country at this time and that demand has kept them in the loop consistently, so they have gained ROI and profit from the construction projects.

The respondents were hesitant on two of the effectiveness measures for cost and they said that they were not as effective for them as expected. These tenets are that QMS resolves problems of construction projects effectively without changes on the amount of project, and lowers production cost by fewer nonconforming products, less rework, lowered rejection rates, streamlines processes and fewer mistakes. They had argued that once a problem occurred, it will incur extra cost to resolve it regardless of QMS implementation or not. But the respondents were in agreement that QMS lowers correction cost by realizing the defects earlier. They have explained that although some mistakes cannot be avoided, their effect can be minimized by detecting the mistakes earlier before the damage is irreversible or can cause the company loss for correction. Most of the respondents said that they have a contingency plan for such kind of malfunctions included in their budget.

The contractors that had experienced time overrun are two out of three of the contractors that had experienced cost overrun, therefore most of the results on ISO principles implementation are more or less the same. The contractors that had the highest rate of cost overrun among the respondents are Contractor A, Contractor B, and Contractor F. All three respondents have a mutual feeling towards the benefit of QMS as a cost reduction tool and they do not necessarily agree that it was effective on their construction projects. They were somewhat indifferent to it because they said that they have not fully implemented and followed the ISO principles. One contractor has yet to implement one of the principles, Involvement of people. But four principles,

Leadership, Process approach, System approach, and Continual improvement are fully implemented by one of the contractors. And the rest of the principles are minimally implemented by two of the contractors. Therefore, it can generally be understood that QMS plays an important role and be effective for the cost of project if properly implemented.

4.2.4.3. QMS Implementation Effectiveness on Quality of Project

To analyze the role QMS plays on the quality of project and how effective it is for the construction projects of GCI, few measures for effectiveness were derived from literature review and respondents were asked whether each item was effective or not and why. These effectiveness measures for quality of a construction project are that QMS, matches project scope with project proposal and complies with contract specifications, helps as an effective quality assurance process and project audits, decreases product defect rate, improves quality awareness and understanding of the quality objectives in the organization, decreases non-conformities, improves product and service quality, contributes to achieving defined quality objectives for the construction projects, increases effectiveness and efficiency in meeting the organization's quality objectives, improves capability to project scope statement, requirements documentation, and project plan, involves employees in quality improvement activities, measures and monitors consistent out comes to approach expected level of quality, defines procedures that identifies current practices which are obsolete or inefficient, and ensures corrective action is taken whenever defects occur.

The respondents generally complied with the listed items and agreed that QMS is effective regarding the quality of their construction projects on most of the tenets. The interviewees explained that implementing QMS has helped their company to have an effective quality assurance process and project audit. And that it improved their quality awareness and understanding of the quality objectives in their company. They said that they have generally become more mindful of their company and their quality objectives, goals and missions set by their organization. And understanding the quality objectives of the company has increased their effectiveness and efficiency in meeting those objectives. QMS has allowed the contractors to involve employees in quality improvement activities because the employees are the ones who

can breakdown activities and integrate them with each other to develop a model for the quality improvement of the activities.

The interviewees responded that QMS decreases non-conformities, and improves product and service quality. It is explained in an interview that the formats and checklists to prepare cost, and drawing along with technical specifications, request a job order, report site inspection, and approval of drawings for production have minimized the mishaps of deviating from the specification or the expectation of the project outcome. QMS has also improved the contractors' capability to project scope statement, requirements documentation and project plan. The interviewees said that following QMS's standards, they have prepared customer inquiry with proper formats to help them plan the project on what the project shall include and exclude based on the project scope the clients and the contractors initially set. This process has made it easier for the contractors to develop contract documents and finally agreements. The other effective measure for quality of project the interviewees explained is that QMS measures and monitors consistent outcomes to approach expected level of quality. But they have mentioned that although the appropriate tools to monitor consistency is available, sometimes the people responsible for the specific task might not apply it to the project so the out come varies and they have allowed acceptable margins where it is okay for the non-conforming products to continue as is. Nevertheless, they mostly take corrective actions whenever defects occur by following the QMS standards.

Having stated the above responses, the interviewees raised issues on few of the effectiveness tenets regarding quality of project. They have mentioned that QMS has not been effective for their companies on matching the project scope with the project proposal and complying with contract specifications. Although it is theoretically applicable, they have had trouble on practical application specifically on the project quality parameter. They said the reason for that is because mostly on remote locations, the labor force is not skilled manpower and it is usually common for them to follow traditional ways or methods to construct based on their previous experiences. The work methodology is perhaps not fulfilled to its potential hence the outcome can sometimes be inconsistent or deviated from the project scope. QMS implementation was also not effective to most of the contractors regarding decreasing product defect rate. It can be drawn that most of the

contractors have QMS well documented on paper but not practically implemented to the extent that it can be used to avoid or decrease defect rate. Because although they mentioned that QMS improved their quality awareness and understanding of the organizations' quality objectives, they have argued that they were not able to achieve defined quality objectives for specific construction projects. The interviewees mentioned that their companies were also not able to define procedures that identifies practices which are obsolete or inefficient. This shows the lack of continuously updating and upgrading the QMS process once after implementation. If there had been a periodical update, it would have been easier to track practices that don't comply with their current system.

As mentioned earlier on the cost and time parameters analysis, Contractors A and B had the most project time overrun and cost overrun. These contractors also exhibited the highest number of project quality problems. They have the same characteristics as before on the cost and time analysis on the QMS benefits part and ISO principles implementation section. Although these contractors agreed on the benefit of QMS leading to better quality, one of them disagreed that it leads to better performance. This could be a result of the quality merits of the projects, either low standard or poor specification. These contractors don't believe that QMS implementation neither helps nor worsens the quality defect problems. Nevertheless, it can be noticed that these contractors fully implemented only two of the eight ISO principles so they can't achieve the full benefit and effectiveness of QMS for efficient project management.

4.2.4.4. QMS Implementation Effectiveness on Customers' Satisfaction of Project

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 eight ISO 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. Similar to the other three parameters, time, cost, and quality, possible effectiveness measures for customer satisfaction are retrieved from reviewing different scholarly literature. These effectiveness measures of QMS on customer satisfaction are that QMS decreases clients' complaints, improves customers' relationship, communication, and reporting, enhances reputation of the organization and quality image to justify to clients, conforms to the requirements of construction projects

efficiently, improves assessment of process performance and ability to achieve client's satisfaction, improves customer loyalty, improves common understanding of goals and values among interested parties, and resolves issues quickly and effectively by placing processes in track.

The respondents highly favored and agreed that QMS enhances reputation of the organization and quality image to justify to clients. They mentioned that it automatically influences their customers positively when they learn that the company is ISO certified. It is a great marketing tool as it attracts customers without much effort. The other tenet that the interviewees highly favored as well is that QMS resolves issues quickly and effectively by placing processes in track. As they have already explained in the previous sections, since QMS is a standard that follows a process approach, it has helped their companies in serving their customers better by welcoming issues raised by them and quickly resolving accordingly. That has allowed the contractors to improve their relationship with their customers through communication and reporting. The communication medium between the clients and the contractors depends on the project type and the participant parties. But any information exchange is documented and follows a standard format either it is through letter, electronic mail, phone call, or summarized report. And the transparency and dependability of the contractors in providing relatable information has improved the assessment of process performance and the ability to achieve client's satisfaction. The interviewees have also mentioned that if all preconditions are clearly specified on the proposal to the clients and if all inclusions and exclusions are present and all risk factors are all laid out before signing a contract, they will establish a common understanding of goals and values with the clients. But having said that, implementing QMS and practicing the above-mentioned experiences has not decreased clients' complaints. They have explained that through their project executions, deviations usually occur due to various causes. All requirements are formulated on paper throughout the planning phase of a project but variations arise during the execution phase. They said that this usually happens when activities and tasks are not well communicated between office engineers and site project managers. One contractor even said that working drawings get a wear and tear on site and the foreman proceeds with his own common sense on the parts where he/she couldn't read on the hard copy drawings provided. This clearly shows that although the QMS procedures are perfectly knitted to the smallest details

theoretically, there is a huge gap in implementing it practically. Project managers are responsible for bridging that communication gap for better outcome. This is why the interviewees frowned upon the question whether implementing QMS helped them conform to the requirements of their construction projects efficiently. So, even though QMS has been effective to the contractors on building a better communication with their clients, it has not prevented them from receiving complaints from their clients.

Most of the contractors have received complaints from their customers on the construction projects in the last five years. Since most of them have been certified in the 5-8years period and above timeframe, these projects were executed in that period which can be interpreted as the contractors have not exercised their certification on their projects practically.

4.2.4.5. QMS implementation effectiveness on the internal and external factors

The overall result of the analysis shows that the contractors give more emphasis to external factor (customer satisfaction), rather than internal factors (time, cost, and quality). The interviewees are effective almost on all of the QMS implementation effectiveness measures for customer satisfaction. This shows that they focus more on the external factor for the performance of their construction projects. Quality, time, and cost, all of which are internal factors of project performance, prioritized by the GCI contractors respectively next to customer satisfaction.

CHAPTER FIVE

FINDINGS SUMMARY, CONCLUSION, AND RECOMMENDATION

5.1. Summary of Major Findings

In this study of Quality Management System implementation effectiveness on construction projects by Grade One General contractors who participate in the major road and building constructions in Addis Ababa, the major findings that are discovered are listed as follows:

- Although these contractors had implemented QMS, they still face issues regarding time, cost, quality, and customer satisfaction of projects in the construction of roads and buildings.
- The contractors have not gained full benefits from implementing QMS. The majority of the contractors believe that implementing QMS improves documentation and traceability. They also agreed that it leads to a better quality of project deliverable, reduces cost, and improves customer satisfaction. But these contractors did not necessarily agree to institution's competitiveness improvement in the industry, and employees' accountability facilitation as a result of QMS implementation. So, they have not benefited the full potential of QMS implementation.
- The effectiveness of QMS on time of a project is significant for the majority of the contractors. They agreed that QMS implementation results in a more reliable construction project scheduling and delivery, and it reduces duration of projects due to easier documentation procedures for the employees to follow. But more than half of the contractors didn't necessarily agree that QMS implementation reduces project delay that is related to material shortage and delivery since they explained in an interview that material shortage is mostly related with currency shortage to import construction goods.
- The contractors with the highest project time overrun numbers did not necessarily agree that QMS implementation prevents project delay as a result of well managed supply chain that provides a stable flow of goods and services.
- The majority of the contractors however believed that QMS reduces cost of a project by well managing the supply chain. They also agreed that the expenses of resources can be

minimized by efficient process management and optimizing performance. But these contractors also gave the least emphasis to ROI and profit increment as a result of QMS implementation. Most of these contractors have minimally and not-so-fully implemented the Process Approach principle of ISO.

- The contractors with the highest project cost overrun numbers showed the least agreement to the effectiveness measure; QMS resolves problems of construction projects effectively without changes on the amount of project budget. They said that extra cost is incurred whenever there is a construction problem regardless of QMS, resolving a problem will cost money. They also didn't agree that QMS lowers production costs by fewer non-conforming products, less rework, lowered rejection rates, streamlined processes and fewer mistakes.
- Regarding the effectiveness of QMS implementation on quality of a project, a higher weight was given to Effective quality assurance process and project audits as a result of QMS implementation by the majority of the contractors. These contractors also agreed that QMS implementation improves quality awareness and understanding of the quality objectives in the organization. The least emphasis was given to matching project scope with project proposal, and QMSs' contribution to achieving defined quality objectives for the construction projects.
- The contractors with the highest project quality problems are also the contractors with the highest time overrun and cost overrun. These contractors didn't necessarily agree that QMS implementation decreases product defect rate. But they strongly agreed that QMS improves capability to project scope statement, requirements documentation, and project plan.
- All of the contractors commonly agreed that QMS implementation enhances reputation of the organization and quality image to justify to clients. But the majority of them did not necessarily agree that it decreases clients' complaints.
- The ISO principles that show the highest implementation are Leadership, and System approach to management whereas Involvement of people is the least implemented principle.

5.2. Conclusion

Based on the findings and the objective of this study, a conclusion is derived as follows:

- On a previous study mentioned on the literature, there is a low exercise of quality management in GCI companies and it is found that most of the contractors emphasized on ISO certification for the enhancement of reputation of the organization and image of quality to attract customers but often neglect to exhaustively use the standards of QMS after implementation.
- Implementation of QMS is an effective technique to achieve documentation and traceability for construction companies.
- The effectiveness of QMS implementation for the performance of construction projects on the critical factors of a project is overall important for GCI in Addis Ababa as well as it was for other contractors on different parts of the world which was proven by many scholars as pointed on the literature review.
- Although it is mentioned on the literature that TQM is somehow impossible and cannot be achieved, closer results can be achieved through a thorough and complete QMS implementation but the contractors have not received the benefit of implementing QMS to its fullest potential.
- The eight ISO principles are not fulfilled by the contractors to ensure continuous improvement.
- Emphasis is given to external factors by the contractors rather than internal factors for the overall performance of the construction projects.
- It may be concluded that the effectiveness of QMS implementation on customer's satisfaction is more than the other vital criteria in construction projects since process approach of QMS is considered.
- Priority is given by the contractors in the order of; quality, time, and cost next to customer satisfaction for the construction projects
- Although there is always room for improvement on project executions; project delay, project cost overrun, workmanship defects, and customer complaints can be minimized through implementing QMS standards and principles thoroughly, and by following up on the process to sustain a continuous improvement.

5.3. Recommendation

Recommendations for action and recommendations for future research are listed below.

5.3.1. Recommendation for action

5.3.1.1. ISO certified construction companies

- The certified contractors should give equal emphasis to the internal factors; time, cost, and quality as the external factor, customer satisfaction for a better project delivery and sustain customer satisfaction.
- It is suggested that the construction companies should exercise the implementation of QMS on more of the tenets other than customer attraction and better documentation for the effectiveness and efficiency of the project outcomes.
- All of the eight ISO principles should be implemented fully to fulfill their maximum potential in benefiting the company in an all-round effectiveness on project time, project cost, project quality, and customer satisfaction.
- Continuous improvement is a process so certified companies should maintain and exercise the standards after QMS implementation to achieve better results in the workmanship defects, project delay, and cost overrun aspects of quality management.
- The construction industry should set better examples for fellow manufacturing industries by exercising an excellent QMS implementation.

5.3.1.2. ISO certifying and Governmental bodies

- Governmental organizations such as the Ethiopian Standards Agency should facilitate trainings on ISO certification and Quality Management System Implementation to all grades of contractors to upgrade the scale of effectiveness and efficiency on the construction projects in Ethiopia. And to maximize the employment of local contractors rather than foreign (international) contractors to deploy large scale projects on national level
- Certifying bodies should reach the multiple grades spectrum of the construction industry to register and certify more construction companies.

- Large scale projects which are tendered by government offices are encouraged to require an ISO certification and QMS implementation to provide the end users with good quality construction.
- The government should also facilitate a better process of international transactions for the contractors to execute their projects smoothly and practice good QMS implementation

5.3.2. Recommendation for future research

Future research can be conducted on the issues listed below.

- For future research, it is recommended to identify the best ways for the sustainable development of construction projects from the perspective of implementation of a QMS.
- A research can be done on the other critical success factors (CSFs) of projects such as; Management, Safety, Technology, Organization, Environment, and Resources in relation to QMS.
- Further study on all types and grades of contractors (other than GCI) is also recommended.

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APPENDICES

A. Cover Letter Sent to Contractors

ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

School of Commerce, MA degree in Project Management Program

October 25, 2018

Dear Sir/Madam,

I am a graduate student in Project Management at Addis Ababa University, School of Commerce. I am conducting an interview on Quality Management System implementation on construction projects of Addis Ababa-based Grade One General contractors (GC I) as part of my project to fulfill the requirements of Master of Arts in Project Management. The results of this survey will be used solely for academic purposes.

The interview will take a few minutes of your time. Your answers will be treated anonymously and will not end up in the hands of a third party. Only processed collective results will be presented in my report. Your assistance to this research is strictly voluntary. You do not have to answer any question you wish not to.

For any questions or concerns, please contact me through my cell phone no: +251-913-088-793 or e-mail me at: rediet.beide@gmail.com. Thank you for your time and consideration.

Best Regards,

Rediet Beide

Graduate Student, School of Commerce

Addis Ababa University

Part I: Demographic background

1. What is your professional background?

Part II: Construction Experience of the contractor

1. For how long has your company implemented ISO Quality Management System? And have you maintained the certification?
2. How much do you know about ISO Quality Management System?
3. How many large-scale projects have you executed in the last five years?
    a. Of those projects, how many of them were behind schedule?
    b. Of those projects, how many of them were over budget?
    c. Of those projects, how many of them were less than the desired quality?
    d. Of those projects, how many of them were the most complained about from client?

Part III: Benefits and role of QMS on project time, cost, quality, and customer satisfaction.

1. Do you agree with the following commonly agreed benefits of implementing QMS or not? Please explain why?

    - Reduces cost
    - Leads to better performance
    - Reduces risk
    - Leads to better quality
    - Improves documentation and traceability
    - Improves Institution's competitiveness both locally and regionally
    - Facilitates accountability of employees
    - Enhances quality inspection
    - Improves customer satisfaction

2. Do you believe/agree that implementing QMS is effective on the duration of your construction projects regarding the following tenets or not? Please explain why?

    - Project delay is reduced as a result of turnover, rework, errors, lack of communication, unnecessary inspections, and change of scopes by clients
    - Construction project scheduling and delivery is more reliable
    - Delay that is related to shortage and delivery of the materials is reduced
    - There is more confidence to anticipate shorter project completion time
    - Delay due to a well-managed supply chain that provides a stable flow of goods and services is prevented
    - Project duration is reduced due to easier documentation procedures for the employees to follow

3. Do you believe/agree that implementing QMS is effective on the budget of your construction projects regarding the following tenets or not? Please explain why?

    - Problems of construction projects are resolved effectively without changes on the amount of project budget
    - Business outputs are tracked and measured, and areas of waste and duplication are identified and eliminated
    - Optimizes cheaper and easier cost on communication is and follows-up assigned tasks to construction project resources
    - Increases ROI and profit
    - Expenses of efficient process management and resources are reduced by optimizing performance
    - Production costs by are lowered due to fewer nonconforming products, less rework, lowered rejection rates, streamlined processes & fewer mistakes
    - Correction costs are lowered by realizing the defects earlier
    - Expenses are reduced by well-managing the supply chain

4. Do you believe/agree that implementing QMS is effective on the quality of your construction projects regarding the following tenets or not? Please explain why?

    - Matches project scope with project proposal and complies with contract specifications
    - Helps as an effective quality assurance process and project audits
    - Decreases product defect rate
    - Improves quality awareness and understanding of the quality objectives in the organization
    - Decreases non-conformities
    - Improves product and service quality
    - Contributes to achieving defined quality objectives for the construction projects
    - Increases effectiveness and efficiency in meeting the organization's quality objectives
    - Improves capability to project scope statement, requirements documentation, and project plan
    - Involves employees in quality improvement activities
    - Measures and monitors consistent out comes to approach expected level of quality
    - Defines procedures that identifies current practices which are obsolete or inefficient
    - Ensures corrective action is taken whenever defects occur

5. Do you believe/agree that implementing QMS is effective on the customer satisfaction of your construction projects regarding the following tenets or not? Please explain why?

    - Decreases clients' complaints
    - Improves customers' relationship, communication, and reporting
    - Enhances reputation of the organization and quality image to justify to clients
    - Conforms to the requirements of construction projects efficiently
    - Improves assessment of process performance and ability to achieve client's satisfaction
    - Improves customer loyalty
    - Improves common understanding of goals and values among interested parties
    - Resolves issues quickly and effectively by placing processes in track

6. How many of the following eight QMS principles have you implemented fully, and how many are not implemented? Please explain why?

    - Customer focus
    - Leadership
    - Involvement of people
    - Process approach
    - System approach to management
    - Continual improvement
    - Factual approach to decision making
    - Mutually beneficial supplier relationships

Thank you for your valuable time!